LEWISTOWN PUBLIC SCHOOLS
BOARD OF TRUSTEES

Garfield Elementary – Gymnasium

415 East Boulevard
Lewistown MT 59457

MONDAY, January 9, 2012

BOARD ROUNDTABLE DISCUSSION – GARFIELD STAFF

6:00 P.M. TO 7:00 P.M.

REGULAR BOARD MEETING

CALL TO ORDER (7:00 p.m.)
1. Roll Call
2. Pledge of Allegiance

BOARD OF TRUSTEES
3. Presentation—Mary Kepler, Elementary Music Teacher
4. Recognition—Dave Pillar, Pamida Foundation
5. Report—Student Representative
6. Introduction of New Student Representative to the Board
7. Report—Committees of the Board
8. Discussion—Review District Goals
9. Calendar Items, Concerns, Correspondence, Etc.

SUPERINTENDENT'S REPORT
10. Report—Election Update
11. Report—Investment
12. Other Items

PUBLIC PARTICIPATION
13. Recognition of Parents, Patrons, and Others Who Wish to Address the Board

ACTION ITEMS

MINUTES
14. Minutes of the December 12, 2011, Regular Board Meeting

APPROVAL OF CLAIMS
15. Claims

CONSENT GROUP ITEMS
16. Approve Additions to Substitute List for the 2011-2012 School Year

INDIVIDUAL ITEMS
17. Approve Adoption of Science Curriculum
18. Approve Changes to the Fergus High School Renaissance Handbook
19. Approve Accepting the Team Nutrition Training Mini-Grant Funds
20. Approve Request for Extended Leave of Absence
21. Approve Appointment to the Central Montana Foundation Board of Directors
22. Approve Personnel Report

EXECUTIVE SESSION
23. Superintendent's Evaluation

ADJOURNMENT

PUBLIC PARTICIPATION

The Board of Education encourages participation at public school board meetings. Under normal circumstances it is desirable to allow everyone to address the Board. However, when there are many persons who wish to address the Board, the following rules shall apply to protect the public's right to be heard:

- Each speaker shall be allowed a presentation not to exceed three (3) minutes at the appropriate time on the Agenda.
- There will be a limit of one presentation per person.
- The Board requests that organizations and groups be represented by a single spokesperson. The spokesperson for each group shall be limited .to a presentation of three (3) minutes. To save repetition and time, the Board also requests that persons not speak if a previous speaker has expressed a similar position on the same issue.
- The Board will accept comments from the public on each agenda item as it is discussed.

By a majority vote of the Board, these rules may be suspended for special reasons at any particular meeting. Further, the Board may reserve the right to adjust the length of time.

CONSENT GROUP ITEMS

The action of adoption of the "Consent Group" as an official item on the agenda means that all items appearing under the title "Consent Group" shall be adopted by majority approval of a single motion, unless a member of the Board or the Superintendent requests that any particular item be removed from the "Consent Group" and voted on separately.

Generally "Consent Group" items are matters which members of the Board and Superintendent agree are routine in nature and should be acted upon in one motion to conserve time and permit focus on other than routine matters on the agenda.

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 3

☐ **Minutes/Claims** ☒ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action – Consent** ☐ **Action – Indiv.**

ITEM TITLE: PRESENTATION—MARY KEPLER, ELEMENTARY MUSIC TEACHER

Requested By: Board of Trustees **Prepared By:** Mary Kepler **Date:** 01/09/2012

SUMMARY:

Mary Kepler, Elementary Music Teacher, along with some of the fourth grade students from Garfield Elementary would like to show the Board of Trustees what they have been learning in general music.

SUGGESTED ACTION: Informational

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	4

☐ **Minutes/Claims** ☒ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action – Consent** ☐ **Action – Indiv.**

ITEM TITLE: RECOGNITION—DAVE PILLAR, PAMIDA FOUNDATION

Requested By: Board of Trustees **Prepared By:** Jason Butcher **Date:** 01/09/2012

SUMMARY:

The Board of Trustees would like to recognize Dave Pillar, Manager of the Pamida Discount Center in Lewistown, and the Pamida Foundation for their generous donation of $1,566.32 to help cover the cost of student supplies.

Pamida Foundation matches up to the first $250. The remaining amount was raised through the sales of the store clerks to the local customers. The Board would like to thank the local store clerks and customers for their commitment and generosity.

SUGGESTED ACTION: Informational

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

Pamida Gives Back To Our Communities

October 2011

To Whom It May Concern:

On behalf of your local Pamida store and the Pamida Foundation, please accept this check payable to your school.

These funds were made possible through our Back-To-School Fundraiser which included:

1) Our Back-To-School Fundraising Promotion in the stores along with the Foundation Match Program of up to $250 in each community.
2) A School Shopping Day in August, donating 5% of all sales at your local Pamida from that day to your local school.

We are honored to give back to your school to help support the education of the students in the community!

The Pamida Foundation supports many community organizations that share our focus of educating youth, assisting families in need, and enhancing the quality of life for senior citizens. We hope that you will be able to use these funds to help fulfill some of your needs to ensure a quality education for the students in the community.

Pamida is committed to the continued growth and well being of the community and we are pleased to support your school.

Sincerely,

Jessica Strohman
Pamida Foundation Executive Director

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	5

☐ **Minutes/Claims** ☒ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action – Consent** ☐ **Action – Indiv.**

ITEM TITLE: REPORT—STUDENT REPRESENTATIVE

Requested By: Board of Trustees **Prepared By:** Sydney Stivers **Date:** 01/09/2012

SUMMARY:

Fergus High School Student Representative to the Board of Trustees will provide a report on upcoming activities at Fergus High School.

SUGGESTED ACTION: Informational

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

FHS SCHOOL BOARD REPORT
Monday, January 9, 2012

ART CLUB:

- Painting a mural in the FHS Spanish Room
- Continuing to work on signs in the hallways

JUNIOR PROM COMMITTEE:

- Sent out letters to all junior class parents about the parent meeting. Asked all families to contribute $10.00.

STUCO:

- Starting to plan for Winter Spirit Week

FCCLA:

- Sold 468 pies earning approximately $2,000
- Gave gifts to three children from the Angel Tree
- Working on projects for the State Competition

NHS:

- Saved 40 lives with our past blood drive

BPA:

- Collected 890 pounds of food from the high school
- Competing at Regionals on January 16, 2012 in Great Falls
  23 students attending – students will have 65 events to choose from for competition.

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 6

☐ **Minutes/Claims** ☒ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action – Consent** ☐ **Action – Indiv.**

ITEM TITLE: INTRODUCTION OF NEW STUDENT REPRESENTATIVE TO THE BOARD

Requested By: Board of Trustees **Prepared By:** Melanie Smith **Date:** 01/09/2012

SUMMARY:

Melanie Smith, Fergus High School Student Council Co-Advisor, would like to introduce to the Board of Trustees the student that will represent the Fergus High School students on the School Board for the next term.

SUGGESTED ACTION: Informational

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 7

☐ **Minutes/Claims** ☒ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action – Consent** ☐ **Action – Indiv.**

ITEM TITLE: REPORT—COMMITTEES OF THE BOARD

Requested By: Board of Trustees **Prepared By:** Committee **Date:** 01/09/2012

SUMMARY:

The Board of Trustees has the opportunity to provide updates on their various committees.

SUGGESTED ACTION: Informational Report

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 8

☐ **Minutes/Claims** ☒ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action – Consent** ☐ **Action – Indiv.**

ITEM TITLE: DISCUSSION—REVIEW DISTRICT GOALS

Requested By: Board of Trustees **Prepared By:** Board of Trustees **Date:** 01/09/2012

SUMMARY:

The Board of Trustees needs to review the 2010-2015 Goals and Strategic Objectives to see if any changes and/or additions need to be made to any of the goal areas.

Please refer to the Goals and Strategic Objectives at the end of the agenda.

SUGGESTED ACTION: Informational

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date

01/09/2012

Agenda Item No.

9

☐ **Minutes/Claims** ☒ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action – Consent** ☐ **Action – Indiv.**

ITEM TITLE: CALENDAR ITEMS, CONCERNS, CORRESPONDENCE, ETC.

Requested By: Board of Trustees **Prepared By:** _____ **Date:** 01/09/2012

SUMMARY:

Time is provided on the agenda for the Board to discuss calendar items, concerns, correspondence, future agenda items, and comments for the good of the district.

SUGGESTED ACTION:

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	10

☐ **Minutes/Claims** ☐ **Board of Trustees** ☒ **Superintendent's Report** ☐ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: REPORT—ELECTION UPDATE

Requested By: Superintendent **Prepared By:** Mike Waterman **Date:** 01/09/2012

SUMMARY:

Mike Waterman, Business Manager/District Clerk, will report on the election calendar and procedures for 2012.

Attached are the Terms of Office Listing and the 2012 School Election Calendar.

Board members terms of office that are due to expire in 2012 include: Mary Schelle and Monte Weeden. These are both three year terms.

SUGGESTED ACTION: Informational

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD MEMBERS TERMS OF OFFICE

As currently exists, Board members terms of office are as follows:

	Expire 2012	Expire 2013	Expire 2014
SCHOOL DISTRICT #1	Mary Schelle Monte Weeden	Jeremy Bristol Lisa Pierce	Joe Irish Stan Monger Barb Thomas

School District #1 Two (2) - Three (3) Year Terms:

_____ 3 year term (to expire in 2015)

_____ 3 year term (to expire in 2015)

Petitions Filed for Nomination of School Board Trustee:

MAY 8, 2012
SCHOOL ELECTION CALENDAR

December 25, 2011 through March 29, 2012	**Trustee candidates file for election.** Nomination petition and Oath of Candidacy must be filed with election administrator. No person signing a petition may sign more nomination petitions than there are trustee positions open. **NO CANDIDATE MAY APPEAR ON THE BALLOT UNLESS HE OR SHE MEETS THIS DEADLINE.** Candidates from county high school districts with enrollments of 2,000 or more or first-class districts in counties with populations of 15,000 or more must file a form C-1-A, and if desired, a form C-3 with the district clerk and Montana Commissioner of Political Practices within 5 days of filing for office. (13-10-201(6), 13-37-201, 20-3-305 and 20-3-344, MCA) [No earlier than 135 days, or no later than 40 days before election.] **Any candidate that has already filed for election, but wishes to withdraw their name, may do so not less than 38 days before the school election by sending a statement of withdrawal to the election administrator.** (13-10-325, MCA as amended by HB327 (2011 session) effective 4/22/2011)
End of January	Contact the Montana Commissioner of Political Practices (MCPP) office at (406) 444-2942 if you are in (1) a first-class district located in a county with populations of 15,000 or more, ***OR*** (2) a county high school district with an enrollment of 2,000 or more and did NOT receive a notice and a packet of information from the MCPP. (13-37-206, MCA)
Updated in 2009 (SB 276) Changes	**County election administrator mails address confirmation forms to electors who have requested absentee ballots for subsequent elections.** The county election administrator will mail the address confirmation forms in January. You still must contact your county election administrator for the permanent absentee ballot list.
February 23, 2012	**First day elector can request an absentee ballot.** Voters who wish to vote absentee may request an absentee ballot in writing or in person starting at this date until noon the day before the election. Remember to include the following on the application for absentee ballot: ● A section on the form allowing the voter to become part of the permanent absentee list (13-13-211 and 13-13-214, MCA) [75 days before election]
March 29, 2012	**Trustees call for an election.** At least 40 days before the election, the trustees must pass a resolution stating: 1) the date of the election; 2) the purpose of the election; 3) the polling site(s) (if changed from previous school election); and 4) the time the polls will open, if before noon. The trustees do NOT have to set levy amounts at this time; however, they must be set in time for the clerk to certify the ballot. The resolution must be delivered to the county election administrator at least 35 days before the election, but it need NOT be posted. The trustees must also appoint three election judges per precinct. The resolution should appear in the board minutes. An election may also be called by the county superintendent, county commissioners, board of public education or the trustees of a community college. 20-20-401, 20-20-201, and 20-20-203, MCA

March 31, 2012	**Last day trustee candidates can withdraw from the election.** Any candidate that has already filed for election, but wishes to withdraw their name, may do so not less than 38 days before the school election by sending a statement of withdrawal to the election administrator. (13-10-325, MCA as amended by HB327 (2011 session) effective 4/22/2011)
April 3, 2012	**Last day to file resolutions for school election with county election administrator.** (20-20-201(2), MCA) [no later than 35 days before election]
April 8, 2012 (Next Business Day is April 9, 2012)	**Voter registration closes.** A voter must register by this deadline to vote in the school election. County election administrator prepares registration list. It is not necessary to publish any notice of closing of voter registration. (20-20-311 and 20-20-312, MCA) [30 days before election]
April 8 – April 18, 2012	**Notice of election is posted.** The election notice must be published in a newspaper of general circulation in the district AND posted in at least three public places in the district, provided that in incorporated cities and towns at least one notice must be posted in each ward or precinct. Radio or television notice may supplement the notice. The notice must include 1) the date and polling places of the election, 2) polling place hours, 3) each proposition to be considered by the electorate, 4) the number of trustee positions, if any, subject to election and the length of the terms for those positions and 5) where and how absentee ballots may be obtained. (20-20-204, MCA) [not less than 20 days or more than 30 days before election]
April 12, 2012 (By 5 p.m.)	**Deadline for write-in candidate for a trustee position on a school board to file declaration of intent.** (13-10-211(3), MCA) [not less than 26 days before the election]
April 12, 2012 (After 5 p.m.)	**Election by Acclamation and Cancellation of Election - Notice.** If the number of candidates filing a nomination petition or filing a declaration of intent to be a write-in candidate is equal to or less than the number of open trustee positions to be elected, the trustees cancel the trustee election. They must then give notice that a trustee election will not be held. **A trustee election held in single-member or trustee nominating district is considered a separate trustee election for declaring the election by acclamation. (20-3-313, MCA** as amended by HB327 (2011 session) effective 4/22/2011.)
By April 13, 2012	**Election administrator certifies ballot.** The election administrator prepares the final ballot form, listing all candidates and propositions to be voted upon. The ballot must then be delivered to the election administrator, if other than the clerk. See School Election Handbook for more information**. Trustees must pass a resolution stating exact levy amounts by this date in order for the clerk to certify the ballot.** This resolution must include the durational limit, if any, on the levy. [not less than 25 days before election] 13-12-201, 20-20-401, and 15-10-425, MCA **Statement of withdrawal must be received before the ballot is certified by the election administrator. Otherwise, the candidate's name must appear on the ballot.**
April 18, 2012	**Absentee ballots available.** The election administrator prepares ballots for absentee voters. Remember to enclose four things in the absentee package. ● The ballot ● Instructions for voting and returning the ballot ● A secrecy envelope, free of any marks that would identify the voter ● A self-addressed, return envelope with affirmation printed on the back of the envelope (20-20-401, MCA) [at least 20 days prior to election]
April 26-May 28, 2012	Candidates who marked Box "C" on their form C-1-A must file form C-5 with the district clerk and Montana Commissioned of Political Practices. (13-37-226 (4), MCA) [12 days before and 20 days after the school election]

April 28, 2012 (Next Business Day is April 30, 2012)	**Last day to notify election judges of appointment.** (20-20-203, MCA) [not less than 10 days before election]
February 23 until noon May 8, 2012	**Deadline for absentee requests.** Absentee ballots may be requested 75 days before the election but no later than noon the day before the election. *If the voter has a health emergency between 5 p.m. the Friday before the election (May 4) and noon on the election day (May 8), an emergency request for an absentee ballot may be made by noon on the election day (May 8.) (13-13-211, MCA)
May 7, 2012 (By 5 p.m.)	**Absolute last day for write in candidates to file a declaration of intent** (13-10-211, MCA) A declaration of intent may be filed after the deadline and until 5 pm the day before the election only if a candidate for the office that the write in candidate is seeking: dies or is charged with a felony offense.
May 7, 2012	**Deliver certified copy of the lists of registered electors** for each polling place to the district by election administrator before the election day. District then delivers list(s) to election judges prior to opening of polls. (20-20-313, MCA)
May 8, 2012	**Notify election judges of the names of write-in candidates**
May 8, 2012	**ELECTION DAY.** (20-20-105, MCA) The election administrator must prepare polling places, print ballots, ensure election judges are present and conduct a fair and unbiased election. (Title 13, Chapter 13, and 20-20-203, 20-20-401, and 20-20-411, MCA)
April 26-May 28, 2012	Candidates who marked Box "C" on their form C-1-A must file form C-5 with the district clerk and Montana Commissioned of Political Practices. (13-37-226 (4), MCA) [12 days before and 20 days after the school election]
Following receipt of the tally sheets from all polls **AND By May 23, 2012** (Next regular or special board meeting following the election)	**Trustees canvass votes, issue certificates of election and publish results**. The canvassed results shall be published immediately in a newspaper that will give notice to the largest number of people in the district. (20-20-415 and 416, MCA) [within 15 days after the election]
Within 15 days after receipt of certificate of election. (20-20-416, MCA)	**Candidate completes oath of office and files** with the County Superintendent. Newly elected trustees may not be seated until the oath is filed. (20-3-307, 20-1-202, 1-6-101, MCA)
May 23, 2012	**Deadline for trustees to hold organizational meeting.** (20-3-321, MCA) [not later than 15 days after the election] as amended by HB327 (2011 session) effective 4/22/2011.)
June 1, 2012	**Deadline for trustees to request county election administrator to conduct school election for next year.** (20-20-417, MCA)

Additional References:

Sample forms can be found at this address.
http://www.opi.mt.gov/Finance&Grants/schoolfinance/Index.html#p7GPc1_7

1-1-307, MCA. Postponement of day appointed for an action when it falls on a holiday or Saturday. Whenever any act of a secular nature, other than a work of necessity or mercy, is appointed by law or contract to be performed upon a particular day, which day falls upon a holiday or a Saturday, such act may be performed upon the next business day with the same effect as if it had been performed upon the day appointed.

20-3-205, MCA. The county superintendent has general supervision of the schools of the county within the limitations prescribed by this title and shall perform the following duties or acts: (2) administer and file the oaths of members of the boards of trustees of the districts in the county in accordance with the provisions of 20-3-307, MCA.

1-5-416, MCA. A notary public shall: take depositions and affidavits, if the notary is knowledgeable of the applicable legal requirements, and administer oaths and affirmations in all matters incident to the duties of the notary public's office or to be used before any court, judge, officer, or board in this state.

(MASBO takes special care in preparation of the annual election calendar however, if you find a mistake or oversight, please notify the MASBO office so corrections can be noted in future newsletters and in future calendars. Thank You.)

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	11

☐ **Minutes/Claims** ☐ **Board of Trustees** ☒ **Superintendent's Report** ☐ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: REPORT—INVESTMENT

Requested By: Superintendent **Prepared By:** Mike Waterman **Date:** 01/09/2012

SUMMARY:

Attached is the report on the interest earned and distributed for December 2011.

The first column of the report reflects the cash balance in various funds as of December 1, 2011.

SUGGESTED ACTION: Informational

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

Lewistown School District No. One

Investment Distribution Detail Report

Fiscal Year: 2011-2012

Criteria: From Control#: 31 To: 32 Acct Mask: __.__.___.____.___.___ Sort By Acct

☐ Print Internal Accounts Only

Type: Interest Posting Date: 12/31/2011 Amount Distributed: $6,039.36 Control#: 31

Posting Description: Interest Distribution 11/30/2011 Entry#: 288

Account Number	Final Cash	Days	Percent	Amount	Original Cash	Redirect	Redirect Amount	Internal?
101.00.000.0000.101.000	$1,084,317.20	30	.2489907	$1,503.74	$1,084,317.20		$0.00	Yes
110.00.000.0000.101.000	$746,084.24	30	.1713226	$1,034.68	$746,084.24		$0.00	Yes
111.00.000.0000.101.000	$811,112.59	30	.1862550	$1,124.86	$811,112.59		$0.00	Yes
112.00.000.0000.101.000	$118,907.05	30	.0273045	$164.90	$118,907.05		$0.00	Yes
113.00.000.0000.101.000	$0.00	30	.0000000	$0.00	$0.00		$0.00	Yes
114.00.000.0000.101.000	$623,641.68	30	.1432062	$864.87	$623,641.68		$0.00	Yes
120.00.000.0000.101.000	$10,467.20	30	.0024036	$14.52	$10,467.20		$0.00	Yes
121.00.000.0000.101.000	$51,671.63	30	.0118653	$71.66	$51,671.63		$0.00	Yes
124.00.000.0000.101.000	$85,808.23	30	.0197041	$119.00	$85,808.23		$0.00	Yes
128.00.000.0000.101.000	$49,925.23	30	.0114643	$69.24	$49,925.23		$0.00	Yes
129.00.000.0000.101.000	$101,785.53	30	.0233729	$141.16	$101,785.53		$0.00	Yes
150.00.000.0000.101.000	$184,477.57	30	.0423614	$255.84	$184,477.57		$0.00	Yes
160.00.000.0000.101.000	$9,079.65	30	.0020850	$12.59	$9,079.65		$0.00	Yes
161.00.000.0000.101.000	$477,572.25	30	.1096644	$662.30	$477,572.25		$0.00	Yes
Control# 31 Total:	$4,354,850.05		1.0000000	$6,039.36	$4,354,850.05		$0.00	

Balance Calculations based on Prior Month Ending Balances as of 11/30/2011

Type: HS Interest Posting Date: 12/31/2011 Amount Distributed: $3,818.21 Control#: 32

Posting Description: Interest Distribution 11/30/2011 Entry#: 289

Account Number	Final Cash	Days	Percent	Amount	Original Cash	Redirect	Redirect Amount	Internal?
201.00.000.0000.101.000	$684,131.18	30	.2195571	$838.30	$684,131.18		$0.00	Yes
210.00.000.0000.101.000	$445,935.80	30	.1431135	$546.44	$445,935.80		$0.00	Yes
211.00.000.0000.101.000	$207,207.66	30	.0664988	$253.91	$207,207.66		$0.00	Yes
213.00.000.0000.101.000	$0.00	30	.0000000	$0.00	$0.00		$0.00	Yes
214.00.000.0000.101.000	$308,689.63	30	.0990673	$378.26	$308,689.63		$0.00	Yes
217.00.000.0000.101.000	$16,825.03	30	.0053996	$20.62	$16,825.03		$0.00	Yes

Investment Distribution Detail Report

Fiscal Year: 2011-2012

Criteria: From Control#: 31 To: 32 Acct Mask: __.__.___.____.___.___ Sort By Acct

☐ Print Internal Accounts Only

218.00.000.0000.101.000	$16,247.30	30	.0052142	$19.91	$16,247.30	$0.00	Yes
220.00.000.0000.101.000	$9,306.75	30	.0029868	$11.40	$9,306.75	$0.00	Yes
221.00.000.0000.101.000	$25,337.46	30	.0081315	$31.05	$25,337.46	$0.00	Yes
224.00.000.0000.101.000	$163,657.50	30	.0525223	$200.54	$163,657.50	$0.00	Yes
228.00.000.0000.101.000	$118,419.04	30	.0380040	$145.11	$118,419.04	$0.00	Yes
229.00.000.0000.101.000	$112,041.86	30	.0359574	$137.29	$112,041.86	$0.00	Yes
260.00.000.0000.101.000	$67,519.31	30	.0216689	$82.74	$67,519.31	$0.00	Yes
261.00.000.0000.101.000	$649,886.75	30	.2085671	$796.35	$649,886.75	$0.00	Yes
281.00.000.0000.101.000	$90,605.90	30	.0290780	$111.03	$90,605.90	$0.00	Yes
282.00.000.0000.101.000	$200,147.84	30	.0642331	$245.26	$200,147.84	$0.00	Yes
Control# 32 Total:	$3,115,959.01		.9999996	$3,818.21	$3,115,959.01	$0.00	

Balance Calculations based on Prior Month Ending Balances as of 11/30/2011

End of Report

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	12

☐ **Minutes/Claims** ☐ **Board of Trustees** ☒ **Superintendent's Report** ☐ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: OTHER ITEMS

Requested By: Superintendent **Prepared By:** Superintendent **Date:** 01/09/2012

SUMMARY:

Time is provided on the agenda for the Superintendent to discuss with the Board any calendar items, concerns, correspondence, future agenda items, and announcements.

- MHSA Annual Meeting—Monday, January 16, 2012—Billings
- Roundtable Schedule—Monday, February 13, 2012—Fergus High School—6:00 p.m.
- LJHS Geography Bee—Tuesday, January 10, 2012
- PIR Day—Monday, January 16, 2012—Data Analysis/AIMSWeb and Bullying
- FHS BPA Region 3 Leadership Conference—Monday, January 16, 2012—Great Falls
- Adult Education Registration—Tuesday, January 17, 2012—12:00 p.m.—CMEC
- FHS FFA—KMON Contest—January 20-21, 2012—Cascade/Great Falls
- FHS Speech and Drama
  - Divisional Meet—Saturday, January 21, 2012—Havre
  - State Meet—January 27-28, 2012—Polson
- Eagle Booster Feed and Raffle—Monday, January 23, 2012
- FHS FFA Mechanics Contest/Winter MAAE Meeting—Saturday, January 28, 2012—Lewistown
- FHS Junior Cheer Camp—Saturday, January 28, 2012—Fergus Fieldhouse—BBB Half-time
- FHS Winter Spirit Week—January 30-February 3, 2012
- WR—Central A Divisional Meet—Saturday February 4, 2012—Belgrade
- Eastern A Band Festival—February 6-7, 2012—Sidney
- Eagle Booster Meeting—Monday, February 6, 2012—7:00 p.m.—Yogo Inn
- State All Class Wrestling Tournament—February 10-11, 2012—Billings
- Home Athletic Games/Meets:
  - BBB vs. Park High—Friday, January 13, 2012—4:15/5:45/7:30 p.m.
  - GBB vs. Browning—Saturday, January 14, 2012—3:00/4:30/6:00 p.m.
  - WR – Central A Duals—January 20-21, 2012—TBA
  - BBB vs. Laurel—Tuesday, January 24, 2012—4:15/5:45/7:30 p.m.
  - WR vs. Belgrade, Park, Butte Central—Thursday, January 26, 2012—TBA
  - GBB vs. Laurel—Friday, January 27, 2012—4:15/5:45/7:30 p.m.
  - BBB vs. Fairfield—Saturday, January 28, 2012—2:00/3:30/5:00 p.m.
  - GBB vs. Havre—Friday February 3, 2012—4:15/5:45/7:30 p.m.
  - BBB vs. Belgrade—Saturday, February 4, 2012—3:00/4:30/6:00 p.m.
  - GBB vs. Park High—Friday, February 10, 2012—4:15/5:45/7:30 p.m.
  - GBB vs. Browning—Saturday, February 11, 2012—3:00/4:30/6:00 p.m.

SUGGESTED ACTION: Informational

☒ **Additional Information Attached**

MONTANA HIGH SCHOOL ASSOCIATION
2012 ANNUAL MEETING

Monday, January 16, 2012
Billings Hotel & Convention Center
Billings, Montana

PROPOSALS

1. Proposal to Amend Membership By-Law ---------- 1
   Presented by: Manhattan Christian High School

2. Proposal to Amend Participation By-Law ---------- 1
   Presented by: Bigfork High School

3. Proposal to Allow Wrestling Practice by Eighth Grade Students ---------- 2
   Presented by: Choteau High School

4. Proposal to Eliminate Master Basketball Scheduling ---------- 2
   Presented by: MHSA Executive Board

5. Proposal to Rescind Academic Eligibility Requirements for Major Performing Groups ---------- 3
   Presented by: Malta High School

1. PROPOSAL TO AMEND MEMBERSHIP BY-LAW

Manhattan Christian High School proposes the following addition to By-Laws, Article I, Section (1) Membership on page 11 of the current MHSA Handbook in reference to MHSA membership:

1.4 A non-member school may petition to receive Associate Member status in order to receive sanctioning to compete in out-of-state competitions. Associate member schools will not be assigned a district schedule and will be ineligible for instate postseason play as well as in-state multi-school events. All member fees will apply. Associate members must submit schedules for out-of-state competitions, that require sanctioning, at least 60 days in advance.

Rationale:

Most state associations have some form of associate membership that allows private schools to receive sanctioning for parochial system tournaments. Since many private schools have becomed sanctioned by their associations, it has become important for all private schools to be sanctioned in order to play each other at tournaments. Since there is currently no such provision in Montana, the only option for a Seventh-day Adventist or Jewish school is to become a full member and then request tournament scheduling accomodations for Friday night and Saturday games. An Associate Member provision will provide a path for such schools to receive santioning for out-of-state parochial tournaments thus avoiding disruption to MHSA tournaments. This ammendment will also generate income for the association through dues in exchange for minimal services provided.

2. PROPOSAL TO AMEND PARTICIPATION BY-LAW

Bigfork High Schools proposes the following amendment to By-Laws, Article I, Section (1) Membership on page 11 of the current MHSA Handbook in reference to participation:

1.2 ~~Any member school will not be permitted to participate in any interschool athletic contest with a school, club team or other groups (teams) that are not accredited by the State Board of Public Education in the state of Montana and, hence, not eligible for membership in the MHSA, if more than two schools would be participating in the event. If a member school does participate in an interschool contest with a non-accredited school, club team or other groups (teams) and more than two schools are involved, the member school or schools will be subject to penalties under Article VIII.~~

1.2 Non-member schools can compete against member schools in any regular season contest or regular season invitational tournament/meet if the non-member school is an established 9-12 high school. This will not include post season interscholastic athletic competitions or include participation by club teams or groups not established as a high school.

Rationale:

To allow non MHSA schools to participate in regular season track and golf invitationals. It would be a benefit, especially in Golf, as teams are looking for more meets and there need to be at least 3 teams involved for scores to be able to qualify for state tournament.

This is just for regular season events.

3. PROPOSAL TO ALLOW WRESTLING PRACTICE BY EIGHTH GRADE STUDENTS

Choteau High School proposes the following amendments to By-Laws, Article II, Section (5) Students Below Ninth Grade on pages 20-21 of the current MHSA Handbook:

5.1 No student who is enrolled in a grade below the ninth shall be eligible to participate in an Association Contest, except as noted in 5.3 or eighth grade students meeting the following requirements:

a. Eighth grade students may play on a high school volleyball, track relay and/or basketball teams. ***Eighth grade students may practice with the high school wrestling program***.

b. Permission for eighth grade participation ***or practice*** must be requested by the school and authorization granted by the Executive Director of the MHSA. Once granted approval, those eighth grade participants are eligible to participate in varsity and JV competition ***for volleyball, track relay and/or basketball teams. Eighth grade wrestlers may practice with the varsity or JV team(s).***

c. Any eighth grade student allowed to participate ***or to practice*** will have eight semesters of high school eligibility remaining.

d. All eighth grade students participating ***or practicing*** must meet the academic requirements.

Rationale:

Our concern is having a wrestler in a lower weight class (98,105, & 112) paired up at practice with a wrestler from a higher weight class (140 & 145). Pairing wrestlers from different weight classes poses a safety concern and puts our lower weight class wrestlers at risk of getting injured. In the past several years, we have needed wrestling partners for our lower weight class wrestlers to protect their safety. Even when we have had two wrestlers in the lower weight class, this has been a concern when one of the wrestlers can't practice due to illness or injury. This proposal is a safety request; NOT a ploy to have Jr. high wrestlers participating on the high school wrestling team.

4. PROPOSAL TO ELIMINATE MASTER BASKETBALL SCHEDULING

The MHSA Executive Board proposes the following amendment to Basketball, I. General Rules and Regulations on page 98 of the MHSA Handbook:

(11) ~~Master Basketball schedules are for varsity competition only. Any deviation must be approved by the MHSA Executive Director.~~

(11) ***In Classes AA, A, B and C it is the responsibility of each MHSA member school to develop their school's basketball schedule for each school year.***

Rationale:

In 1985 an MHSA Regional Basketball Committee was formed to address MHSA member schools' basketball scheduling and the cost related to each school's basketball travel. The committee developed a regional basketball schedule, which was started in the 1987-88 school year, where schools would play other schools within a 100 mile radius, but may not play all the schools within their conference. With the 2004-05 request by MHSA member schools to play other schools in their conference two (2) times, if possible, the original intent of reducing costs for MHSA member schools by developing a regional

basketball schedule has been lost. Many member schools now drive through a school's community to play a contest with a different school.

Several schools do not play other members of their district or division until tournament time.

Schools are not always listed in the same sequence on the master basketball schedule thus causing games to be played during the week and not only on weekends. School time is lost with more weekday games.

The Master Basketball Committee is the only MHSA Committee that develops schedules for MHSA member schools.

The Master Basketball Scheduling Committee has worked very hard to meet the basketball scheduling requests of the MHSA member schools. However, the task of creating a workable schedule while accommodating all requests is increasingly difficult, in part because of the following factors:

- Schools move from one classification to another.
- Schools move from one conference to another.
- Schools are requesting cooperative sponsorship agreements more frequently.
- Cooperative sponsorship agreements and other factors can create realignment issues, in some cases resulting in 9, 10 or 11 team conferences.
- Concerns from schools about scheduling, which are unique to basketball because in other sports schools develop their own schedules.

The vast majority of schools request a schedule consisting of sixteen games, which allows little or no flexibility in the scheduling process.

Fiscal Note:

There will not be any fiscal difference to the MHSA.

5. PROPOSAL TO RESCIND ACADEMIC ELIGIBILITY REQUIREMENTS FOR MAJOR PERFORMING GROUPS

Malta High School proposes that the academic eligibility rule for major performing groups in music which are in effect for 2011-2012 be maintained, and that the academic eligibility standard approved by the MHSA Executive Board to align major performing groups with all other activities in 2012-2013 be rescinded.

2011-12 Eligibility:
Students in major performing groups must be enrolled in the corresponding music class in order to participate in the district music festival.

2012-13 Eligibility:
Students in major performing groups must meet the same academic standards as state music participants, forensics participants, and athletes. A student must be enrolled in twenty hours per week and in regular attendance ten hours per week at the school where the student participates. A home school student is not eligible to participate for an MHSA member school. A student must have received a passing grade and received credit in at least twenty periods of prepared class work or its equivalent in the last previous semester.

Rationale:

Malta High School respectfully requests consideration of keeping the current, successful District Festival eligibility rules for bands, choirs and orchestras in place.

A thorough rationale was provided by the MHSA Music Committee when the current rule was adopted more than fifteen years ago. From our perspective, the arrangement has worked well all those years, and the rationale originally provided is still valid. Eligibility for major performing groups should be defined as enrolled in a curricular class.

District Music Festival, as it applies to bands, orchestras and choirs, represents a nexus of academics and activities. A performing group's performance at the District Music Festival is the most rigorous academic authentic assessment available to school music groups in Montana. Far from being "festive," the event provides a practical, affordable forum in which students and teachers are not only assessed on their current level of musical achievement, but also receive expert advice on how to improve. A panel of trained professional adjudicators assesses the group's performance using a rubric designed specifically for the type of group (band, orchestra, choir, brass solo, string solo, etc.). All MHSA certified adjudicators have degrees in music, most have advanced degrees.

Very few administrators have the background to provide technical assistance to their music teachers, or understand how to evaluate their music program based on state and national standards. Input from District Festival adjudicators is one of the few ways directors are introduced to effective assessment and teaching techniques that most administrators are unable to offer.

Given the extraordinary amount of brain research linking academic success to music making, it is clear that a band, choir or orchestra's District Festival performance is the culmination of a rigorous academic unit which begins when the music is selected, probably in February, and ends only after the adjudication sheets have been reviewed and suggestions for improvement are implemented.

There is a fundamental issue with attempting to apply extracurricular rules to such a clearly curricular process. District Music Festival is unlike any other MHSA activity. There is no other academic area in which, if a student enrolls, he/she is also considered an extracurricular participant because of one performance at one annual event. Schools are required to enter their major performing groups in District Festival, if they have paid the appropriate fees, or face MHSA sanction. Almost exclusively, directors require students to perform with the group for district festival as a grade requirement. To music education, the festival performance is analogous to turning in a term paper, or presenting a science project. However, it is unique in that the entire group must present their project at the same time to make it a valid educational experience. Administrators should be aware that there are a number of students who would choose *not* to attend the festival if attendance were not required.

Denying a student participation in the most valid authentic assessment of the school year because of poor performance in other classes is not a student-centered decision. To follow the analogy above, not to allow a student to take his unit history test, even if he needs to ride a bus to a different town to take the test, because of poor math grades makes no sense.

And it is not just the festival performance that is affected. What is the director to do with an ineligible student during the six weeks or so of intense rehearsals leading up to the festival, if the student will not be part of the performance? The music must be rehearsed as it will be performed, not rehearsed with parts (musicians) that will not be present during the actual performance. Keep in mind, unlike a sports team, there are no substitutes to bring in off the bench in a music group.

If the school band has only two drummers, but both are deemed ineligible to perform at the District Festival, it is entirely conceivable that the entire band would not be able to perform because the integrity of the music is lost. Imagine a snappy march with no drums. Or, the director could choose music with no drum parts, but what becomes of the two drummers for the six weeks of rehearsals? That scenario affects

all students' learning and could easily invalidate the assessment process, the very reason festivals exist, or create legal issues.

MHSA eligibility rules apply to students auditioning and participating in All-State groups, and students who enter district festival as a soloist or small ensemble with the opportunity to participate at State Festival. Those are clearly extracurricular--as the term suggests, more than the curriculum calls for. But the band, choir or orchestra festival performance is clearly curricular.

The issue boils down to being able to tell a parent why their son can go to the music festival on Friday, but not the track meet on Saturday. MHSA's mantra has always been "local control." If an administrator feels reasonable people will not be able to understand the rationale, a school may supersede the MHSA rule and apply local control. But please do not impose that situation upon the entire state.

To quote Thomas Jefferson, *"There is nothing more unequal than the equal treatment of unequal people."*

BOARD OF TRUSTEES ROUNDTABLE SCHEDULE

2011-2012

Date	Group	Time	Meeting Site
November 14, 2011	Highland Park Elementary	6:00-7:00 p.m.	Highland Park Elementary School
December 12, 2011	Lewis and Clark Elementary	6:00-7:00 p.m.	Lewis & Clark Elementary School
January 9, 2012	Garfield Elementary	6:00-7:00 p.m.	Garfield Elementary School
February 13, 2012	FHS Staff	6:00-7:00 p.m.	Fergus High School
March 12, 2012	Junior High School	6:00-7:00 p.m.	Junior High School
April 9, 2012	LEA Executive Board	6:00-7:00 p.m.	Lincoln Board Room

ALBERTA BAIR THEATER BUS TRIPS
Prime seats on main floor; dinner on your own at arranged stop. Fee includes bus & show ticket. Board the bus at Fergus High School at 2:30 PM; show time at 7:30 PM.

***ELVIS LIVES!* * SIGN UP NOW!**
Multi-media extravaganza pays homage to Elvis during stages of his career. Tribute artists will be joined by a live band, back-up singers, dancers, as well as iconic imagery, portraying Elvis in four eras: 1950, 1960, his movie career and concert years. Friday, February 17 only. Fee: $65. No discounts. **Must register and pay by January 17!**

***DAMN YANKEES* * SIGN UP NOW!**
Fly balls & devilishly good fun meet at the home plate of this 7 Tony Award-winning Broadway musical. This is the story of a 1950's middle-aged baseball fanatic who trades his soul to the Devil for a chance to lead his favorite team against the New York Yankees only to realize the life (and wife) he's left behind. Filled with hit songs, this show is a musical comedy home run! Saturday, March 3 only. Fee: $65. No discounts. **Must register and pay by February 3!**

FUNDAMENTALS OF ICE HOCKEY * SIGN UP NOW!
Learn how to play the game, watch the game & enjoy this sport. On & off the ice instruction. Lewistown Ice Skating Assoc. instructors: Berg, Merker, Rutten. Lewistown Ice Rink. 8 wks, Thurs, Jan 19-Mar 8, 6:30-8:30 PM. Fee: $15/person or $25 parent/student combo

RESHAPING YOUR BODY THROUGH EXERCISE *
Designed to help with building bone density through weight bearing exercises. Focus on the body as a whole, working through each group of muscles with a variety of exercises. Instructor: Lisa Campbell. Parrish Hall, St James Episcopal Church, Thurs, 8 wks, 5:30-6:30 PM, Feb 2-Mar 22. Fee: $32 per person. No discounts

BEGINNING YOGA *
The movements, breathing practice & relaxation techniques of Yoga can help to improve fitness, reduce stress & pain, & enhance healing & well-being in your life. Instructor: Judy Kellogg. Parrish Hall, St James Episcopal Church, Tues, 8 wks, 5:30-6:45 PM, Feb 7-Mar 27. Fee: $40 per person. No discounts

NAVIGATING WINDOWS 7 *
Learn the tricks to smooth your Windows 7 experience. Learn to navigate folders, organize your files, utilize the task bar and desktop and how to keep your machine secure. Instructor: Todd Lark. FHS library lab, Mons, 2 wks, 6-9 PM, Feb 6 & 13. Fee: $25

GOOGLE APPLICATIONS *
This course takes a look at all things Google & how these various applications, such as Gmail, Gcalendar, Google documents & Picasa tie together for a seamless user experience. Instructor: Todd Lark. FHS library lab, Weds, 2 wks, 6-9 PM, Feb 8 & 15. Fee: $25

DIGITAL PHOTOGRAPHY & YOUR COMPUTER - PART ONE *
Learn how to make your digital photography experience efficient & fun. Learn best practices for downloading pictures, performing basic edits & preparing pictures for sharing via email & web. Will primarily work in Picasa (a free google application). Basic computer skills recommended. Instructor: Todd Lark. FHS library lab, Mon & Wed, 2 wks, 6-9 PM, Feb 20 & 22. Fee: $25

DIGITAL PHOTOGRAPHY & YOUR COMPUTER - PART TWO *
Take your photography a step further using advanced editing techniques utilizing Picasa & GIMP (an open source alternative to Adobe Photo Shop). We will learn to optimize work flow, utilize digital tools to make the right edit, & prepare photos for both print & digital media. Instructor: Todd Lark. FHS library lab, Mon & Wed, Feb 27 & 29, 2 wks, 6-9 PM. Fee: $25

ADVANCED EXCEL 2010 *
Will cover the use of more advanced formulas, filtering, comments, pivot tables, & other features as requested from the class. A good workable knowledge of Excel 2010 is required in order to benefit from this class. Instructor: Russell Epperson. CMEC computer lab. Tues & Thurs, Mar 6-15. 6-8m PM. Fee: $40

GOOGLE SKETCHUP *
A free easy to learn piece of software that anybody can use to model objects in 2D or 3D. Draw a house to scale, design a piece of furniture or create a city. Learn the basics in just a few hours & then let your imagination do the rest! Instructor: Jeff Friesen. FHS library lab, Tues, Feb 14 & 21, 7-9 PM. Fee: $20

HOW TO GET CONNECTED *
TVs, wires, Netflix, home theater – how does a person make sense of it all? Learn basics of integrating the audio & video in your media setup. Includes a physical demonstration of how wires interconnect between the components of your audio & video systems as well as how a computer, a Roku or gaming consoles (PS3, Xbox) can be integrated into your media system. Discuss ways media is being delivered into the home such as Netflix, Hulu & Blockbuster. Course will be adjusted to knowledge of participants. Instructor: Jeff Friesen. FHS library lab, Tue, 6:30-9:00 PM, Feb 7 only. Fee: $15

ROOM LOCATION KEY: FHS = Fergus High School
LJHS = Lewistown Junior High School
CMEC = Cent MT Ed Center, Airport Road

BASIC DOG OBEDIENCE *
Course for beginning dog, six months or older. Teaches foundation commands for a well-behaved companion. Require proof of current rabies & distemper/ parvo vaccines at first class. Instructor: Christina McGiboney. LJHS gym. 5 wks, 7-8 PM, Weds, Feb 1-29. Fee: $35. No discounts.

DRAWING IN THE ROUND *
Learn to give a wide range of objects the feel of realism by drawing them in the 3rd dimension. Use various shading techniques & perspective techniques to create richly defined depth in both the objects & in your composition. Instructor: Clint Loomis. LJHS art room, 6 wks, Thurs, Jan 26-Mar 1, 7-9 PM. Fee: $35

BASIC BEADED JEWELRY *
This class will cover basic stringing materials, clasps & the use of simple tools & findings. Create necklaces, earrings & bracelets using your own favorite beads or using beads & supplies that you can purchase from the instructor. Tools provided. Instructor: Gayle Arntzen. FHS rm 213, 4 wks, Mons, 6-9 PM, Mar 5-26. Fee: $30 + supplies

CARD MAKING FOR VALENTINE'S DAY *
A handmade card is a gift in itself. You will learn card making & paper crafting in this class. The instructor will teach rubber stamping techniques & the use of a die cutting machine. Instructor: Denice Marshall. FHS rm 222, Thur, 6-9 pm, Feb 2. Fee: $15 + supplies

SCULPEY CLAY JEWELRY WORKSHOP *
Using polymer clay is a fun way to make fabulous & funky jewelry. Use a variety of techniques to make beads, flowers or small sculptural figures that can be made into necklaces or earrings. Instructor. Cheryl Bannes. FHS rm 216, Tue, 6-9 PM, Feb 7. Fee: $20 + supplies

QUICK & EASY PRINTMAKING WORKSHOP *
Create cards through simple printmaking processes. Use soft wood to make a basic wood block print that can be used for making cards, pictures or for blocking patterns on fabric. Instructor: Cheryl Bannes. FHS rm 216, Tue, 6-9 PM, Feb 21. Fee: $20 + supplies

BASIC METAL EMBOSSING WORKSHOP *
Create simple raised metal designs in soft metal to decorate boxes, candles, books or for a decorative wall piece. Create your own design & transfer it to metal. Instructor: Cheryl Bannes. FHS rm 216. Tue, 6-9 PM, Mar 6. Fee: $20 + supplies

MEALS IN MINUTES IN THE MICROWAVE * Recipes & Taste-Testing! Enjoy the flavors & tastes of home with meals prepared from scratch but cooked in the microwave. Includes appetizers, main dishes & desserts. Instructor: Janelle Fulbright. FHS rm 117, Thur, 6-8 PM, Feb 2 only. Fee: $15

DELIGHTFUL CUPCAKE DECORATING * Recipes & Taste-Testing! Learn to make playful creations with cupcakes using inexpensive supplies. No special skills required. Instructor: Cindy Kennedy. FHS rm 117, Tue, 6-9 PM, Feb 21 only. Fee: $15

BEYOND GREEN BEANS & BROCCOLI, APPLES & ORANGES * **Recipes & Taste-Testing!** Are your fruit & vegetable dishes boring? Have you been offering your family the same old things for years? Explore the variety of fruits & vegetables we have available to us & fill up your family with delicious, interesting recipes. Instructor: Denise Seilstad. FHS rm 117, Thur, 6-8 PM, Mar 1 only. Fee: $15

FOOD "SERVSAFE" TRAINING
Safe food handling training for people who work in temporary food service such as fair booths or school concessions; or those working in restaurants, day cares, etc. Instructors: D Seilstad & D Pomeroy. FHS 117, Mon & Wed,6-8 PM, Feb 27 & 29. Fee:$15 includes book

FIRST AID / ADULT, INFANT & CHILD CPR *
A certified American Heart Association course with hands-on learning of life-saving techniques, choking & rescue breathing & practical first aid. Instructor: Don Kern. Central MT Education Center on Airport Rd. All classes on Saturdays. No discounts.
FIRST AID: 9-12 noon. Fee: $30
Choose one date: Feb 4, Feb 18 or Mar 17
ADULT, INFANT/CHILD CPR: 1-4 PM. Fee: $30
Choose one date: Feb 4, Feb 18 or Mar 17
FIRST AID & CPR Combination: 9 AM-4 PM, Fee: $45
HEALTH CARE PROVIDERS: Mar 31, 9-1 pm. Fee: $45

ADULT BASIC EDUCATION / GED PREPARATION
For adults over 16 years old who are not enrolled in a regular school setting. One-to-one instruction in reading, writing, language skills, math, basic job skills, driver license assistance, computer literacy, & GED exam preparation. Instructors: Mike Rea & Bob Feist. Central MT Education Center. Start anytime. No charge. Tues, Weds & Thurs, 9 AM-5 PM. Evenings by appointment.

* Limited Enrollment

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 13

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: RECOGNITION OF PARENTS, PATRONS, AND OTHERS WHO WISH TO ADDRESS THE BOARD

Requested By: Board of Trustees **Prepared By:** _____ **Date:** 01/09/2012

SUMMARY:

Time is provided on the agenda for anyone who wishes to address the Board.

SUGGESTED ACTION:

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	14

☒ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: MINUTES

Requested By: Board of Trustees **Prepared By:** Mike Waterman **Date:** 01/09/2012

SUMMARY:

The following minutes are attached for your approval:

- Minutes of the December 12, 2011, Regular Board Meeting

SUGGESTED ACTION: Approve Minutes as Presented

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

MINUTES
LEWISTOWN PUBLIC SCHOOLS
BOARD OF TRUSTEES

Lewis & Clark Elementary – Gymnasium

212 Crystal Drive
Lewistown MT 59457

MONDAY, December 12, 2011

BOARD ROUNDTABLE DISCUSSION – LEWIS & CLARK STAFF

6:00 P.M. TO 7:00 P.M.

REGULAR BOARD MEETING

CALL TO ORDER (7:00 p.m.)

1. ROLL CALL

   TRUSTEES PRESENT:

   Board Chair Stan Monger, Barb Thomas, Joe Irish, Mary Schelle, Jeremy Bristol, Lisa Pierce, Monte Weeden

   STAFF PRESENT:

   Superintendent Jason Butcher, Business Manager/District Clerk Mike Waterman, Sandi Chamberlain, Andrea Payne, Jerry Feller, Scott Dubbs, Michelle Trafton, Suzie Flentie, Justin Guyer, Kerry Vaughn, Mike Mangold, Steve Paulson, Teresa Majerus, Jeff Russell, Amanda Kase

   OTHERS PRESENT:

   Joe Zahler-KXLO/KLCM Radio; Doreen Heintz-Lewistown News-Argus, Tara Taylor, SRO Justin Jenness, and other interested parties.

2. PLEDGE OF ALLEGIANCE

   The group recited the Pledge of Allegiance.

BOARD OF TRUSTEES

3. RECOGNITION—FERGUS HIGH SCHOOL VOLLEYBALL TEAM

   The Board of Trustees recognized coaches Tara Taylor, Deena Ross, and Josie Krause and the members of the Fergus High School Volleyball Team for taking 1st Place at the State A Volleyball Meet in Bozeman on November 10-12, 2011. The Board also congratulated the coaches and team for their 1st place finish at the Class A Divisional tournament as well.

4. REPORT—STUDENT REPRESENTATIVE

   Student Representative Sydney Stivers was not present so there was not a student activity report.

5. REPORT—COMMITTEES OF THE BOARD

   The Curriculum Committee members reported on the ongoing work of their committees. The Board Members of the Gaining Committee, Jeremy Bristol, Lisa Pierce, and Barb Thomas met on Monday, November 28, 2011, and December 8, 2011. The next Gaining meeting is scheduled for Thursday, December 15, 2011. Trustee Barb Thomas also reported on the ongoing curriculum meetings.

6. DISCUSSION—DISTRICT SAFETY POLICIES AND PROCEDURES

Jason Butcher, Superintendent, outlined for the Board of Trustees some of the current policies and procedures that are in place to ensure the safety of the staff and students in the Lewistown Public Schools. Justin Jenness, Student Resource Officer, gave a short presentation regarding his role with the school district.

7. PRESENTATION—SCOTT DUBBS, CURRICULUM DIRECTOR

Scott Dubbs, Curriculum Director, presented to the Board of Trustees a report on the suggested curriculum selected by the Science Curriculum Committee.

8. DISCUSSION—CHANGES TO FERGUS HIGH SCHOOL RENAISSANCE HANDBOOK

Jerry Feller, Fergus High School Principal, presented to the Board of Trustees proposed changes to the selection process for Valedictorian and Salutatorian that are outlined in the Fergus High School Renaissance Handbook.

9. DISCUSSION—REVIEW DISTRICT GOALS

The Board of Trustees noted that a discussion of the Board's 5-year goals was in order. The Board was encouraged to review the goals in preparation for the January 2012 meeting.

10 DISCUSSION—FACILITIES

The elevator project at Lewistown Junior High School is nearing completion. The elevator is in place and final details will hopefully be completed by the end of December 2011. Board Chair Stan Monger also reported on a discussion with the Airport Manager regarding the bus barn situation at the airport. It was also noted that the Airport Board renewed the bus barn lease through December 2012, but the Airport Manager indicated that the Airport Board may not be willing to renew the lease after that time.

11. DISCUSSION—2012-2013 BUDGETS

Mike Waterman, Business Manager/District Clerk, discussed with the Board of Trustees some preliminary information regarding the 2012-2013 General Fund Budgets. At this early point, it appears the District will again face funding shortfalls in fiscal year 2012-13. The Board reviewed the timeline for the budget development and discussed issues that may affect the budget in the coming months.

12. CALENDAR ITEMS, CONCERNS, CORRESPONDENCE, ETC.

Trustee Mary Schelle and Business Manager Mike Waterman reported on the first meeting of the MTSBA Class A Caucus in Helena. The Caucus representatives heard presentations from legislative staff on the history of Montana's school funding system. The Caucus also began the process of goal development.

SUPERINTENDENT'S REPORT

13. REPORT—ELECTION UPDATE

Mike Waterman, Business Manager/District Clerk, presented to the Board the 2012 School Election Calendar and advised them of the trustee seats that will be up for election in 2012.

14. REPORT—INVESTMENT

Interest earned and distributed for November 2011, was reported with $2,205.08 in the elementary funds and $1,444.89 in the high school funds for a total of $3,649.97.

15. OTHER ITEMS

Jason Butcher, Superintendent, noted the closure of the Central Office on December 26, 2011, and January 2, 2012, in anticipation of staff taking annual leave. The Board was reminded of Superintendent Butcher's evaluation scheduled after the regular Board meeting on January 9, 2012. The Board also reviewed dates for upcoming District events.

PUBLIC PARTICIPATION

16. RECOGNITION OF PARENTS, PATRONS, AND OTHERS WHO WISH TO ADDRESS THE BOARD

There was no public input.

ACTION ITEMS

MINUTES

17. MINUTES OF THE NOVEMBER 14, 2011, REGULAR BOARD MEETING – approved unanimously (Pierce/Thomas).

APPROVAL OF CLAIMS

18. CLAIMS – The claims referenced in the 2011-12 Bill Schedule and submitted through December 8, 2011, were approved unanimously (Irish/Pierce). Finance committee members for January–March 2012 will be Trustees Monger, Bristol, Irish, and Schelle.

CONSENT GROUP ITEMS – approved unanimously (Thomas/Weeden)

19. APPROVE ADDITIONS TO SUBSTITUTE LIST FOR THE 2011-2012 SCHOOL YEAR – Substitute Teacher/Aide List—Vernon Fletcher and Kendra Smith; Substitute Custodian List—Andrew James-Bruno.

INDIVIDUAL ITEMS

20. APPROVE REQUEST TO APPLY FOR THE SAFE ROUTES TO SCHOOL GRANT. A motion to approve the Safe Routes to School Grant was unanimously approved (Pierce/Thomas - unanimous). The Board requested the District purchase the equipment locally, if possible.

21. APPROVE PERSONNEL REPORT – See Exhibit A – approved unanimously (Bristol/Irish).

ADJOURNMENT

The meeting was adjourned at 8:52 p.m. The next Board meeting will be held at 7:00 p.m. on Monday, January 9, 2012, at Garfield Elementary School (Bristol – unanimous).

STAN MONGER
BOARD CHAIR

MIKE WATERMAN
BUSINESS MANAGER/CLERK

"EXHIBIT A"
PAGE 1 OF 2

LEWISTOWN PUBLIC SCHOOLS
LEWISTOWN, MONTANA

PERSONNEL REPORT FOR BOARD ACTION

DATE: December 12, 2011

EMPLOYEE NAME	*POSITION*	*LOCATION*	*RECOMMENDED ACTION*	*EFFECTIVE DATE*	*COMMENTS*
SCHNITZMEIER, KC	Resource/Playground Aide	Lewis & Clark Elementary	Approve revision of contract to reflect changes in duties assigned—AIDE II Step 3 for up to 5.50 hours per day and AIDE III Step 3 for up to 2.00 hours per day	December 12, 2011	See attached memo.
HUTCHINS, Mandie	Playground Aide	Garfield Elementary	Approve revision of contract to reflect changes in duties assigned—AIDE III Step 3 add up to .50 hours per day	December 12, 2011	See attached memo.
MAXWELL, Shannon	Playground Aide	Garfield Elementary	Approve revision of contract to reflect changes in duties assigned—AIDE III Step 1+30 change hours from up to 3.50 hours per day to up to 1.50 hours per day	December 12, 2011	See attached memo.
WRIGHT, Beau	Central Montana Youth Mentoring Co-Advisor	Fergus High School	Approve appointment on schedule—(0.0175)	December 12, 2011	See attached memo.
BREIDENBACH, Sherry	Weight Room Co-Coordinator	Fergus High School	Approve appointment at $15.00 per hour for up to a maximum of $900.00	December 12, 2011	See attached memo.
OLSON, Steve	Weight Room Co-Coordinator	Fergus High School	Approve appointment at $15.00 per hour for up to a maximum of $900.00	December 12, 2011	See attached memo.
PHILLIPS, Ty	Volunteer Boys Basketball Coach	Fergus High School	Approve appointment on a volunteer basis	December 12, 2011	See attached memo.

LEWISTOWN PUBLIC SCHOOLS
LEWISTOWN, MONTANA

PERSONNEL REPORT FOR BOARD ACTION

DATE: December 12, 2011

EMPLOYEE NAME	*POSITION*	*LOCATION*	*RECOMMENDED ACTION*	*EFFECTIVE DATE*	*COMMENTS*
FELLER, Vic	Volunteer Wrestling Coach	Fergus High School	Approve appointment on a volunteer basis	December 12, 2011	See attached memo.
SAUER, Dianna	Choral Accompanist	Fergus High School	Approve appointment on schedule—AIDE I Step 0 for up to 3.00 hours per day	December 12, 2011	See attached memo.
IRWIN, Robert "Denny"	Homebound Tutor	School District #1	Approve appointment at $12.00 per hour on an as-needed basis	December 12, 2011	See attached memo.

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	15

☒ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: CLAIMS

Requested By: Board of Trustees **Prepared By:** Sherry Martin **Date:** 01/09/2012

SUMMARY:

Approve claims paid through January 5, 2012, as approved by the Finance Committee.

Members of the Finance Committee for January-March 2012 include: Stan Monger, Jeremy Bristol, Joe Irish, and Mary Schelle.

SUGGESTED ACTION: Approve Claims as Presented

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date

01/09/2012

Agenda Item No.

16

Agenda Items	Additional Information
16. Approve Additions to the Substitute List for the 2011-2012 School Year	

SUGGESTED ACTION: Approve All Items

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	16

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☒ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: APPROVE ADDITIONS TO THE SUBSTITUTE LIST FOR THE 2011-2012 SCHOOL YEAR

Requested By: Board of Trustees **Prepared By:** Sandi Chamberlain **Date:** 01/09/2012

SUMMARY:

The Board of Trustees needs to approve the additions to the substitute list for the 2011-2012 School Year. The substitutes being added to the list are:

Substitute Teacher/Aide List:

Melissa Gee
Sarah Kortum-Kuni
Arlene Wagner

Substitute Custodian List:

Teran Alaers

SUGGESTED ACTION: Approve Additions to the Substitute List for the 2011-2012 School Year

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	17

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☒ **Action - Indiv.**

ITEM TITLE: APPROVE ADOPTION OF SCIENCE CURRICULUM

Requested By: Board of Trustees **Prepared By:** Scott Dubbs **Date:** 01/09/2012

SUMMARY:

The Board of Trustees needs to approve the recommendation for the Science Curriculum as presented by the committee at the December 12, 2011, Board Meeting.

SUGGESTED ACTION: Approve Adoption of Science Curriculum

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
LEWISTOWN, MONTANA

SCIENCE CURRICULUM PROJECT
2008-2011
GRADES K-12

BOARD MEMBERS

Jeremy Bristol	Dave Byerly *
Tara Cutler *	Jennifer Granot *
Joe Irish	Becky Jackson *
Stan Monger	Lisa Pierce
Mary Schelle	Barb Thomas
Monte Weeden	

* Former Member during project review or curricular adoption

DISTRICT ADMINISTRATION

Jason Butcher, Superintendent — Mike Waterman, Business Manager

SCIENCE CURRICULUM TEAM MEMBERS

Gina Armstrong	Highland Park	1st Grade
Suzie Flentie	Lewistown Junior High	Physical Science
Gary Gebert	Fergus High	Biology
Laura Gilskey	Highland Park	Kindergarten
Justin Guyer **	Fergus High	Physics/Chemistry
Charley Karinen	Garfield	3rd Grade
Mike Mangold	Fergus High	Earth Science
Steve Paulson **	Lewistown Junior High	Life Science
Jill Reed	Lewis & Clark	5th Grade
Linda Rinaldi	Fergus High	Resource
Jeff Russell	Lewis & Clark	6th Grade
Polly Weichel	Highland Park	2nd Grade
Kerry Vaughn	Garfield	4th Grade
Mary Schelle	Board Member	
Scott Dubbs	Curriculum Director	
Carolyn Shields	Former Member	Garfield - 4th Grade
Chad Armstrong	Former Member	L & C - 6th Grade
Dick Brosseau	Former Member	FHS - Earth Science
John Moffatt	Former Curriculum Director	

** Co-Chairperson

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Lewistown Public Schools

Science Curriculum Introduction

The Lewistown Public Schools science curriculum standards are composed of two types, process standards and content standards. Students are engaged in the processes described in the *process* standards as they engage in learning the science content described in the *content* standards. The purposes of this document are to create a set of standards that align with the District Mission, are articulated in grades kindergarten through high school, and lay a foundation of proficiency for all students in Lewistown Public Schools.

District Core Purpose

Lewistown Public Schools, as entrusted by the Lewistown Community, provides children with an accountable, high quality, rigorous education in a safe, nurturing environment; developing the full potential of each child and preparing them for lifelong success in their personal lives and careers, wherever they may be in the world.

Science Curriculum Goals

Science is a method of understanding how nature works in earth, space, life, and physical systems through the utilization of tools of inquiry and by employing the process skills of questioning, hypothesizing, predicting, testing and drawing conclusions.

The purpose of science education is to develop lifelong learners who can understand how science, technology, and society are interconnected and who can then use this knowledge in everyday decision-making. Learners should have a substantial knowledge of basic facts, concepts, environmental responsibility, and process skills, which enable him/her to continue to learn and think logically.

Students should be allowed to "act like scientists" as they study science. Students need to learn in ways that encourage them to build on their natural curiosity; to explore science in depth; use inquiry; conduct investigations and explorations; identify and solve problems; ask questions; make predictions; offer explanations; and discuss and write about their findings and apply their knowledge like scientists do. Students should have opportunities to use the strategies and tools, including technology, which scientists use.

Learning science is something that students do, not something that is done to them. "Hands-on" activities, while essential, are not enough. Students must have "minds-on" experiences as well.

The importance of inquiry does not imply that all teachers should pursue a single approach to teaching science. Just as inquiry has many different facets, so teachers need to use many different strategies to develop the under- standings and abilities described in the Montana and National Standards.

The teacher's role should be one who encourages the flow of ideas, facilitates learning, and motivates students by modeling the skills of scientific inquiry. Teachers should have a rich variety of instructional materials and tools that will motivate, excite, and interest all students in science.

Teachers need to focus their assessment on student understanding and the process students must learn to apply science knowledge and processes to solve real problems and make decisions. The curriculum is designed to be integrated, where appropriate, and includes a variety of assessment techniques that include traditional, performance, and standardized assessments.

Essential Questions

Essential questions are big ideas stated in question form. They are designed to guide the inquiry process and provide a foundation for students and teachers to tie the curriculum standards.

Essential Understandings and Skills

This section of the standards document outlines the core concepts and skills that make up the core of instruction in a particular grade level/course. These concepts and skills are the focus of instruction, with the goal of developing deep understanding and transfer or meaning making.

Process Standards

The process standards for science include observing, measuring, describing, predicting, inferring, experimenting (collecting evidence), recording and reporting. Inquiry, the focus of Lewistown process standards, is embedded within every content standard. Inquiry processes should be used as tools for exploring and promoting understanding of scientific principles and phenomena. In the grade level/course standards documents, their presence is illustrated through the use of action verbs that indicate the degree of knowing and understanding expected.

Connections

Science is not a collection of separate strands or standards, even though its content can be presented this way. It is an integrated field of study, and understanding scientific concepts involves making connections. Students continually apply the skills they have learned to process new ideas and construct logical, well-supported conclusions.

Applications/Manipulatives

The study of science is necessarily an active, experiential, constructivist field. "From the earliest grades students should experience science in a form that engages them in the active construction of ideas and explanations and enhances their opportunities to develop the abilities of doing science" (National Research Council, 1999). Students should ask questions about objects, organisms, and events in the environment, plan and conduct investigations, employ equipment and tools to gather data, use data to construct a reasonable explanation and communicate investigations and explanations to others through writing, oral presentation, charts, graphs and other media appropriate for their developmental level.

Content Standards

The science content standards for Kindergarten through Grade 5 are organized by grade level and are arranged into four strands with essential learning expectations identified below each strand. The content standards for Grades 6 through 12 are organized according to course instead of by grade level, with the same four strands identified.

Physical Science (P)

- Matter (M)

- Force, Motion and Energy (F)

Life Science (L)

- Living Systems (S)
- Life Process (P)

Earth and Space Science (E)

- Earth and Space Structures (S)
- Earth and Space Interrelationships – Patterns, Cycles and Change (I)

Place Based Issues (Human Relationships with the Environment) (H)

- Technology (T)
- Resources (R)
- Culture (I)

In the standards document each strand is identified by a colored box and is supported by an "Essential Learning Expectation" indicating the focus of the content standard in each grade level. Within each strand are Learning Goals denoted with an alphanumeric code. Within each learning goal is one or more specific proficiency describing the specific concept in which all students should attain proficiency, along with an example designed to guide instruction. Example: PM.1.1 = Physical Science (strand), Matter (essential learning expectation), Structure (learning goal), Specific Proficiency 1. In many cases an example is included to provide further clarification for teachers.

Essential Learning Expectations

Essential Learning Expectations (ELE) are key ideas and understandings that represent focal points within each grade level/course in science in which all students should become proficient. This is a broad statement that encompasses the specific proficiencies for the target population. ELEs are described in the gray boxes beneath the content strand to which they are tied.

Learning Goals

Learning goals target a portion of the essential learning expectations and describe what students will know and be able to do as a result of instructional experiences. Learning goals are denoted by a bold alpha numeric code such as **PM.1.0** followed by a single word underlined and bold such as **Structure**.

Specific Proficiencies

Specific Proficiencies describe very specific topics/concepts within the learning goals and include an action verb that indicates the degree and depth of learning on a continuum from rote knowledge to applied understanding. Specific proficiencies are denoted by an alpha numeric code that ties each to the learning goal and essential learning expectations. Ex: PM.1.2.

Examples

Each specific proficiency has one or more examples designed to provide teachers and school administrators with ideas about how the proficiency looks in a classroom setting. The examples are suggestions for implementation.

Technology

All courses and grade levels should integrate technology into instruction on a regular basis as a tool for enhancing and applying understanding of scientific concepts. It is the goal of Lewistown Public Schools to increase student and teacher use of technology in every course and in every grade level throughout the district. Technology includes calculator use, virtual manipulatives, computer modeling, smart boards, projection devices, internet research and software applications that enhance learning of scientific concepts and their practical application. Technology is discussed explicitly in the "Place-based Issues" strand as well as embedded throughout the specific proficiencies and examples in this document.

Professional Development

Professional development is key to ensuring that all students receive the same degree of high level instruction regardless of the background and/or experience of the teacher. Focused professional development will be provided to all teachers and administrators and will target key concepts and instructional strategies necessary to provide quality instruction for all Lewistown Public School students.

Assessment

Assessment is the manner in which teachers and administrators collect data from state and district level evaluation tools to inform instruction. The Criterion Referenced Test from the OPI represents state level standardized assessment and is administered in grades 4, 8 and 10. District level assessments will be revised to align with the content and process standards and administered and evaluated annually as a means of guiding instructional practices.

Science Essential Questions

Overarching EQs

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world in which you live?

Physical Science EQs

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes “it” “it” and why/how is it doing that?
- How do things work?

Life Science EQs

- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How did life begin, how has it changed and how might it change in the future?
- How is life interdependent on the Earth's conditions or other life?

Earth Science EQs

- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?
- Why does the Earth shake, rattle and roll?

Place Based EQs

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

Science Curriculum Philosophy Statement

Science is a method of understanding how nature works in earth, space, life, and physical systems through the utilization of tools of inquiry and by employing the process skills of questioning, hypothesizing, predicting, testing and drawing conclusions.

The purpose of science education is to develop lifelong learners who can understand how science, technology, and society are interconnected and who can then use this knowledge in everyday decision-making. Learners should have a substantial knowledge of basic facts, concepts, environmental responsibility, and process skills, which enable him/her to continue to learn and think logically.

Students should be allowed to "act like scientists" as they study science. Students need to learn in ways that encourage them to build on their natural curiosity; to explore science in depth; use inquiry; conduct investigations and explorations; identify and solve problems; ask questions; make predictions; offer explanations; and discuss and write about their findings and apply their knowledge like scientists do. Students should have opportunities to use the strategies and tools, including technology, which scientists use.

Learning science is something that students do, not something that is done to them. "Hands-on" activities, while essential, are not enough. Students must have "minds-on" experiences as well.

The importance of inquiry does not imply that all teachers should pursue a single approach to teaching science. Just as inquiry has many different facets, so teachers need to use many different strategies to develop the under- standings and abilities described in the Montana and National Standards.

The teacher's role should be one who encourages the flow of ideas, facilitates learning, and motivates students by modeling the skills of scientific inquiry. Teachers should have a rich variety of instructional materials and tools that will motivate, excite, and interest all students in science.

Teachers need to focus their assessment on student understanding and the process students must learn to apply science knowledge and processes to solve real problems and make decisions. The curriculum is designed to be integrated, where appropriate, and includes a variety of assessment techniques that include traditional, performance, and standardized assessments.

Science Curriculum Scope and Sequence

The standards that follow later in this document provide an integrated and sequential development of the goals of this curriculum. Specific learning activities or examples are included in these standards, but they are intended to be illustrative. Imaginative teachers will create their own curricular activities to engage student participation.

We see this scope and sequence as a starting point for developing inquiry based lesson plans. In working with the learning expectations that follow, we sought a way to make sure that students were exposed to information that would help them meet the our local and state standards. Implementation of these standards requires collaborative planning among grade level teachers, science teachers and administrators. As part of these curricular standards, we have developed this topical "scope and sequence" outlining the most general of topics that are to be taught at each grade level or within each course.

Additionally, It should also be noted that in the scope and sequence, topics addressed at one grade level grouping reemerge at subsequent levels. For example, a unit on the properties of matter is first presented - in a very basic way in kindergarten. The topic comes up again in in several more grade levels. That is not to say that those are the only grades at which students encounter the properties of matter.

The scope and sequence topics for kindergarten through grade twelve are as follows:

Kindergarten	General Science
Grade One	General Science
Grade Two	General Science
Grade Three	Life, Earth & Physical Science
Grade Four	Life, Earth & Physical Science
Grade Five	Physical Science
Grade Six	Earth Science
Grade Seven	Life Science
Grade Eight	Physical Science
Grade Nine	Earth Science
Grade Ten	Biology
Grades Ten-Twelve	Chemistry
	Physics
Grades Eleven-Twelve	Applied Bio-Chemistry & Forensics
	Advanced Placement Biology
	Advanced Placement Chemistry
	Advanced Placement Physics

Lewistown Public Schools

Science Curriculum
Kindergarten

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of kindergarten, all students recognize that matter can be classified as magnetic or nonmagnetic and that magnets repel and attract certain materials, that objects are either living or non-living, and that changes in weather and times of day affect human behavior. Students will describe and explain examples of Montana American Indian contributions to our scientific and technological knowledge of the natural world.

Essential Skills: Throughout kindergarten, students begin to learn about scientific inquiry through use of the five senses to explore their surroundings. Students use a variety of tools, including technology, to measure, represent data and communicate with others.

Content Standards: Kindergarten content standards include investigations in Physical Science, Life Science, and Earth and Space Science and incorporate an emphasis on natural cycles and human relationships with the environment. In kindergarten, the unifying themes are explorations of Magnets, Living and Non-Living Objects, and the Effects of Weather on People.

Process Standards: Using inquiry processes, students conduct, evaluate, and communicate scientific investigations. Kindergarten process standards stress the use of the five senses to explore common materials, objects, and living things. Emphasis is placed upon gathering information, asking questions, measuring, sorting, classifying, and communicating information about the natural world. Students will use appropriate tools, including technology, to measure and represent data (e.g., graphs, charts, pictures).

(P) Physical Sciences: As a result of inquiry based curricular activities, all students will investigate properties of matter.

Essential Question: What gives matter its unique qualities?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and can be classified by physical properties. Matter can be classified as magnetic or nonmagnetic.

PM.1.0 <u>Structure</u>: Students will identify liquids, solids and gases.

PM.2.0 <u>Properties</u>: Students will observe and classify objects as magnetic or non-magnetic.

PM.2.1 Kindergarteners ask questions, make predictions, and investigate whether objects are magnetic or non-magnetic.

Example: Students construct background knowledge by freely exploring a variety of objects and magnets (e.g., plastic, wood, rocks, paper, different metals, marbles, etc.).

Example: Students explore the question, "Is an object magnetic or not?" Teacher records responses and questions as students raise them.

Example: Given a set of objects, students will predict whether objects are magnetic by sorting them (without magnets) into three groups: magnetic, non-magnetic, and other.

Example: Given a set of objects, students will use magnets to sort objects into groups of magnetic and non-magnetic items and then record results.

PM.3.0 <u>Changes</u>: This learning goal is not addressed.

(F) Essential Learning Expectation – Force, Motion and Energy: Forces act upon objects and influence motion. Magnets repel and attract certain materials.

PF.1.0 <u>Types of Force</u>: Students observe that magnets repel and attract each other.

PF.1.1 Kindergarteners construct background knowledge by freely exploring only with magnets.

Example: *Students explore the forces of "pushing" and "pulling" by conducting magnet races.*

PF.1.2 Students explore the question, "Do magnets work through other materials?"

Example: *Students test whether magnets still push or pull through a variety of objects and materials.*

PF.2.0 <u>Forms of Energy</u>: Students identify the basic characteristics of light, heat,motion, electricity and sound.

PF.2.1 Students will identify light vs. dark.

PF.2.2 Students explore the different ways objects move such as; zigzag, round and round, back and forth, fast and slow.

PF.3.0 <u>Mechanical Systems</u>: This learning goal is not addressed.

(L) Life Science: As a result of inquiry based curricular activities, all students will develop an understanding of the attributes of living and non-living objects.

Essential Question: What is life?

(S) Essential Learning Expectation – Living Systems: Living systems encompass a variety of living and non-living objects.

LS.1.0 <u>Characteristics of Living Things</u>: Students observe and classify objects as living or non-living.

LS.1.1 Kindergarteners ask questions, make predictions, and investigate whether objects are living or non-living.

Example: Students construct background knowledge by freely exploring a variety of objects (e.g., plastic, plant, seeds, apple, carrot, wood, rocks, toys, fake flowers, stuffed animals, etc.).

Example: Students explore the question, "Is an object alive or not?" Teacher records responses and questions as students raise them.

Example: Given a set of objects, students will predict whether objects are living by sorting them into three groups: Living, Non-living, and shares characteristics of both.

Example: Given a set of objects, students will use graphic organizers (e.g. Venn Diagram, graphs, etc.) to sort and record objects into groups of Living, Non-Living, and shares characteristics of both.

LS.2.0 <u>Characteristics of Living Environments:</u> This learning goal is not addressed.

LS.3.0 <u>Structure and Function:</u> This learning goal is not addressed.

LS.4.0 <u>Diversity and Adaptation:</u> This learning goal is not addressed.

(P) Essential Learning Expectation - Life Process: All organisms have certain basic needs and life cycles.

LP.1.0 <u>Growth</u>: Students observe and record basic requirements that allow living things to grow.

LP.1.1 Students explore the question, "What does my body need to grow?"

Example: Students discuss and communicate daily activities that help them grow and stay healthy (e.g. eating, sleeping, playing).

LP.2.0 <u>Cycles</u>: Students observe and recognize their own *physical* changes as part of their life cycle.

LP.2.1 Students research and represent their own physical changes from birth to present.

Example: Students construct a record of their physical changes using storyboards, timelines, growth charts, and/or family pictures, pieces of art.

LP.3.0 <u>Reproduction</u>: This learning goal is not addressed.

(E) Earth and Space Science: As a result of the inquiry based curricular activities all students will develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?

(S) Essential Learning Expectation – Earth and Space Structures: Space objects include the Sun, Earth, Moon and stars.

ES.1.0 **<u>Earth and Planetary Materials:</u> Students recognize that the Earth is made up of rock, soil, and water, and that it is surrounded by air (atmosphere).**

ES.1.1 Students identify water in three forms: liquid, ice, steam.
Example: Students observe and record changes in an ice cube as it melts and evaporates. Students observe and record that heated water can produce steam.

ES.1.2 Students use magnifying glasses to explore the question, "What is in soil?"
Example: Students predict what they will find in soil, then explore soil, and communicate their observations.

ES.1.3 Students observe that Earth is surrounded by an invisible layer of air called the atmosphere.
Example: Students identify examples of moving air (e.g. flags, clouds moving, trees blowing, quaking aspens, candy wrappers, hands out car windows…).

ES.2.0 **<u>Landforms (geomorphology</u>): Students recognize and identify major planetary features and landforms such as mountains, lakes, valleys, rivers, and oceans.**

ES.2.1 Students explore the question, "Is the Earth flat?"
Example: Students use the playground as a model to compare playground features with actual landforms.

ES.2.2 Students explore the question, "Where on Earth do we find water?"
Example: Students use the playground as a model to compare playground features with major water features.

(I) Essential Learning Expectation – Earth and Space Interrelationships – Patterns, Cycles and Change: The sun and Earth work together to create night and day. We can see the sun in the sky during the day and the moon and stars in the sky at night. The change of seasons, the weather, and time of day affect what people do.

EI.1.0 <u>Weather, Climate and Change</u>: Students observe and record weather over time (phenology) to become aware of long term changes.

EI.1.1 Students predict, observe, and record daily weather conditions.
Example: Students update a class data chart daily that records temperature, windy/calm, sunny/cloudy, form of precipitation.

EI.1.2 Students will show how weather can affect our choice of clothing and activities.
Example: Students explore the question, "How would an informed person dress for the weather today?"
Example: Students explore the question, "How will today's weather affect my plans?"

EI.1.2 Students will represent how the seasons can affect our choice of clothing and activities.
Example: Students make collages that represent what people wear and do in summer and what they wear and do in winter.

EI.2.0 <u>Living Organisms:</u> Students recognize that day and night affect what people do.

EI.2.1 Students address the question, "What do people do during the day?"
Example: Students represent their thinking (through pictures, role-playing, etc.).

EI.2.2 Students address the question, "What do people do during the night?"
Example: Students represent their thinking (through pictures, role-playing, etc.).

EI.3.0 <u>Earth's History:</u> This learning goal is not addressed.

EI.4.0 <u>Catastrophic Events:</u> This learning goal is not addressed.

EI.5.0 <u>Planetary Systems:</u> Students will be introduced to the concept that night and day are a function of the Earth's rotation.

EI.5.1 Students explore the question, "Why is there day and night?"
Example: Partners take turns role-playing the stationary Sun and rotating Earth as it revolves around the Sun.

EI.5.2 Students explore the questions, "What do we see in the sky during the day?" and "What do we see in the sky at night?"

(H) Place Based Issues (Human Relationships with the Environment): As a result of inquiry based curricular activities, all students will develop an understanding of their school building and schoolyard environment.

Essential Questions:
- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?

- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology.

HT.1.0 T<u>echnology</u>: Students are introduced to the concepts of simple machines as forms of technology used in everyday life.

HT.1.1 Students identify and classify examples of familiar technology.
Example: Students find examples of technology and demonstrate their uses (tools, playground equipment, buttons, zippers, scissors).
Example: Students classify some examples into the categories of levers, wedges, and screws.

HT.1.2 Students will identify examples of tools that have been developed or are being developed by Montana American Indians.

(R) Essential Learning Expectation – Resources: We use natural resources, some of which are renewable and some of which are not. We can relate observations of nature to the traditional practices of Montana American Indians.

HR.1.0 <u>Resources</u>: Students classify natural resources as renewable or non-renewable.

HR1.1 Students identify natural resources.
Example: Students tour the playground finding examples of natural resources.

HR1.2 Students explore the concept of natural resources as either renewable or non-renewable (grown or mined).
Example: Over time, students build a class chart of natural resources that classifies items into renewable and non-renewable categories.
Example: Role-play the categories. One group of students is renewable; one group isn't. Over the course of the game, the renewables keep growing back while the non-renewable group gets smaller and smaller.
Example: Students classify American Indian projectile points (arrow heads) as examples of wedges.

HR1.3 Students listen to stories about Montana American Indians interacting with the physical environment.

HR 1.4 Students identify examples of Montana American Indians making use of natural resources.

(I) Essential Learning Expectation – Culture: A variety of different cultures make contributions to the diversity of our community.

HI.1.0 <u>Culture</u>: Students recognize that people come from many different places.

HI.1.1 Students identify where they were born and observe the variety of birth places of their classmates.

Example: Students stick their photos on a map to indicate where they were born.

Lewistown Public Schools

Science Curriculum
First Grade

Essential Questions:
- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of first grade, all students recognize that matter exists in three basic forms (i.e., solids, liquids, and gases), that plants and animals have life needs, functional parts, and stages of growth and development, that people use their body parts to live and learn, that people grow and change, and that features of the Earth (mountains, rivers, deserts, etc.) and the sky (constellations, moon phases, and weather) can change. Students will describe and explain multiple examples of Montana American Indian contributions to our scientific and technological knowledge of the natural world.

Essential Skills: Throughout first grade students explore scientific concepts through direct observation. As a result, students develop questions and make predictions with guidance and use a variety of tools, including technology, throughout their exploration.

Content Standards: First grade content standards include investigations in Physical Science, Life Science, and Earth and Space Science and incorporate an emphasis on natural cycles and human relationships with the environment. In first grade, the unifying themes are explorations of Plants, Animals, & People; Living Things & Where They Live; Earth Our Home; Weather & the Sky; States of Matter; Energy Sources & Motion.

Process Standards: Using the inquiry process, students will conduct, evaluate, and communicate scientific investigations. First grade process standards stress the importance of making observations, developing simple questions, making predictions, and drawing conclusions in directed experimentation. Students will select and use appropriate tools, including technology, to measure, analyze, and represent data (e.g., graphs, models, pictures).

(P) Physical Sciences: Students demonstrate knowledge of types of force, forms of energy, mechanical systems, as well as physical properties of matter and changes in states of matter.

Essential Questions:
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?

- What makes “it” “it,” and why/how is it doing that?
- How do things work?
- What floats and what sinks?

(M) Essential Learning Expectation - Matter: Matter exists and can be classified in three forms (i.e., solids, liquids, and gases).

PM.1.0 <u>Structure</u>: Students demonstrate understanding that matter exists in three forms – solid, liquid and gas.

PM.1.1 Students classify a variety of materials into the categories of solid, liquid, and gas.

PM.2.0 <u>Properties</u>: Students demonstrate that the characteristics of matter can be observed.

PM.2.1 Students explore the question: “How do we know if something is a solid?”

PM.2.2 Students explore the question: “How do we know if something is a liquid?”

PM.2.3 Students explore the question: “How do we know if something is a gas?”

PM.3.0 <u>Changes</u>: Students observe that matter can change form when temperature changes.

PM.3.1 Students use a variety of representation to changes in matter corresponding temperature changes.
Example: Record/draw/ role-play, mixture and water phase changes.

(F) Essential Learning Expectation – Force, Motion and Energy: Energy is something that can cause change or do work.

PF.1.0 <u>Types of Force</u>: This learning goal is addressed through vocabulary and investigates. (Unit F: Chapter 13: lessons 1-3)
Example:.

PF.2.0 <u>Forms of Energy</u>: Students recognize that light is a form of energy that can be seen and manipulated.

PF.2.1 Students explore the question, “What makes light?”
Example: examples, show and tell, class chart, picture collage, school field trip.

PF.2.2 Students explore the question, “Can we change the direction that light travels?”
Example: bends, diffuses, bounces or reflects/mirror, prism, water.

PF.3.0 <u>Forms of Energy</u>: Heat is a form of energy that can make things warm.

PF.3.1 Students explore where heat comes from.

Example: sun, fire, light bulbs, friction; and their effect on different materials.

PF.4.0 <u>Forms of Energy</u>: Sound is a form of energy that you can hear.

PF.4.1 Students explore that sound can be produced when an object vibrates.
Example: rubberband/can

PF.4.2 Students explore how sounds are different and that many things vibrate and make sound. Students will classify sounds by pitch and volume.
Example: musical instruments, people, animals, space shuttle

PF.4.0 <u>Motion</u>: This learning goal is not addressed.

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycles and environments of organisms.

Essential Questions:
- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How is life interdependent on the Earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems: Plants, animals, and people have life needs and those needs create a food chain.

LS1.0 <u>Characteristics of Living Things</u>: Students recognize that plants, animals, and people have basic needs for survival.

LS.1.1 Students explore the question, "What do plants need to survive?"

LS.1.2 Students demonstrate knowledge that plants need soil, water, air, and light to survive.

LS.1.3 Students explore the question, "What do animals need to survive?"

LS.1. 4 Students demonstrate knowledge that animals need food, water, homes, and oxygen.
Example: bring back to connecting students as animals with needs

LS.1.5 Students explore the question "How do people use their body parts to move and live.
Examples: 5 senses (sight, hearing, touch, smell, taste)

LS.1.6 Students demonstrate knowledge that people change as they grow older.
Examples: life stages pictures, classification collages on healthy choices (exercise, eating, sleep)

LS.2.0 <u>Characteristics of Living Environments</u>: Students recognize that plants and animals exist within interdependent relationships.

LS.2.1 Students identify examples of interdependent relationships.
Example: bird nests, nibbled leaves, seed dispersal through scat and hitchhiking

LS.3.0 <u>Structure and Function</u>: Students know that plants and animals have distinct parts and each part is important to the survival of the organism.

LS.3.1 Students recognize that the principle parts of a plant are the roots, stem, and leaves. Students draw and label the roots, stem, and leaves of plants.

LS.3.2 Students communicate the function of each of the principle parts of a plant.

LS.3.3 Students recognize that familiar animals have specific physical characteristics (i.e., legs, wings, tails, fur, feathers, scales, skin, skeletons, feelers, ears).

LS.3.2 Students explain the function of animals' physical characteristics.

LS.4.0 <u>Diversity and Adaptation</u>: Students realize that plants, animals, and people are different from one another. Plants can be classified into groups. Animals can be classified into groups. People can be classified into groups.

LS.4.1 Students sort examples of organisms into their respective categories of plants or animals or people.

LS.4.2 Students sort examples of plants by looking at their parts.

LS.4.3 Students sort examples of animals into five categories: insects, birds, fish, mammals, and reptiles/amphibians.

LS.4.4 Students sort examples of people based on their life stages: infant, toddler, school-aged child, teen, adult, and senior adult.

(P) Essential Learning Expectation - Life Process: Plants, animals, and people have basic needs and life processes including growth, survival needs, cycles and similarities among offspring and their parents.

LP.1.0 <u>Growth</u>: Students know that all plants, animals, and people grow and change.

LP.1.1 Students observe and record the growth of a plant from seed to maturity.

LP.1.2 Students match the baby and parent forms of various animals/people
Example: pictures of selves/parents

LP.2.0 <u>Cycles</u>: Students know that all plants, animals, and people have a life span (cycle) with an identifiable beginning, middle, and end.

LP.2.1 Students record the growth of a plant from seed to seed.

LP.2.2 Students recognize that animals have predictable but varied life cycles.
Examples: cat's life cycle vs. salamander's life cycle

LP.2.3 Students recognize that people have an identifiable life cycle that includes infancy, childhood, teenage, adult, and old age.

LP.3.0 <u>Reproduction</u>: Students know that all plants and animals reproduce.

LP.3.1 Students collect, display, and name examples of seeds and then represent the parent plant (e.g. through pictures or drawings).

LP.3.1 Students sort examples of animals into two categories: hatched from an egg or born alive and well.

(E) Earth and Space Science: As a result of the curriculum activities all students should develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- What covers Earth? How do people use rocks and minerals? What is soil?
- What is weather and how can we measure it?
- Why do we need to know about the Solar system and planets? And how does the movement of the Earth affect the changing of the seasons?

(S) Essential Learning – Earth and Space Structures: Earth's physical features can be identified as land, water, and air (ex. mountains, rivers, deserts, ponds and lakes). The stars in the sky form identifiable constellations. The Sun, one of the stars in the sky, provides heat and light.

ES.1.0 <u>Earth and Planetary Materials</u>: Students can describe the materials that cover Earth.

ES.1.1 When shown a model of the Earth, students will identify land formations (such as mountains, deserts), water formations (such as rivers, oceans, lakes, streams), and the atmosphere.

ES.1.2 Students explore the characteristics of natural resources and the importance of protecting Earth's resources.
Example: persuasive writing on clean water/air; list of classroom things that come from a land resource

ES.1.3 Students explore how rocks/minerals are different and how people use rocks and minerals.
Example: compare/classify rocks by sorting them based on characteristics, list four ways people use rocks/minerals.

ES.1.4 Students will explore the composition of soil and its importance.
Example: soil sift

ES.2.0 <u>Planetary Systems</u>: Students identify prominent features that can be seen in our sky, including the moon, the sun, stars, and planets.

ES.2.1 Students identify and describe objects in the day sky and night sky.

ES.2.2 Students explore what causes day and night and describe how Earth's rotation causes day and night.
Examples: set up a single central light source (i.e. flashlight). Students will role-play the Earth. When they face the light, its daytime. When they face away, it's night. Students rotate through the cycle. Extend by having students place hand on chest and call the spot Lewistown. Tell them to make it daytime in Lewistown. Now make it night.

ES.2.3 Students understand that the moon seems to change shape.
Example: compare shape of moon during 1 month period

ES.2.4 Students explore ways that the sun seems to move.
Example: sundial shadows, sun charts

(I) Essential Learning – Weather and the Sky: Weather is what the air outside is like. It can be measured with various tools.

EI.1.0 <u>Weather, Climate and Change</u>: Students investigate that weather changes from day to day and over the seasons. Students will explore weather by measurable quantities, such as temperature, wind direction/speed, and precipitation.

EI.1.1 Students observe, record, and discuss changes in sunrise and sunset times, weather conditions, and season of the year.
Example: stellarium, Google Sky, dressing bears

EI.1.2 Students will explore what weather is and how it can be measured.
Example: Observe the weather for 5 days and record observations, measure weather using thermometer

EI.1.3 Students will investigate clouds and rain by comparing water changes.
Example: water cycle bracelets and/or diagrams

EI.2.0 <u>Living Organisms</u>: This learning goal is not addressed.

EI.3.0 <u>Earth's History</u>: This learning goal is not addressed.

EI.4.0 <u>Catastrophic Events:</u> This learning goal is not addressed.

EI.5.0 <u>Planetary Systems</u>: Students review and extend the concept that day and night are a function of the Earth's rotation.

EI.5.1 Students role-play the cycle of day and night using a central light source.
Examples: set up a single central light source (i.e. flashlight). Students will role-play the Earth. When they face the light, its daytime. When they face away, it's night. Students rotate through the cycle. Extend by having students place hand on chest and call the spot Lewistown. Tell them to make it daytime in Lewistown. Now make it night.

(H) Place Based Issues (Human Relationships with the Environment): As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local scientific issues with an emphasis on local neighborhoods.

Essential Questions:
- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning – Technology: Our lives and community are shaped in many ways by the advances in science and technology.

HT.1.0 <u>Technology</u>: Students learn about current innovations and uses of technology that are directly tied to the science studied.

HT.1.1 Students explore technology through the unit Focus on Technology pages, DVDs, and internet resources (www.eduplace.com/sct/).
Examples: Focus on Technology pages- Unit A(A18); Unit E(E24); Unit F(F23) Discover! Simulations from eduplace.com/sct/ National Geographic DVDs

(R) Essential Learning – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on local systems.

HR.1.0 <u>Resources</u>: Students will identify that a natural resource is something from Earth that people use.

HR1.1 Students recognize that people use rocks to make statues/buildings; you need fresh water to live and grow; and that soil is an important natural resource.
Examples: compare/contrast Earth's natural resources, compare/classify rocks, describe composition of soil

HR.1.2 Students will identify that air and water help keep living things alive.

Examples: Activities to show that reusing, reducing, and recycling trash saves natural resources (ex. keeping playground clean, recycling paper in the classroom)

(I) Essential Learning – Culture: Many cultures make contributions to science and technology affecting societies in different ways. Science, technology and human activity are interrelated.

Essential Question

- **What are the four seasons?**
- **What are different ways that we determine when each season starts and ends?**
- **How do some Salish people determine when each season starts?**
- **What activities take place during the Salish seasonal round?**

HI.1.0 <u>Culture</u>: Students observe and note the changes in their environment. Students recognize the historical significance of seasonal changes on nomadic Native American cultures.

HI1.1 Students will understand the differences in weather of the four seasons; in what month each season begins; and Seasonal Rounds of the Salish of Montana.

Example: Utilizing the book, <u>Challenge to Survive: History of the Salish Tribes of the Flathead Indian Reservation</u> to access information about specific activities the Salish did during each season, students will create their own Seasonal Round calendar. Their calendar will depict activities that take place during the different times of the year. These activities will come from their own experiences and from the seasonal rounds of the Salish. Each student will compare their " seasonal round" calendars to the calendars they are used to seeing and using. (seasonal vs. monthly activities)

Lewistown Public Schools

Science Curriculum
Second Grade

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of second grade, all students recognize that sounds are vibrations that can be manipulated to create different pitches and volumes, that plants and animals have similarities and differences, and that the Earth has a fixed amount of water that re-circulates through evaporation, precipitation, and condensation (i.e., the water cycle). Students know that Montana American Indians have made numerous contributions to our scientific and technological understanding of the natural world. An enviroment (habitat) is made up of plants and animals and non-living things. Such habitats consist of stream,woodland, desert, tundra, ocean, and pond. Living things get energy from food. Food chains and food webs show howenergy is passed from one living thing to another.

Essential Skills: Throughout second grade students explore the natural world using scientific process focusing upon recording observations in detail and forming conclusions with guidance. Students report their observations, data and conclusions using a variety of tools, including technology.

Content Standards: Second grade content standards include investigations in Physical Science, Life Science, and Earth and Space Science and incorporate an emphasis on natural cycles and human relationships with the environment. In second grade, the unifying themes are explorations of sound, plants and animals, and the water cycle. These themes consist of the following units: 1.Enviroments, 2. Food Chains, 3. Natural Resources, 4.Weather Patterns, 5. Patterns in the Sky, 6. Matter and Energy, 7. Motion and Forces

Process Standards: Using the inquiry process, students conduct, evaluate, and communicate scientific investigations. Second-grade process standards stress the importance of making detailed observations, recognizing unusual or unexpected data, developing simple questions, making predictions, drawing conclusions in guided experimentation. Students select and use appropriate tools, including technology, to measure, analyze, and represent data (e.g., graphs, models, pictures).

(P) Physical Sciences: Students demonstrate knowledge of types of force, forms of energy, mechanical systems, as well as physical properties of matter and changes in states of matter.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- How are the three types of matter classified?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and can be classified by physical properties. Sound behaves in predictable ways (pitch, volume) and exhibits characteristics that have practical applications for humans (ultrasounds, radio waves, and sonar).

PM.1.0 Structure: Students know that sound is a form of energy that results from vibrations and travels in waves.

PM.1.1 Students explore the question, "What is sound?"
Example: variety of vibrating and non-vibrating materials

PM.1.2 Students know that there are 3 states of matter. Solids, liquids, and gases.

PM.2.0 Properties: Students know that sound travels as a wave and may be observed through its effect on matter.

PM.2.1 Students observe and record the effects of sound on a material that sensitive to vibration, such as the surface of a drum.
Example: rice on drumhead w/speaker beneath

PM. 2.2 Students know that all living things are made of matter.
Example: compare matter and classify according to their properties,by tools to measure volume, length, and mass

PM.3.0 Changes: Students recognize that the pitch and volume of a sound can be changed.

PM.3.1 Students invent a musical instrument and then demonstrate how the pitch and volume can be changed.
Example: cookie tin mandolin, soda can banjo, rubber band guitar, percussion

PM.3.2 Students recognize that all matter changes.
Example: students investigate ways in which matter can change, by heating and cooling

(F) Essential Learning Expectation – Force, Motion and Energy: Forces act upon objects and impact their motion.

PF.1.0 **<u>Types of Force</u>: Sound is a form of energy that travels in waves and acts upon various materials. (This learning goal is addressed under PM.1.0 and PM.2.0.)**

PF.2.0 **<u>Forms of Energy</u>: Students know that sound waves are a form of energy. (This learning goal is addressed in PM.1.0 and PM.2.0)**

PF.3.0 **<u>Mechanical Systems</u>: Students design and construct instruments that demonstrate fundamental principles of sound. (This learning goal is addressed under PM.3.0.)**

PF.4.0 **<u>Objects in Motion</u>: The position of an object can be described by locating it in relation to another object.**

PF.4.1 Pushes and pulls are forces that change position of objects

PF.4.2 Distance and speed are measures of motion

PF.4.3 Ramps, levers, and pulleys are simple machines

PF. 5.0 **<u>Magnets</u>: Magnets attract and repel each other.**

PF.5.1 Objects that contain iron are magnetic, objects made from glass, paper, wood, or plastic are non-magnetic.

PF.5.2 Magnets can attract or repel only those objects that are in it's "magnetic field"

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycle and environments of organisms.

Essential Questions:

- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How has life changed, and how might it change in the future?
- How is life interdependent on the Earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems Living Systems encompass a diversity of organisms. Animals can be classified according to physical similarities and differences as well as differences in their life cycles.

LS.1.0 **<u>Characteristics of Living Things</u>: Students identify similarities and differences among living things and classify (group) organisms according to those similarities and differences.**

LS.1.1 Students learn to classify living things into groups whose members share characteristics.

LS.1.2 Students investigate the needs of animals and explore how living things meet their needs.

LS. 1.3 Students compare and contrast the life cycles of living things.

LS.1.4 Students observe and collect specimens (or possible photos) of animals.

LS.1.5 Students formulate and share theories for classifying animals.

LS.1.6 Students reclassify the collection of animals according to the recognized rules of zoology. Classifications will include insects, mammals, reptiles, amphibians, fish, birds, and other.

LS.2.0 <u>Characteristics of Living Environments</u>: Students know that certain animals have specific environments in which they live and can match those specific environments to selected animals.

LS.2.1 Students identify animals that live in desert, mountain, prairie, and aquatic environments.

LS.3.0 <u>Structure and Function</u>: Students identify differences in the structures of a variety of living organisms and understand that differences make the organisms unique.

LS.3.1 Students compare and contrast the different structures of plants and animals that live in desert, mountain, prairie, and aquatic environments.
Example: Venn Diagram

LS.4.0 <u>Diversity and Adaptation</u>: Students know that diversity is a result of differences in organisms' structures.

LS.4.1 Students demonstrate understanding of how specific structures of animals help those organisms live within their respective environments. Different animals have different body parts to help them live on land, water, and air.
Example: bird bones are hollow

(P) Essential Learning Expectation - Life Process Plants and animals have basic needs and life processes including growth, survival needs, cycles and similarities among offspring and their parents.

LP.1.0 <u>Growth</u>: Students understand that as animals grow and change, their needs change.

LP.1.1 Students observe and record specific needs that change as animals grow.
Example: crabs, insect, millipedes, butterflies, guppies

LP.2.0 <u>Lifecycles</u>: Life cycle stages are different for different animals

LP.2.1 Students observe that living things produce offspring that resemble their parents but have individual differences.

LP.2.2 Students observe that some animals change form as they grow from baby to adult. Changing structures help them function in different environments.

(E) Earth and Space Science: As a result of the curriculum activities all students should develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- Why do we need to know about the Solar System and planets?

(S) Essential Learning Expectation – Earth and Space Structures -There is a fixed amount of water on Earth that re-circulates through evaporation, condensation, and precipitation (i.e., the water cycle).

ES.1.0 <u>Earth and Planetary Materials</u>: Students know that water is one of the primary materials of which the earth is composed.

ES.1.1 Students identify and provide specific examples of water in its various forms: fresh water (lakes and streams), salt water (oceans and seas), ice (glaciers, icebergs), and vapor (geysers, fog, clouds).

ES.1.2 Students recognize that most of the Earth's surface is covered by water.

ES.1.3 Students recognize that water exists above, below, and within the ground.

ES.2.0 <u>Weather Patterns</u>: Weather changes in patterns over time

ES.2.1 Students recognize that water moving from earth to the air and back again is called the Water Cycle.

ES.2.2 Weather conditions include precipitation and wind.

ES.2.3 The number of daylight hours changes with the seasons.

ES.2.4 People and other living things adjust to seasonal changes in weather.

ES.3.0 <u>Motions in the Sky</u>: Students know that objects in our Solar System such as the Sun, the planets, and the Moon, have properties, locations and movements that can be observed and described.

ES.3.1 Earth's rotation causes day and night; Earth's revolution around the Sun causes the seasons.

ES.3.2 The reflection of the Sun's light on the Moon and the Moon's orbit around Earth Change how the Moon looks throughout a month.

ES.3.3 A star is a ball of hot gases.

(I) Essential Learning Expectation –Land, Water, and Air

EI.1.0 <u>Weather, Climate and Change</u>: Students explain that water moves throughout the planet by means of a cycle that includes evaporation, condensation, and precipitation.

EI.1.1 Students record daily observations of precipitation and temperature and discuss how changes in those measurements affect their environment and their daily life
Example: using weather instruments such as rain gauges and thermometers

EI.1.2 Students create a visual representation of the water cycle.
Example: poster, model, diagram

EI.2.0 <u>Living Organisms</u>: Students know that living organisms require water in order to survive and are affected by the water cycle.

EI.2.1 Students explore the questions of where do we find water and how did it get there?
Example: deserts, forests, wetlands, rivers, lakes, oceans, etc.

EI.2.2 Students explore the question, "What would happen to life if the water cycle stopped?"

(H) Place Based Issues (Human Relationships with the Environment): As a result of inquiry-based curriculum activities all students use scientific evidence to analyze local and regional scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds and surrounding Judith, Snowy, Little Belts and Moccasin mountains.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal; science drives technological advances which in turn, drive future scientific endeavors.

HT.1.0 <u>Technology</u>: Students identify how the production of music has evolved and changed through technological advances.

HT.1.1 Students know that people have used music for many purposes and used a variety of materials to make music instruments.
Example: wood/metal flutes

HT.2.1 Students observe a variety of objects used to store music and discuss changes due to technological advancement.

Example: gramophone, phonographs/vinyl record, cassette tapes, CD's, iPod's etc.

(R) Essential Learning Expectation – Resources Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on local systems.

HR.1.0 <u>Resources</u>: Students identify water as a resource and discuss its importance in their daily lives by listing the uses of water in our homes, school, and neighborhoods.

(I) Essential Learning Expectation – Culture Many cultures make contributions to science and technology affecting societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 <u>Culture</u>: Students identify plants and animals in their neighborhood and discuss how human activities affect them.

Lewistown Public Schools

Science Curriculum
Third Grade

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world in which you live?

Essential Understandings: By the end of third grade, all students recognize that simple machines make work easier, that animals can be classified as vertebrates or invertebrates, and that the properties of rocks, minerals, and soils reflect the processes that formed them. Students know that Montana American Indians have made numerous contributions to our scientific and technological understanding of the natural world.

Essential Skills: Throughout third grade students explore the natural world through scientific inquiry with an emphasis on formation of hypotheses, inferences and conclusions based upon direct and indirect observation. Students use a variety of tools, including technology, to gather information and report results.

Content Standards: Third grade content standards include investigations in Physical Science, Life Science, and Earth and Space Science and incorporate an emphasis on human relationships with the environment. In third grade, the unifying themes are explorations in simple machines vertebrates and invertebrates, and Earth materials (including rocks, minerals, soil, and fossils).

Process Standards: Using the inquiry process, students conduct, evaluate, and communicate scientific investigations. Third grade process standards stress the importance of gathering data, making inferences, and drawing conclusions. Developing simple questions, formulating simple hypotheses, and making predictions in experimentation are emphasized. Students select and use appropriate tools, including technology, to measure, analyze, and represent data (e.g., graphs, models, pictures).

(P) Physical Sciences: Students demonstrate knowledge of types of force, forms of energy, mechanical systems, as well as physical properties of matter and changes in states of matter.

Essential Question:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?

- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and can be classified by physical properties. Matter can be mixed and separated.

PM.1.0 <u>Structure</u>: Students know that matter exists in the three states (solid, liquid, and gas) and extend their thinking by recognizing that states of matter depend on molecular structure and that matter is classified by structure - how close or far apart the components (molecules) are from each other.

PM.1.1 Students sort various substances into the categories solid, liquid, and gas.
Example: word bank w/categories

PM.1.2 Students are introduced to the concept that states of matter depend on the distance between molecules.
Example: mini-kit, good literature connection

PM.2.0 <u>Properties</u>: This learning goal is not addressed.

PM.3.0 <u>Changes</u>: Students know that matter changes form when exposed to a change of temperature.

PM.3.1 Students collect examples of matter that changes form when exposed to a change in temperature.
Example: eggs, ice cream, cookie batter, wool, Cherry's knitted potholders, clay, plastic, etc.

(F) Essential Learning Expectation – Force, Motion and Energy: Simple machines help to make work easier. Simple machines can be classified into specific groups.

PF.1.0 <u>Types of Force</u>: Students know that force can be a push or a pull, that force changes motion, and that forces act in pairs (action/reaction, Newton's 3rd Law).

PF.1.1 Students classify various types of common forces as pulls or pushes (e.g. drop things, twists, open a door, close a door, tug-o-war, crack the whip, magnets, etc.).

PF.1.2 Students demonstrate that force changes motion.
Examples: marble games, pendulum demonstration, water splashes, examples in writing or picture, pool games at the SUB, hockey puck/stick, quarterback/linebacker collisions. Friction is a force that changes motion: brakes.

PF.1.3 Students are introduced to the concept that forces act in pairs—that for every action, there is an opposite reaction.

Example: Jellyfish squeezes water out in one direction, and the jellyfish goes in the opposite direction. Action: Pushing off the wall of a swimming pool. Reaction: Your body travels in the opposite direction. Balloon: action is air pushing in one direction and the balloon traveling in the opposite direction. Blast-off.

PF.1.4 When shown examples of the uses of simple machines, students will identify the action forces and reaction forces involved.

Example: Lever—when you push down on one side of a teeter-totter, the other side goes up.

PF.2.0 <u>Forms of Energy</u>: Students are introduced to the concept that energy exists in different forms and that one type of energy can change into other types of energy.

PF.2.1 Students collect and sort examples of energy forms, including electrical, mechanical, sound, light, thermal, and chemical energy.

Example:

PF.2.2 Students recognize the difference between potential and kinetic energy.

PF.3.0 <u>Mechanical Systems</u>: Students observe simple machines (tools that have few parts and that make work easier) as basic mechanical systems.

PF.3.1 Students identify and collect six fundamental types of simple machines: inclined plane, lever, pulley, wedge, screw, wheel and axle.

Example: collect and sort; kitchen tool or device dissection

PF.3.2 Students explore how combinations of simple machines can form compound machines by designing, building, and demonstrating their own compound machines that perform specific tasks.

Example: Rube Goldberg devices

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycle and environments of organisms.

Essential Questions:

- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How did life begin, how has it changed and how might it change in the future?
- How is life interdependent on the Earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems, Living systems encompass a diversity of organisms that are classified according to similarities and differences in

behavior, basic structure (vertebrates or invertebrates), function, life cycle and energy needs. Vertebrates can be further classified as mammals, reptiles, amphibians, fish, and birds.

LS1.0 <u>Characteristics of Living Things</u>: Students know that all living things, including vertebrates and invertebrates, share common characteristics. They are made of cells, obtain and use energy, respond to their environments, grow and develop, and reproduce.

LS.1.1 Students review that all living things grow and develop, reproduce, and respond to their environments.

LS.1.2 Students are introduced to the concept that all living things are made up of cells.

LS.1.3 Students are introduced to the concept that all living things obtain and use energy to power their activities.

LS.2.0 <u>Characteristics of Living Environments</u>: Students recognize that life-supporting environments must provide energy, nutrients, air, shelter, and water.

LS.2.1 Students explore the question, "What traits do all life-supporting environments have in common?"
Example: jigsaw traits of different major environments such as deserts, prairies, rainforest, etc.; kids report back with an ear for common traits

LS.3.0 <u>Structure and Function</u>: Students identify and compare structures of vertebrates and invertebrates.

LS.3.1 Students examine and sort multiple examples of vertebrates and invertebrates.
Example: (to include vocabulary exoskeletons, endoskeletons, annelids, others)

LS.3.2 Students explore the questions, "Are there any advantages to being a vertebrate; are there any advantages to being an invertebrate?"
Example: food chain, language, movement, support, flexibility, protection

LS.4.0 <u>Diversity and Adaptation</u>: Students compare how the body parts and behaviors of various types of animals help them adapt to their environments.

LS.4.1 Students explore how the body parts of different types of animals help them propel themselves, obtain oxygen, protect themselves, and obtain food.
Example. Fish use tails to move through water; birds use wings to fly. Spiders use webs to catch prey; wolves use long legs, sharp teeth to bring down elk… Crabs protect themselves with shells; antelope speed, camouflage. Humans: thumbs

LS.4.2 Students explore how the behaviors of different types of animals help them survive.

Example: Birds and other animals migrate with the seasons; fish school; herbivores often herd; some predators hunt cooperatively…nocturnal/diurnal; hibernators/cachers; symbiotic relationships between animals.

(P) Essential Learning Expectation - Life Process: Plants and animals have basic needs, inherit traits from their parents, and exhibit various life processes including growth and reproduction.

LP.1.0 <u>Growth</u>: Students review their understanding that animals need energy from their environment to grow and change.

LP.1.1 Students provide examples of how various types of animals obtain and conserve energy from their environments.

Example: Food, of course, but also conserving warmth through behaviors like hibernation/torpor and structures like fur and feathers and blubber, and shelter.

LP2.0 <u>Cycles</u>: Students review that all plants and animals have a life cycle with an identifiable beginning, middle, and end.

LP.3.0 <u>Reproduction</u>: Students review their knowledge that all animals reproduce to perpetuate their species. They recognize that offspring inherit traits from their parents and that animals can be classified as either viviparous (live birth) or oviparous (egg-layers).

LP.3.1 Students explain how animals perpetuate their own species.

LP.3.2 Students observe and communicate that offspring inherit specific traits from their parents (e.g., that offspring resemble their parents).

(E) Earth and Space Science: As a result of the inquiry-based curricular activities all students will develop an understanding of composition and structures of the Earth, objects in the sky and changes in Earth and sky.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?
- Why does the Earth shake, rattle and roll?

(S) Essential Learning Expectation – Earth and Space Structures: The Earth system is classified into structures within the Earth, and the properties of rocks and minerals reflect the processes that formed them. The Earth's soil is composed of the weathered rocks, minerals, and organic matter. Rocks and minerals can replace living organisms, creating a fossil.

ES.1.0 <u>Earth and Planetary Materials</u>: Students know that the earth is composed of inorganic compounds such as rocks and minerals as well as organic matter derived from living organisms.

ES.1.1 Students recognize that soil is composed of weathered rocks, minerals, and organic matter.

ES.2.0 <u>Landforms</u> (geomorphology): Students know that the Earth's surface continually changes through weathering, erosion, deposition, volcanic action.

ES.2.1 Students explain that Earth's surface features continually change as a result of weathering, erosion and deposition, volcanic action.

ES.3.0 <u>Planetary Systems</u>: Students identify the basic components of our Solar System, including the sun, the planets, moons, asteroids, comets, and meteors.

(I) Essential Learning Expectation – Earth and Space Interrelationships – Patterns, Cycles and Change- The dynamic nature of the lithosphere (earth) has a profound effect on the formation of landforms composed of rocks, minerals, soil, and fossils. Some of Earth's changes happen quickly and some happen slowly.

EI.1.0 <u>Weather, Climate and Change</u>: Students recognize that weather and climate cause changes in landforms both in the short and long term.

EI.1.1 Students explore the roles of weathering and erosion in changing landforms over the short and long term.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology Our lives and community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal; science drives technological advances, which in turn drives future scientific endeavors.

HT.1.0 <u>Technology</u>: Students identify how simple machines influence daily life and lead to new technological advances.

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on local systems.

HR.1.0 <u>Resources</u>: Students will identify renewable and non-renewable resources.

HR1.1 Students will identify ways to conserve resources.
Example: recycling, using less electricity

(I) Essential Learning Expectation – Culture Many cultures make contributions to science and technology affecting societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 <u>Culture</u>: Students identify the various uses of stones and minerals including uses by Montana Native Americans and other indigenous people.

HI.1.1 Students identify the various uses of stones, including historic uses by Montana Native Americans and other cultures.
Example: projectile points, knives, scrapers, tipi rings, mortar-pestle, cooking stones, sweat lodges

HI.2.1 Students identify the various uses of minerals, including historic uses by Montana Native Americans and other peoples.
Example: paints, dyes, medicines

Lewistown Public Schools

Science Curriculum
Fourth Grade

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world in which you live?

Essential Understandings: By the end of fourth grade, all students recognize that electromagnetism is a fundamental force of nature, that movement within the solar system profoundly influences life systems on Earth, that the human body is a unique living system exhibiting characteristics that are both inherited and learned, and that human activities impact the environment. Students understand that Montana American Indian have made a variety of contributions to our scientific and technological knowledge of the natural world.

Essential Skills: Throughout fourth grade, students explore the natural world through scientific inquiry and emphasizing the collection, analysis and verification of results. Students utilize a variety of tools, including technology, to collect data, and create representations of data.

Content Standards: Fourth grade content standards include investigations in Physical Science, Life Science, and Earth and Space Science and incorporate an emphasis on human relationships with the environment. In fourth grade, the unifying themes are explorations in Electromagnetism, Human Body, and the Solar System.

Process Standards: Using the inquiry process, students design, conduct, evaluate, and communicate scientific investigations. Fourth grade process standards stress the importance of using information, analyzing data, and validating experimental results. Defining variables and making simple predictions in experimentation is emphasized along with refining skills in questioning and creating hypotheses. Students will select and use appropriate tools, including technology, to measure, analyze, and represent data (e.g., graphs, models, pictures).

(P) Physical Sciences: Students demonstrate knowledge of types of force, forms of energy, mechanical systems, as well as physical properties of matter and changes in states of matter.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and can beclassified by physical properties. All matter consists of atoms.

PM.1.0 <u>Structure</u>: Students are introduced to concept that electricity is produced by the movement of electrons.

PM.1.1 Students demonstrate knowledge of basic atomic structure, including nucleus, neutrons, protons, and electrons.
Example: Build a model, draw a diagram, etc. Resources: Magic School Bus Electricity, Bill Nye, Powers of 10 films

PM.1.2 Students demonstrate knowledge that protons carry a positive charge, that electrons carry a negative charge, and that electrons can move from atom to atom.
Example: Model, diagram, report, etc., based on a resource such as Magic School Bus book. Balloon experiments (static electricity).

PM.2.0 <u>Properties</u>: Students recognize that there is a fundamental interrelationship between electricity and magnetism, that magnetic fields have predictable patterns, and that electromagnetism behaves in predictable ways.

PM.2.1 (Students explore the concept of how magnets can be used to produce electricity.
Example: generators, Faraday's experiment

PM.2.2 Students explore the concept that electricity can be used to produce magnetic force.
Example: electromagnet (Faraday), interactive Internet sites

PM.2.3 Students explore the concept that magnets have magnetic fields that have predictable shapes and behave in predictable ways.
Examples: *Shape of magnetic field depends on the shape of the magnet (check with iron filings). North and south vs. positive and negative poles*

PM.2.4 Students recognize that some magnets are stronger than others and explore the concept of why magnetic force varies.

PM.2.5 Students demonstrate that magnets can be used to produce electricity and that electricity can be used to produce magnetism.
Example: Student will build an electromagnet.

PM.3.0 <u>Changes</u>: Students recognize that objects can be positively or negatively charged, that opposites attract, and that distance affects the forces of attraction and repulsion.

PM.3.1 Students experiment with static electricity in order to discover how to charge objects and use them to attract and repel.

Examples: Rub balloon on sweater, then raise your neighbor's hair or stick balloon to wall. Charge two balloons and watch them repel one another (static electricity).

(F) Essential Learning Expectation – Force, Motion and Energy: Electromagnetism is one of the four fundamental forces of nature (the others are gravity, the strong nuclear force, and the weak nuclear force). Electromagnetism acts upon objects, it impacts position, direction, and speed, and it exhibits characteristics with practical applications for humans (electrical, mechanical (motion), sound, light, thermal, and chemical).

PF.1.0 Types of Force: Students are introduced to the concept that electromagnetic force is responsible for virtually all of the phenomena we experience in daily life.

PF.2.0 Forms of Energy: **Students are introduced to the concept that electromagnetism can produce energy in various forms: electrical, mechanical, sound, light, thermal, and chemical.**

PF.2.1 Students collect and sort examples of how electromagnetism produces electricity, motion, sound, light, heat, and chemical energy.

PF.2.2 Students explore how light energy and sound energy behave.
Example: Students do activities with mirrors. Students do activities with sound traveling along solids and through the air.

PF.2.3 Students recognize that static electricity is a form of potential energy and that current electricity is a form of kinetic energy.

PF.3.0 <u>Mechanical Systems</u>: Students know that electric devices employ electromagnetism and involve specific parts including conductors, insulators, switches, and circuits.

PF.3.1 Students design and build simple circuits, including parallel circuits, series circuits, and switched circuits.

PF.3.2 Students deconstruct electrical devices and then analyze, diagram, and label the key electrical parts
Example: Students manipulate switches, conductors, insulators, batteries, magnets, coils in a lab setting

PF.4.0 <u>Simple Machines:</u> Students identify simple machines and how they can be combined to form compound and complex machines.
Examples: Students build a wind boat with wheels to test best design. Students explain the effects of friction and gravity.

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycle and environments of organisms.

Essential Questions:

- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How did life begin, how has it changed and how might it change in the future?
- How is life interdependent on the Earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems: The human body is a unique living system with structures and functions that work together to sustain human life. Humans have characteristics that are both inherited and learned.

LS1.0 <u>Characteristics of Living Things</u>: Students recognize that the human body is composed of various systems that have specific functions and that are interdependent.

LS.1.1 Students identify and describe the functions of the basic systems of the human body, including, musculoskeletal system, respiratory system, circulatory system, and digestive system.

LS.2.0 <u>Characteristics of Living Environments:</u> Students will identify the basic needs of all living things.

LS.3.0 <u>Structure and Function</u>: Students identify the major components of the human musculoskeletal system and explain how they work together to provide support and protection and to produce movement.

LS.3.1 Students observe movement of the human body; develop theories of how the body moves, and communicate those theories verbally and in writing.

LS.3.2 Students demonstrate knowledge of the human skeleton's three primary functions: support, protection, and movement.

LS.3.3 Students demonstrate a working knowledge of vocabulary related to the human musculoskeletal system.

LS.3.4 Students demonstrate knowledge of the components of a human joint.
Example: Students will construct a model arm.

LS.3.5 Students will name the three basic types of muscle (skeletal, cardiac, smooth) and identify where each type is found.

LS.3.6 Students will compare and contrast the human skeleton to other skeletons.

(P) Essential Learning Expectation - Life Process: Like all plants and animals, humans have basic needs, inherit traits from their parents, and exhibit various life processes including growth and reproduction.

LP.1.0 Growth: Learning goal not addressed.

LP.2.0 Cycles: Students review the concept that all living things, including humans, have a life span and various stages of growth and development.

LP.2.1 Students compare different types of life cycles.
Example: Record stages of mealworm's life cycle.

LP.2.2 Students distinguish difference between life cycle and life span.

LP.3.0 Reproduction: Students review the concept that offspring exhibit specific traits that are inherited from their parents.

LP.3.1 Students identify genetic traits of animals and their relationship to their offspring
Example: Students will sort cards of adult animals and their babies.

LP.4.0 Ecosystems: Students will review the role of food chains and food webs in ecosystems.

LP. 4.1 Students identify parts of a food chain (producer, herbivore, carnivore, omnivoe, decomposer)

LP. 4.2 Students recognize physical and behavioral adaptations of various animals to their environment.

(E) Earth and Space Science: As a result of the inquiry based curricular activities all students will develop an understanding of composition and structures of the Earth, objects in the sky and changes in Earth and sky.

Essential Questions:
- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?
- Why does the Earth shake, rattle and roll?

(S) Essential Learning Expectation – Earth and Space Structures: The universe is composed of galaxies, stars and other astronomical bodies, including our own Milky Way galaxy and solar system.

ES.1.0 Earth and Planetary Materials: This learning goal is not addressed.

ES.2.0 Landforms: This learning goal is not addressed.

ES.3.0 Planetary Systems: Students identify the basic components of our Solar System, including the sun, the planets, moons, asteroids, comets, and meteors.

ES.3.1 Students recognize that the Sun is a star and that all the other objects in the Solar System revolve around it.

ES.3.2 Students demonstrate knowledge of the relative positions and sizes of the Sun and the planets of our solar system.

ES.3.3 Students explain the differences between the inner planets and the outer planets.

ES.3.4 Students explain the differences among asteroids, meteors, comets, and dwarf planets.

ES.3.5 Students explore the question: "What makes a planet a planet?"

(I) Essential Learning Expectation – Earth and Space Interrelationships – Patterns, Cycles and Change - The relative positions and motions of the Earth, Sun, and Moon create climate, tides, and seasons which profoundly affect life on Earth. A planet's distance from its sun determines its potential for life.

EI.1.0 <u>Weather, Climate and Change</u>: Students recognize that conditions on Earth are influenced by the relative positions of the Earth, Sun, and Moon (i.e. seasons, tides, day and night, climate and weather).

EI.1.1 Students demonstrate how the relative positions of the Earth and Sun account for the changing seasons and the changing lengths of day and night (the four seasons, the solstices and equinoxes).

Example: seasons are determined by the Earth's orbit around the Sun and the tilt of the Earth's axis.

EI.1.2 Students demonstrate how the rotation of the Earth on its axis accounts for the cycle of day and night.

EI.1.3 Students explore how the Earth's rotation and its orbit around the Sun influence weather and climate.

EI.1.4 Students explore how the Earth's rotation and the planet's proximity to the Moon influence tides.

EI.1.5 Students identify the basic phases of the moon and explain how they are produced by the relative positions of the Sun, Earth, and Moon.

EI.1.6 Students observe and record moon phase changes over the course of an entire lunar cycle.

Example: Students make a flip book showing the moon phases.

EI.1.7 Students review the concept that weather reflects short-term changes in temperature and precipitation and that climate reflects long term trends in temperature and precipitation.

EI.2.0 <u>Living Organisms</u>: Students understand that life exists within relatively narrow parameters, including Earth's distance from the Sun.

EI.2.1 Students review the basic needs of all living organisms and explore the question of why there is life on Earth but not on the other planets in our solar system.

EI.3.0 <u>Earth's History</u>: This learning goal is not addressed.

EI.4.0 <u>Catastrophic Events</u>: Students know that meteorites have had a considerable impact on life on Earth.

EI.4.1 Students explore the question, "How have meteorites influenced life on Earth?"
Example: dinosaur extinction

EI.5.0 <u>Planetary Systems</u>: Students recognize that our solar system is one of many that make up our galaxy, the Milky Way, and that there are many other galaxies in the universe.

EI.5.1 Students define what constitutes a galaxy.
Example: Internet search, Google Sky

EI.5.2 Students explain that constellations are groups of stars and planets that often reflect differing cultural beliefs.

EI.5.3 Students identify astronomers and astrophysicists as scientists who study the universe.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology - Our lives and community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal; science drives technological advances, which in turn drives future scientific endeavors.

HT.1.0 <u>Technology</u>: Students identify various types of technology used to explore outer space and improve our lives on Earth. They recognize that space travel offers opportunities for exploring scientific questions in ways that are impossible on Earth.

HT.1.1 Students collect and classify examples of technology from the past and present used to explore our universe, including telescopes, satellites, spacecraft, and rovers.

HT.1.2 Students describe examples of technology developed for space exploration that have benefits for everyday use.
Example: temporpedic mattress, electronic calculator, satellite television and phones, GPS, weather prediction, Earth science

HT.1.3 Students design a scientific investigation specifically tailored for the International Space Station.

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 <u>Resources</u>: Students describe energy as a finite source and explain how electricity is produced in Montana.

HR.1.1 Students examine local forms of energy generation; discuss the materials needed for each and compare their sustainability.
Example: Wind, coal, hydro, solar, geothermal

HR.2.0 <u>Conserving Resources:</u> Students will explore ways to conserve Earth's natural Resources.

HR.2.1 Students will examine local and regional efforts to recyle Earth's resources.
Example: identify recycling sites in Lewistown.

(I) Essential Learning Expectation – Culture: Many cultures make contributions to science and technology affecting societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 <u>Culture</u>: Students recognize the importance of Native American and other indigenous peoples discoveries and applications of medicinal plants.

HR.1.1 Students know that many of our current medicinal uses of plants originate with Native American or other cultures' discoveries and applications of indigenous plants.
Example: chamomile

Lewistown Public Schools

Science Curriculum
Fifth Grade

Essential Questions:
- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What do learning, practicing, understanding and applying science mean to you and the world in which you live?

Essential Understandings: By the end of fifth grade, all students will develop beginning understandings of the properties of matter and its structure, an objects motion, mass, forces and the transfer of energy. Scientific advances have significant impacts on our society and Montana American Indians contributions to scientific understanding.

Essential Skills: Throughout fifth grade science students explore the natural world through scientific inquiry with an emphasis on the formation of conclusions based upon verified results. Students utilize a variety of tools, including technology, to collect and represent data.

Content Standards: Fifth grade content standards include investigations in Physical Science and incorporate an emphasis on human relationships with the working systems. In fifth grade, the unifying themes are explorations in the structure, characteristics of matter, changes of state, forces, motion, and work, energy and waves, temperature and heat, electrical energy.

Process Standards: Using the inquiry process, students design, conduct, evaluate, and communicate scientific investigations. Fifth grade process standards stress the importance of using information, analyzing data, validating experimental results, and drawing logical conclusions. Emphasis is placed upon defining variables, forming hypotheses, and conducting fair tests during independent experimentation. Students will select and use appropriate tools, including technology, to measure, analyze, record, and represent data (e.g., graphs, models, pictures).

(P) Physical Sciences: Students demonstrate knowledge of types of force, forms of energy, mechanical systems, as well as physical properties of matter and changes in states of matter.

Essential Questions:
- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that? How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and can be classified by structure, characteristics/physical properties and changes of state

PM.1.0 <u>Structure of Matter</u>-The atom is the basic unit of matter

PM.1.1 Elements are matter made of one kind of atom and classified in the Periodic Table according to their properties.

PM.1.2 Compounds are substances made of at least two elements that are chemically combined.

PM.2.0 <u>Characteristics of Matter</u>- A chemical change causes a change in the characteristics of matter, while a physical change does not.

PM.2.1 Mixtures contain substances that are physically, but not chemically combined

PM.2.2 Solutions are mixtures in which particles combine at the molecular level.

PM.3.0 <u>Changes of State</u> – Matter exists in three states: solids, liquids, and gases.

PM 3.1 Matter can change from one state to another when energy is added or removed.

PM.3.2 Changes of state include melting, freezing, deposition, sublimation, vaporization, and condensation.

(F) Essential Learning Expectation – Force, Motion and Energy: Forces act upon objects and impact their motion. Motion can be described in terms of position, direction, and speed. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion and sound. Energy is transferred in many ways. Life depends on energy like light, sound, heat, mechanical, and electrical. Light behaves in predictable ways (refraction, reflection, absorption), and it exhibits characteristics that have practical applications for humans (lasers, cameras, telescopes, etc.).

PF.1.0 <u>Force Motion and Work</u>: Students define force is a push or a pull that can change an object's motion.

PF.1.1 Work is done when force moves an object over a distance.

PF.1.2 Magnetism is a force that acts between magnets and certain objects.

PF.1.3 Simple machines make doing work easier.

PF.2.0 <u>Energy and Waves</u>- Energy can be changed into different forms but cannot be created or destroyed.

PF.2.1 Sound waves are mechanical waves that carry energy through a medium.

PF.2.2 Light is a form of energy transferred by electromagnetic.

PF.2.3 Visible light contains light of different wavelengths.

PF.2.4 Students define light as a form of energy and the Sun as a major source of light energy. Students recognize that visible light is a portion of the electromagnetic spectrum, can be described by wavelength and frequency, and that colors are determined by their wavelengths. (Light, consisting of visible light, infrared and ultraviolet radiation, is a small part of a range of energy known as the electromagnetic spectrum.)

PF.2.5 Students review the concept that light is a form of energy and identify the Sun as a major source of light energy.

PF. 2.6 Students observes light in a variety of ways and then develops theories about the physical properties of light.

PF .2.7 Students explore the questions of what light is and where it comes from.

PF .2.8 Students explore the concept that different wavelengths of light determine different colors.

PF.2.9 Through research, students discover that light is formally described in terms of frequency and wavelength.

PF.2.10 Students describe how light travels in straight lines as waves.

PF.2.11 Students design an experiment to test the hypothesis that in order to see an object, light from that object must enter the eye.

PF.3.0 <u>Mechanical Systems</u>: Students examine optical devices and identify their important components.

PF.3.1 Students deconstruct optical devices, label and diagram their components, and explain how the devices work.
Example: camera, telescope, binoculars, microscopes, periscopes ,kaleidoscopes

PF.4.0 <u>Temperature and Heat:</u> Temperature is the average kinetic energy of particle in a substance.

PF.4.1 Heat is the transfer of thermal energy from warmer to cooler area of matter.

PF.4.2 Materials called conductors facilitate heat transfer while substances called insulators try to prevent it.

PF.5.0 <u>Electrical Energy</u>: Static electricity releases a brief burst of energy, while an electrical currents provides a constant flow of electricity.

PF.5.1 An electrical circuit provides a path for electrons to travel.

PF.5.2 Generators convert mechanical energy to electric energy, and motors do the reverse.

(L) Life Science: This learning strand is not addressed in this course.

(S) Essential Learning Expectation – Living Systems

LS.1.0 Characteristics of Living Things: This learning goal is not addressed.

LS.2.0 Characteristics of Living Environments: This learning goal is not addressed.

LS.3.0 Structure and Function: This learning goal is not addressed.

LS.4.0 Diversity and Adaptation: This learning goal is not addressed.

(P) Essential Learning Expectation - Life Process

LP.1.0 Growth: This learning goal is not addressed.

LP.2.0 Cycles: This learning goal is not addressed.

LP.3.0 Reproduction: This learning goal is not addressed.

(E) Earth and Space Science: This learning strand is not addressed in this course.

(S) Essential Learning – Earth and Space Structures.

ES.1.0 Earth and Planetary Materials: This learning goal is not addressed.

ES.2.0 Landforms: This learning goal is not addressed.

ES.3.0 Planetary Systems: This learning goal is not addressed.

(I) Essential Learning Expectation – Earth and Space Interrelationships

EI.1.0 Weather, Climate and Change: This learning goal is not addressed.

EI.2.0 Living Organisms This learning goal is not addressed.

EI.3.0 Earth's History: This learning goal is not addressed.

EI.4.0 Catastrophic Events: This learning goal is not addressed.

EI.5.0 Planetary Systems: This learning goal is not addressed.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and

benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances drive future scientific endeavors.

HT.1.0 <u>Technology</u>: Students identify specific fields of science and technology, major milestones in science that have impacted science, technology, and society including those contributions made by Montana Native Americans.

HT.1.1 Students describe scientific or technological innovation that impacts communities, cultures, and societies including those contributed by Montana Native Americans.
Example: *Native American Unit with stories from their culture*

HT.1.2 Students will use everyday tools to collect graph and analyze data.
Example: *TBD*

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 <u>Resources</u>: Students understand how natural resources are used in society.

HR1.1 Students identify how various rocks and minerals are used by Montana Native Americans in tribal life.
Example: *TBD*

HR1.2 Students research the extraction, refining, uses and economics of natural resources.
Examples: *Wind energy with wind turbine installed at FHS*

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 <u>Culture</u>: Students identify scientific contributions made by different cultures and how scientific developments have impacted human activity and culture including contributions by Montana Native Americans.

HI.1.1 Students understand Native American practices and innovations of mixed use, sustainable living, and simple machines and medicine.
Example: http://www.healingtherapies.info/Native-American%20Medicine.htm

Lewistown Public Schools

Science Curriculum
Sixth Grade

Essential Question(s):

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of sixth grade, all students understand that:

- the physical world may be described through the application of chemical reactions and physical models;
- life and the environment are interdependent and characteristics of living things change because of environmental change/pressure;
- the Earth has dynamic landforms and has continued to change throughout its historical record.
- the Earth has several layers including lithosphere, hydrosphere, and atmosphere that interact with each other and the universe;
- the Earth is constantly changing as a result of a variety of factors including human impact;
- current events reflect local issues as well as regional, national and global issues;
- science and technology are the results of human activity throughout history that help us assimilate new information that connects past to present;
- observation is a key inquiry process used by Montana American Indians;
- Montana American Indians have been affected by and made significant contributions to scientific and technological knowledge.

Essential Skills: Throughout science students will develop skills with an emphasis on scientific inquiry including the ability to:

- identify and communicate testable questions, safely plan and conduct experimental investigations, communicate results, and communicate;
- utilize technological applications such as spreadsheets, projectors and data collection tools to collect, analyze and communicate data results.

Content Standards: In sixth grade students demonstrate transfer of knowledge in the areas of physical science, earth and space science and place-based issues with an emphasis on the natural world. Each content standard should be addressed through inquiry-based investigations with appropriate technology using the process standards listed above.

Process Standards: Using the inquiry process students identify a testable question, determine dependent and independent variables, formulate testable hypotheses, plan and predict the outcome of an investigation, safely conduct scientific investigations using appropriate tools, including technological applications, to make measurements, gather, compare and analyze data and communicate the results of an investigation. Emphasis is placed upon the development of inferences supported by evidence as well as the development of effective models in order to understand and explain scientific concepts and phenomena.

(P) Physical Science: As a result of inquiry-based curriculum activities all students will be able to

develop recognition of the changes of properties in matter and transfer of energy.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms. Matter can be classified by physical and chemical properties. Phases/states of matter are dependent upon the quantity of energy present in the system.

PM.1.0 <u>Structure</u>: Students describe physical model of the atom.

PM.1.1 Students identify and describe parts of the atom.
Example: http://msteacher.org/epubs/science/science21/science.aspx

PM.2.0 <u>Properties</u>: Students examine, describe compare and classify matter based on physical and chemical properties.

PMP. 2.1 Students differentiate between properties of electrons, protons and neutrons, including electrical charge and mass.
Example: *TBD*

PM. 2.2 Students describe density in various physical contexts.
Example: Rock cycle, rock/mineral identification, continental vs. oceanic plates

PM.3.0 <u>Changes</u>: Students identify basic physical and chemical changes in matter.

PM.3.1 Students describe physical changes in matter including phase changes.
Example: *Phase changes - parts of rock cycle*
http://msteacher.org/return_list_science.aspx?id=1393

(E) Earth and Space Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the composition, structures, processes and interactions of the Earth systems, Earth's history, and objects in space.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?
- Why does the Earth shake, rattle and roll?

(S) Essential Learning – Earth and Space Structures: The universe is composed of galaxies, stars and other astronomical bodies, including our own Milky Way galaxy and Solar System. The Earth system is classified into structures within the Earth, hydrosphere and atmosphere.

ES.1.0 Earth and Planetary Materials – Students describe and explain the structure of the Earth system.

ES.1.1 Students identify and understand the composition of the earth's interior.
Example: *core, mantle, asthenosphere, lithosphere, plate tectonics*

ES.1.2 Using inquiry processes students define and classify minerals based on characteristic properties.
Example: hardness, luster, streak, color, density, etc.

ES.1.3 Students differentiate between types of rocks.
Example: igneous, metamorphic, sedimentary

ES.1.4 Students explain the parts and processes of the rock cycle.
Example: creation of rock cycle using Inspiration 7 on laptops

ES.2.0 Landforms: Students model and explain the external features of the earth within the context of plate tectonics and constructive and destructive forces.

ES.2.1: Using inquiry processes students explore convection currents in the mantle and explain how it results in plate tectonics resulting in mountain building and trenches.
Example: volcanoes, faults, ridges, etc.

ES.2.2 Students describe the process of erosion and deposition and the resulting landforms.
Example: web based exploration of rock cycle as context for erosion, moraines, and cirques

ES.3.0 Planetary Systems: Students describe and explain components of the universe (i.e. solar system, stars, and galaxies) and how they have been discovered. Students will describe Earth, Moon, planets, and other objects in space in terms of size and structure.

ES.3.1 Students describe and model the motion and tilt of earth in relation to the sun and the resulting impact on earth (including day/night, seasons).
Example: *Use Starry Night Backyard to analyze angle of separation and change in length of day*

ES.3.2 Students describe the Earth, Moon, planets and other objects in space in terms of relative size, composition, location and movement.
Example:
http://hubblesite.org/sci.d.tech/behind_the_pictures/meaning_of_color/index.shtml

ES.3.3 Students explain theories of the origin and evolution of the Earth and Solar System.
Example: TBD

(I) Essential Learning Expectation – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere and hydrosphere has profound effects on processes within Earth systems. There are common interrelationships between physical bodies in our Solar System and the universe.

EI.1.0 <u>Weather, Climate and Change</u>: Students identify and explain seasons. Students describe change in global climate as a result of Earth's motion and tilt.

EI.1.1 Students understand how Earth's positioning affects seasons and climate.
Example: Using inquiry processes, investigate earth's tilt and how this affects seasons. Investigate why the northern latitudes have snow instead of rain in winter.

ES.2.0 <u>Earth's Energy System</u>: Students understand that radiant energy from the Sun is a major source of energy for the Earth and know how radiation occurs.

ES.2.1 Students know how differential heating of the Earth results in circulation patterns in the atmosphere and oceans that distribute heat globally.
Example: *TBD*

EI.5.0 <u>Planetary Systems</u>: Students describe the movement and interactions of the Earth, Moon and planets in our solar system.

EI.5.1 Students model and explain the motion and tilt of the Earth relative to the Sun, including the concepts of day, night, seasons, and year.
Example: Use inquiry processes to explore physical models

EI.5.2 Students model and explain how the relationship of the earth, moon, and sun causes the phases of the moon.
Example: *Using inquiry processes, discover how much of a sphere is illuminated as it revolves around the student's head.*

(I) Essential Learning – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere and hydrosphere has profound effects on processes within Earth systems. Some Earth changes happen quickly and some happen slowly. There are common interrelationships between physical bodies in our Solar System and the universe.

EI.1.0 <u>Weather, Climate and Change</u>: Students discover and explain how heating, cooling, compression and weathering perpetuate the rock cycle.

EI.1.1 Students explore, through inquiry processes, the effects of heating, cooling, compression and weathering on a variety of rocks.
Example: compare and contrast effects on sedimentary, metamorphic, igneous through examination of the rock cycle

EI.1.0 <u>Weather, Climate and Change</u>: Students observe and describe local and global weather and demonstrate how weather conditions are measured.

EI.1.1 Students describe the composition of the atmosphere.

Example: *http://msteacher.org/return_list_science.aspx?id=1237*

EI.1.2 Students explain how the atmosphere interacts with land and oceans to impact large scale weather patterns.
Example: *Uneven heating and cooling*

EI.1.3 Students identify and use tools and technology to measure weather phenomenon.
Example: thermometers, wind vanes, rain gauges and web-based exploration

EI.3.0 Earth's History: Students study the theories of continental drift and plate tectonics to explain Earth's structural changes throughout Earth's history and connect Earth's active, geologic landform features to lithospheric plate movement.

EI.3.1 Students identify key structural changes and their causes throughout Earth's history.

Example: theory of Pangaea

EI.3.2 Students understand that there is a connection between Earth's active core, lithospheric plate movement and formation/destruction of landforms.
Example: earthquakes and volcanoes

EI.4.0 Catastrophic Events: Students identify the explosive processes of earthquakes and volcanic eruptions and their contributions to the constructive changes of Earth's lithosphere and know that severe weather can contribute to the destructive changes of Earth's lithosphere.

EI.4.1 Students identify the explosive processes of earthquakes and volcanic eruptions and their contributions to the constructive changes of Earth's lithosphere
Examples: mountain building, ocean trenches

EI.4.2 Students know and identify types of severe weather that contributes to the destructive changes of Earth's lithosphere.
Examples: hurricanes, tornadoes, floods

ES.2.0 Landforms – Students understand the concept of watersheds and their key physical components.

ES.2.1 Students differentiate between watersheds based on key physical features.
Example: inquiry activities in Project WET: Discover a Watershed

ES.2.2 Students understand that all land areas exist within a watershed.
Example: Project WET, Discover a Watershed

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycle and environments of organisms.

Essential Questions:
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?

- How is life interdependent on the Earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems: Living systems encompass a diversity of organisms that are classified according to characteristics (structure, function and organization). Living systems involve interactions among organisms and their environment (biotic and abiotic). Organisms evolve through genetic change leading to adaptation. Life forms tend to arrange themselves into communities that correspond with particular climates and landforms that provide for the needs of individual organisms.

LS1.0 <u>Characteristics of Living Things</u>: Students compare and contrast visible physical characteristics of organisms (plants and animals) within and among particular biomes.

LS.1.1 Students will sort signature species of plants and animals into their respective biomes.
Example: Camels and cacti in deserts, alligators and mangroves in swamps, etc

LS.2.0 <u>Characteristics of Living Environments</u>: Students describe, compare, and contrast living conditions within various biomes (i.e., the interrelationships among climates, landforms, and resources).

LS.2.1 Students research and communicate living conditions within each of the major biomes.
Example: TBD

LS.2.2 Students compare and contrast living conditions within various biomes.
Example: Students collectively study one national park that encompasses several of the major biomes. Next, each student does individual research about one biome found elsewhere in the world. Finally, pairs of students compare their research and present their findings to the class.

L.S.2.3 Students explore the question, "Lewistown is located in which biome?"
Example: TBD

(H) Place-based Issues (Human Relationships w/the environment): As a result of inquiry-based curriculum activities all students use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Gallatin Valley and the Greater Yellowstone Ecosystem. All students develop an understanding of personal health, populations, resources and environments, natural hazards, risks and benefits and science, technology and society.

Essential Questions:
- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances that drive future scientific endeavors.

HT.1.0 Technology: Students identify specific fields of science and technology, and major milestones and innovations in science that have impacted science, technology, and society.

HT.1.1 Students describe the specific fields of science and technology as they relate to occupations within those fields.
Example: *http://www.ideafinder.com/history/timeline.htm*

HT.1.2 Students describe a scientific or technological innovation that impacts communities, cultures, and societies (including Native Americans).
Example:http://news.nationalgeographic.com/news/2004/09/0914_040913_information_about_indians.html

HT.1.3 Students simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public.
Example: Internet

HT.1.4 Students demonstrate proficiency in use of hardware and software related to their scientific investigations.
Example: Spreadsheets and graphing, Databases, Probe ware and other data collection devices, presentation software, word processing, simulations, calculators, etc

(R) Essential Learning – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 Resources: Students use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.

HR1.1 Students discuss how natural and manmade factors affect human health.
Example: *air pollution*

HR1.2 Specific Proficiency: Students discuss how the use of natural resources affects their community/world, and how overuse of resources can have adverse affects on climate and society.
Example: TBD

(I) Essential Learning – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 Culture: Students identify scientific contributions made by different cultures including how scientific developments have impacted human activity and culture.

HI.1.1 Students describe how Montana American Indians as well as other indigenous cultures have contributed and impacted science and technology.
Example: *Teepee structure, use of fire, land management, medicine*http://www.epa.gov/OSP/tribes/sciinf/projects.htm

HI.1.2 Students identify the key inquiry processes used by Montana American Indians.
Example: Observation, Native ways of knowing,
http://www.epa.gov/osp/tribes/sciinf/waysknow.htm

Lewistown Public Schools

Science Curriculum
7th Grade - Life Science

Essential Question(s):
- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of seventh grade, all students understand that:
- Biotic and abiotic objects may be identified and classified through the application of common classification schemes;
- Life and the environment are interdependent and characteristics of living things change because of environmental change/pressure;
- Current events reflect local issues as well as regional, national and global issues;
- Science and technology are the results of human activity throughout history that help us assimilate new information that connects past to present;
- Observation is a key inquiry process used by Montana American Indians;
- Montana American Indians have been affected by and made significant contributions to scientific and technological knowledge.

Essential Skills: Throughout 7th grade science, and within the context of instruction, students develop skills with an emphasis on scientific inquiry, including the ability to
- Identify and communicate testable questions, safely plan and conduct experimental investigations, communicate results, and communicate;
- Utilize technological applications such as spreadsheets, projectors and data collection tools to collect, analyze and communicate data results.

Content Standards: In seventh grade students demonstrate transfer of knowledge in the areas of life science and place-based issues with an emphasis on the natural world. Each content standard should be addressed through inquiry-based investigations with appropriate technology using the process standards listed below.

Process Standards: Using inquiry processes students identify a testable question, determine dependent and independent variables, formulate testable hypotheses, plan and predict the outcome of an investigation, safely conduct scientific investigations using appropriate tools, including technological applications, to make measurements, gather, compare and analyze data and communicate the results of an investigation. Emphasis is placed upon the development of inferences supported by evidence as well as the development of effective models in order to understand and explain scientific concepts and phenomena.

The General Objectives of the Course are:

1) The student will gain a better understanding of living things.

2) The student will gain some historical perspective for the development of the biological sciences.
3) The student becomes aware of how scientists in various disciplines of the biological sciences carry out the study of living things.
4) The student will be able to point out the interrelationships between various scientific disciplines.
5) The student will be made aware of the progress that has been made in the study of living things.
6) The student will become aware of the many applications of the biological sciences in our daily lives.
7) The student will be able to point out how technology can be used as a positive force in cleaning the environment.
8) The student will become aware that many careers are directly related to the biological sciences and that knowledge of biology is helpful in people's work and in their daily life.
9) The student knows and is able to apply basic scientific processes including, but not limited to:
    a) Observing
    b) Sorting and Classifying
    c) Measuring
    d) Communicating
    e) Predicting
    f) Inferring
    g) Synthesizing

(P) Physical Science: As a result of inquiry-based curriculum activities all students develop a recognition of the changes of properties in matter, motions and forces, and transfer of energy.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes "it" "it" and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms. Matter can be classified by physical and chemical properties. Phases/states of matter are dependent upon the quantity of energy present in the system.

PM.1.0 <u>Structure</u>: Students describe physical models of atoms, molecules, pure substances and mixtures.

PM.1.1 Students understand the molecular structure of water.
Example: http://msteacher.org/epubs/science/science21/science.aspx

PM.1.2 Students compare water as a pure substance versus as a mixture in natural aquatic systems.
Example: http://biblioteca.universia.net/html_bura/verColeccion/params/id/281.html

PM.2.0 Properties: Students describe, compare and classify properties of water in various aquatic systems.

PM.2.1 Students use chemical and physical properties to compare water quality of a variety of water sources.
Example: *pH, DO, turbidity*http://biblioteca.universia.net/html_bura/verColeccion/params/id/281.html

PM.3.0 Changes: Students identify basic physical and chemical changes in matter.

PM.3.1 Students describe how phase changes impact watersheds and specific bodies of water.
Examples: *http://www.epa.gov/owow/nps/nps_edu/index.html*, *http://www.cacaponinstitute.org/watershed_lesson_plan.htm*

PM.3.2 Students use chemical and physical properties to describe and compare the change in water quality of a variety of water sources.
*Example*s: *DO, FC, pH, Temp, BOD, NO3, PO4, turbidity, TDS*

(F) Essential Learning Expectation– Force, Motion and Energy: Forces act upon objects and impact their motion. Motion can be described in terms of position, direction, and speed. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, and sound. Energy is transferred in many ways.

PF.1.0 Types of Force: This learning goal is not addressed.

PF.2.0 Forms of Energy: This learning goal is not addressed.

PF.3.0 Mechanical Systems: This learning goal is not addressed.

(L) Life Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the characteristics, structures and function of living things.

Essential Questions:
- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How did life begin, how has it changed and how might it change in the future?
- How is life interdependent on the earth's conditions or other life?

(S) Essential Learning – Living Systems: Living systems encompass a diversity of organisms that are classified according to characteristics (structure, function and organization). Living systems involve interactions among organisms and their environment (biotic and abiotic). Organisms evolve through genetic changes that lead to adaptation.

LS.1.0 Characteristics of Living Things: Students distinguish between living and non-living things and understand how scientists classify all organisms.

LS.1.1 Students understand the five characteristics of all living things.
Example: difference between a principal and a moving fan

LS.1.2 Students use and apply the Linnaean classification system.
Example: *kingdom, phyla, class, etc.*

LS.1.3 Students create and use dichotomous keys.
Example: insect collection

LS.2.0 <u>Characteristics of Living Environments</u>: Students explain cause and effect relationships between abiotic and biotic components within ecosystems.

LS.2.1 Students understand the major source of energy in an ecosystem is sunlight and that energy passes from organism to organism in an energy pyramid (food web).
Example: *http://msteacher.org/epubs/science/science17/standards.aspx*

LS.2.2 Students understand the interdependent nature of populations and communities.
Example: predator/prey

LS.3.0 <u>Structure and Function</u>: Students identify the differences and similarities of prokaryotic and eukaryotic organisms; students will understand the process of photosynthesis.

LS.3.1 Students identify and compare prokaryotic and eukaryotic organisms.
Example: *http://www.cellsalive.com/cells/3dcell.htm*

LS.3.2 Students understand the process of photosynthesis to transfer solar energy into food energy.
Example: Science in Focus: Shedding Light on Science: Sunlight to Starch, http://www.hsdvl.org/video.php?record_serial=227

LS.4.0 <u>Diversity and Adaptation</u>: Students understand that biological evolution accounts for the diversity of species and species acquire unique characteristics through biological adaptation, which involves selection of naturally occurring variations in populations.

LS.4.1 Students investigate the idea that species have unique traits that allow them to survive and reproduce in their environment.
Example: *TBD*

LS.4.2 Using principles of genetic modeling students understand that there are variations in traits.
Example: Punnett Squares

LS.4.3 Students understand that the traits of species change over time and allow the species to adapt to changes in their environment through the process of evolution.
Example: http://msteacher.org/epubs/science/science3/help.aspx

LS.5.0 Biology of the Invertebrates and Vertebrates. Students will understand basic structures of invertebrates and vertebrates

LS.5.1 Students understand that the traits of invertebrate and vertebrate species and allow the species to adapt to changes in their environment through the process of evolution.
Example: http://neok12.com/animals

LS.6.0 Human Anatomy and Physiology. Students will demonstrate an understanding of the basic structure of human anatomy in a systematic approach.

LS.6.1 Students understand the systems of Human Anatomy.
Example: http://neok12.com/Anatomy

(P) Essential Learning Expectation - Life Process: Living organisms at all levels of organization demonstrate the complementary nature of structure and function.

LP.1.0 Growth: Students describe the life cycles of plants and animals.

LP.1.1 Using inquiry processes students explore and demonstrate understanding of the life cycles of flowering plants, insects and vertebrates.
Example: trout, native plants, butterflies vs. mayflies

LP.2.0 Cycles: Using inquiry processes students explore the role of reproduction in maintaining life cycles in a variety of organisms.

LP.2.1 Students understand that all organisms' life cycles depend upon successful reproductive strategies.
Example: exploration and comparison of asexual and sexual forms of reproduction

LP.2.2 Students understand that the water cycle is a key aspect of every ecosystem and impacts life processes in a variety of ways.
Example: *TBD*

LP.3.0 Reproduction: Students understand that reproduction is a characteristic of all living organisms, is essential to the continuation of every species and that through reproduction organisms inherit genes and specific traits.

LP.3.1 Students explain the difference between asexual and sexual reproduction.
Example: *exploration and comparison of asexual and sexual forms of reproduction*

(E) Essential Learning Expectation - Ecology: Living organisms at all levels of organization and their interaction with each other and the enviroment.

LE.4.0 Ecological Relationships – Use of ecological relationships is essential to understanding our environment and the role each organism within it.

LE.4.1 Students will define and understand environments around them and the ecology affecting each.

LE.4.2 Students will examine and analyze environments and relate man's responsibility to them by listing pollution causes and listing reasons of the concern for the environment

LE.4. 3 Students will understand and apply ecological concepts in field research projects
Example: Students will use and collect local plants for mounting and identification. They will analyze populations of plants and animals and calculating populations in a sample plot

LE.4.4 Students will demonstrate an understanding of stream ecology and water quality.
Example: Brewery Flats and Frog Pond environmental research- Students will measure stream characteristics such as volume and velocity to calculate stream discharge. Students will also collect water samples, collect and identify macro-invertebrates by using taxonomic keys.

(E) Earth and Space Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the composition, structures, processes and interactions of the Earth systems and Earth's history.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?

(S) Essential Learning – Earth and Space Structures: The universe is composed of galaxies, stars and other astronomical bodies, including our own Milky Way galaxy and Solar System. The Earth system is classified into structures within the Earth, hydrosphere and atmosphere.

ES.1.0 Earth and Planetary Materials – This learning goal is not addressed.

ES.2.0 Landforms – Students understand streams and the concept of watersheds and their key physical components.

ES.2.1 Students know that stream flow shapes our landscape and that water quality is
Example: Brewery Flats and Frog Pond environmental research- Students will measure stream characteristics such as volume and velocity to calculate stream discharge.

ES.2.2 Students differentiate between watersheds based on key physical features.
Example: inquiry activities in Project WET: Discover a Watershed

ES.2.3 Students understand that all land areas exist within a watershed.
Example: Project WET, Discover a Watershed

ES.3.0 Planetary Systems: This learning goal is not addressed.

(I) Essential Learning – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere and hydrosphere has profound effects on processes within Earth systems. There are common interrelationships between physical bodies in our Solar System and the universe.

EI.1.0 Weather, Climate and Change: Students observe and describe local and global climates and demonstrate how climate differences affect biomes.

EI.1.1 Students understand the relationship between different climates and the ecosystems that are present within them.
Example: *TBD*

EI.2.0 **<u>Living Organisms</u>: Students investigate fossils and compare to living organisms, making inferences about life long ago as well as how organisms are affected by the environment.**

EI.2.1 Using the fossil record, students predict what the environment was like long ago.
Example: http://science-ed.pnl.gov/teachers/plans/Fossils_Part3_1'08_v1.pdf

EI.2.2 Students examine the similarities and differences between fossils and live organisms
Example: TBD

EI.3.0 **<u>Earth History</u> : This learning goal is not addressed.**

EI.4.0 **<u>Catastrophic Events</u>: This learning goal is not addressed.**

EI.5.0 **<u>Planetary Systems</u>: This learning goal is not addressed.**

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances that drive future scientific endeavors.

HT.1.0 **<u>Technology</u>: Students identify specific fields of science and technology, and major milestones and innovations in science that have impacted science, technology, and society.**

HT.1.1 Students describe the specific fields of science and technology, and major milestones and innovations in science that have impacted science, technology, and society.
Example: http://www.ideafinder.com/history/timeline.htm

HT.1.2 Students describe the specific fields of science and technology as they relate to occupations within those fields.

HT.1.3 Students describe a scientific or technological innovation that impacts communities, cultures, and societies (including Native Americans).

Example:
http://news.nationalgeographic.com/news/2004/09/0914_040913_information_about_indians.html

HT.1.4 Students simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public.
Example: Internet, professional journals

HT.1.5 Students simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public.

HT.1.6 Students demonstrate proficiency in use of hardware and software related to their scientific investigations.
Example: Spreadsheets and graphing, Databases, Probe ware and other data collection devices, Presentation software, word processing, simulations, calculators, etc.

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 Resources: Students use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.

HR1.1 Students discuss how the use of natural resources effects their community or world, and how overuse of resources can have adverse effects on climate and society.
Example: TBD

HR.1.2 Students discuss how natural and manmade factors affect watersheds and biomes.
Example: *Logging- pros and cons, grazing, fertilizer and herbicides;*
http://epa.gov/waterscience/tribes/index.htm

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 Culture: Students identify scientific contributions made by different cultures including how scientific developments have impacted human activity and culture.

HI.1.1 Students describe how science and technology have impacted Montana American Indians and other indigenous people.
Example: http://www.epa.gov/OSP/tribes/sciinf/projects.htm

HI.1.2 Students identify the key inquiry processes used by Montana American Indians and other indigenous people.
Example: Observation of light projected through a pinhole as indicator for crop planting, http://www.epa.gov/osp/tribes/sciinf/waysknow.htm

Lewistown Public Schools

Science Curriculum
8th Grade - Physical Science

Essential Questions:
- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- How do learning, practicing, understanding and applying science affect you and the world you live in?

Essential Understandings: By the end of 8th grade science, all students understand that
- Matter has a specific structure with chemical and physical properties that are dependent upon its composition;
- The structure and properties of matter changes as it undergoes physical and chemical changes;
- Chemical reactions yield new substances with unique chemical and physical properties;
- the motion of an object can be described in terms of its position, velocity and acceleration;
- The forces acting upon an object can change its motion;
- Mass and energy can change form, but are conserved;
- The earth is a dynamic system;
- Scientific advances have significant impacts on our society;
- Montana American Indians have made significant contributions to scientific understanding.

Essential skills: Throughout 8th grade science students develop skills for scientific inquiry including the ability to
- Identify and generate a testable question, safely construct, plan and implement safe, controlled investigations, make logical inferences based on observations, accurately interpret data, form conclusions and communicate results;
- Utilize technological applications such as spreadsheets, online applications, science software, internet resources and data collection tools to collect, analyze data and communicate results.

Content Standards: Eighth grade content standards focus on physical science, the application of physical science concepts to life and earth science and an understanding of the interconnectedness of the macroscopic world of observable phenomena, the microscopic world of molecules, atoms and subatomic particles, and the mathematical world of physics formulas, chemical formulas, equations and symbols. Content standards emphasize students' ability to:
- qualitatively and quantitatively describe the motion of an object and the forces that cause changes in that motion, conservation of energy, and the interaction of energy and matter;
- describe forces and processes that affect our dynamic environment;
- describe and understand historical developments in science and technology;
- understand how local, regional and global scientific issues affect lives including contributions made by Montana Native Americans.

Process Standards: Eighth grade science process standards focus on developing students' abilities to gather data, make inferences and communicate results with an emphasis on scientific inquiry which includes identifying questions and concepts that guide scientific investigations, using models to understand scientific explanations, effective communication of results through data tables, charts, graphs and narrative including utilization of technological applications.

(P) Physical Science: As a result of inquiry-based curriculum activities all students develop an understanding of the structure of the atom, elements, properties of matter, chemical reactions, motion, forces, energy, and the interaction of physical and chemical systems.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and is made of minute particles called atoms that are composed of even smaller components. Elements are composed of a single type of atom and atoms may be bonded together to form molecules. Chemical bonds are created when electrons of an atom are transferred or shared to form molecules. Chemical reactions describe how atoms and molecules are rearranged to form unique molecules. The physical properties of matter reflect the nature of interactions between its molecules and the pressure and quantity of energy present in a system.

PM.1.0 <u>Structure:</u> Students describe the history of atomic theory, structure of an atom including the properties of the subatomic particles. Students understand the differences between atoms, elements, molecules and compounds.

PM.1.1 Students explain role of scientists over time in the development of atomic theory.
Example: *explore the website http://atomictimeline.net/index.php*

PM.1.2 Students explain properties of subatomic particles.
Example: *Location, mass, charge, and importance of a proton, a neutron, and an electron – use the Internet to research http://webelements.com/*
http://www.nyu.edu/pages/mathmol/textbook/atom.html
http://www.physics.montana.edu/ret/sflentie/PDF/ElementBoxBoardNotes.pdf

PM.1.3 Students identify the differences between atoms, elements, molecules and compounds.
Example: *Given atomic models represent and produce drawings of an atom, atoms of different elements, a molecule, and a compound.*
Example: *Given a symbol/chemical formula identify as an element, molecule, or compound. Use discs to represent atoms and molecules in a chemical formula for hands on experience balancing chemical equations.*
http://www.physics.montana.edu/ret/sflentie/LessonPlans.html#FullCell

PM.2.0 <u>Properties:</u> Students use the periodic table to predict the similarities and differences in the properties of elements based upon valence electrons and energy levels. Students will be able to describe and classify objects based on their chemical and physical properties.

PM.2.1 Students will know the terminology associated with physical properties. They will identify and use these physical properties in experimenting and making calculations associated with them.

Examples of physical properties: state of matter, shape, solubility, odor, melting/freezing point, viscosity, density

Examples of measurements: volume, mass, density, length, time, temperature

Examples of calculations: basic calculations such as V= LxWxH or finding volume with water displacement and D=M/V

PM.2.2 Students identify elements in the periodic table and explain the properties of atoms, molecules and ions in terms of subatomic particles and their role in number of valence electrons and energy levels.

Example: *Diagram and explain the difference between a sodium atom and a sodium cat ion, and the difference between a chlorine atom and a chlorine anion using atomic model structures.*

PM.2.3 Students identify the trends within the periodic table with respect to valence electrons and number of energy levels.

Example: *Draw models for elements 1-20*

PM.2.4 Students explain isotopes and average atomic mass

Example: Calculate number of protons, electrons, and neutrons given atomic number and mass number.

Example: Calculate average atomic mass for an element given relative abundance of its isotopes.
http://www.physics.montana.edu/ret/sflentie/PDF/AtomicStructureWorksheet.pdf

PM.3.0 Changes: Students describe and predict the physical and chemical changes that matter will undergo based on its chemical composition including the changes atoms undergo during chemical bonding and chemical reactions based upon knowledge of periodic trends.

PM.3.1 Students explain the difference between ionic, covalent, and metallic bonds.

Example:
http://www.physics.montana.edu/ret/sflentie/PDF/TypesOfChemicalBonds.pdf

PM.3.2 Students identify types of chemical reactions and understand the difference between chemical change and physical change.

Example: Demonstrations and labs including electrolysis, fuel cells and chemical reaction labs. http://www.physics.montana.edu/ret/sflentie/FuelCell.html
http://www.physics.montana.edu/ret/sflentie/PDF/ChemicalReactionLab.pdf

PM.3.3 Students describe the differences between exothermic and endothermic reactions.

Example: *Vernier physical science labs http://www.vernier.com/*

PM.3.4 Students calculate the amount of energy that is absorbed or released from a chemical reaction.

Example: *Use Vernier data gathering sensors to calculate temperature change*

PM.3.5 Students balance chemical equations for chemical reactions based upon conservation of mass. Students introduced to mole ratios from balanced chemical equations.
Example:
http://www.physics.montana.edu/ret/sflentie/PDF/BalancingEquationsActivity.pdf

PM.3.6 Students predict bond type given two or more elements.

PM.3.7 Students predict the chemical formula (including subscripts) given two elements

PM.4.0 Measurement & Principles: Students know and utilize the International System of Units and prefixes. Students understand basic principles of fluids

PM. 4.1 Students use lab equipment to measure mass, volume, density etc. using the SI system.
Examples of equipment used: balance, thermometer, electronic probes, metric ruler & meter stick, graduated cylinder, beaker

PM. 4.2 Students are able to make metric conversions within the metric system and between the English and metric systems.

PM. 4.3 Students understand and identify examples of Principles of fluids.
Examples include Pascal's, Archimedes', Bernoulli's, Charles's and Boyle's Laws

(F) Essential Learning Expectation – Force, Motion and Energy - An object's motion may be described in terms of its position, velocity and acceleration. The motion of an object changes when an unbalanced force is applied. Newton's laws of motion may be used to describe and calculate the magnitude of the change of motion. All matter has energy and may exist in the form of heat, light, chemical, electrical, mechanical and sound energy. Mechanical energy is classified as either kinetic or potential energy. Heat consists of the random motion of particles. Increased temperature is an indicator of greater motion of particles. Waves have energy and can transfer energy when they interact with matter. Magnetism and electricity are important factors affecting the advancement of technology and the understanding of forces.

PF.1.0 Types of Forces: Students qualitatively and quantitatively describe the motion of an object in terms of its position, velocity and acceleration as well as the forces acting upon it.

PF.1.1 The students know the difference between a scalar and a vector quantity.
Example: *distance & displacement, speed & velocity*

PF.1.2 Students calculate speed of an object if given the distance the object travels and the time over which the distance is covered.
Example:
http://www1.teachertube.com/viewArticle.php?article_id=488&title=SpeedisDistanceOverTimGoeswithvideo
http://www.teachertube.com/viewVideo.php?title=Mr__D___Edmonds___Speed_Is_Distance_Over_Time_Song&video_id=118880

PF.1.3 Students calculate velocity of an object if given the change in speed and direction and the time over which that change occurs.
Example: *Toy car lab: http://atlantis.coe.uh.edu/texasipc/units/motion/cars.pdf*

PF.1.4 Students calculate the acceleration of an object if given the change in velocity of the object and the time over which the change in velocity occurs.
Example: *TBD*

PF.1.5 Students interpret a distance vs. time graph to determine the relative speed of several objects as well as calculate the average speed of an object.
Example: *Students create a graph using data points from their car lab to show the average speed determined in their lab and showing a horizontal line at the point where their car stops.*

PF.1.6 Students interpret a speed vs. time graph to determine the relative velocity of several objects as well as calculate the average velocity of an object.
Example: *Students create a graph using data points from their car lab to show the change in velocity determined in their lab and showing a horizontal line at the point where their car experiences a constant pace.*

PF.1.7 Students know what a force is and will be able to identify the main types of forces.
Example:
http://www.physics.montana.edu/ret/sflentie/Images/Rocket/NewtonLawsDiagram.jpg

PF.1.8 Students demonstrate an understanding of Newton's First Law of Motion.
Example: Newton's 1st Law demo
http://www.physics.montana.edu/ret/sflentie/PDF/BalancingEggDemo.pdf

PF.1.9 Students demonstrate an understanding of Newton's Second Law (Acceleration is directly proportional to the applied net force and inversely proportional to the mass of the object).
Example: *Newton's 2nd Law demo*
http://www.physics.montana.edu/ret/sflentie/PDF/LeadBallDemo.pdf

PF.1.10 Student know how to apply the equation F = ma to solve one dimensional motion problems that involve constant forces.
Example: Newton Car Lab
http://www.physics.montana.edu/ret/sflentie/PDF/NewtonCarLab.pdf
http://www.physics.montana.edu/ret/sflentie/PDF/NewtonCarlabReport.pdf

PF.1.11 Students know the relationship between the universal law of gravitation and the effects of gravity on an object on the surface of the Earth.

PF.1.12 Students know that when forces are balanced, no acceleration occurs and the object continues to move at a constant speed or stays at rest.
Example: Balanced forces structure lab

PF.1.13 Students interpret a free body diagram to determine the direction and magnitude of the net force and the acceleration of the object.
Example: *Draw and explain a diagram of structure lab*

PF.1.14 Students demonstrate an understanding of Newton's Third Law (Every force is accompanied by an equal and opposite force).

Examples: Match Rocket Lab & Bottle Rocket Lab

http://www.physics.montana.edu/ret/sflentie/PDF/MatchRocketLab.pdf
http://www.physics.montana.edu/ret/sflentie/PDF/MatchRocketLabReport.pdf
http://www.physics.montana.edu/ret/sflentie/PDF/BottleRocketLab.pdf
http://www.physics.montana.edu/ret/sflentie/PDF/BottleRocketReport.pdf

PF.1.16 Students understand the history of rocketry and the implications of Newton's Laws in the development of rocketry and space travel.

Examples: Students understand the history of rocketry development.

http://www.physics.montana.edu/ret/sflentie/PDF/HistoryOfRocketry.pdf

PF.2.0 Forms of Energy: Students describe energy and compare and contrast the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves, recognizing that energy can change forms.

PF.2.1 Students calculate the kinetic energy and/or gravitational potential energy of an object.

Example: *Vernier physical science labs with sensors*

PF.2.2 Students understand total mechanical energy consists of potential energy plus kinetic energy and that potential energy can be transformed into kinetic energy and visa-versa (energy is conserved).

Example: *TBD*

PF.2.3 Students understand that work occurs when a force acts upon an object to cause a displacement.

Example: Calculate work done
Example: In which cases is work done

PF.2.4 Students understand that an object that possesses mechanical energy has the ability to do work.

Example: *Lego Labs*

PF.2.5 Students know that the internal energy of an object includes the energy of random motion of the object's atoms and molecules. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules. (Thermal Energy)

Example: http://www.school-for-champions.com/science/thermal_energy.htm

PF.2.6 Students know that waves carry transmit energy from one place to another.

Example: http://web.me.com/dtrapp/ePhysics.f/WDwaves.html

PF.2.7 Students know that waves can be classified as either electromagnetic or mechanical and can identify the characteristics of transverse versus mechanical waves in real world examples.

Example: http://www.physicsclassroom.com/class/waves/u10l1c.cfm

PF.2.8 Students understand that the electromagnetic spectrum shows the characteristic distribution of electromagnetic radiation emitted or absorbed by an object.
Example: http://www.physicsclassroom.com/class/light/u12l2a.cfm

PF.3.0 Mechanical Systems: Students identify the basic characteristics of electricity and magnetism.

PF.3.1 Students understand that physical science core concepts revolve around transfers of energy within and between systems and energy availability regulate what can occur in any process.
Examples: Electrical energy: The flow of charged particles called electrons or ions. Chemical energy: Energy that is stored in molecular bonds, the forces that hold molecules together. (van der Waals force, ionic bonds and covalent bonds). Magnetic force: The magnetic force is exerted through a magnetic field. Like gravitational and electric force, a magnetic force can be exerted even when objects are not touching.

PF.3.2 Students will understand how alternating current works in a simple motor.
Example: Construct a simple motor to observe how the current changes from positive to negative as it spins.

PF.3.3 Students know that charged particles are sources of electric fields and are subject to the forces of the electric fields and other sources.
Examples: Electrons swarm around the nucleus of an atom, but they also spin. Because of the movement, each electron produces a magnetic field. Magnetic Field Demo

(L) Life Science: Biogeochemcial cycles and biological compounds have an elemental basis.

Essential Question:
How is life interdependent on the Earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems: All living thing have basic organic macromolecules in common.

LS.1.0 Characteristics of Living Things: This learning goal is not addressed.

LS.2.0 Characteristics of Living Environments: The structure of biological compounds is responsible for the characteristics of living environments.

LP.2.1 Students know that the elements found in lipids (fatty acid tails and glycerol heads), carbohydrates (sugars), nucleic acids (nucleotides), and proteins (amino acids) determine many characteristics of our environment.
Example: Students show how chemical elements are used in living environments as part of their chemical element research project.

LS.3.0 Structure and Function: This learning goal is not addressed.

LS.4.0 Diversity and Adaptation: This learning goal is not addressed.

(P) Essential Learning Expectation - Life Process: Living organisms at all levels of organization are part of biogeochemical cycles.

LP.1.0 Growth: This learning goal is not addressed.

LP.2.0 Cycles: Simple biogeochemical cycles are the basis for much of life.

LP.2.1 Students describe simple biogeochemical cycles in terms of their chemical basis and function in living things.
Example: *Carbon, nitrogen, and phosphorus cycles, photosynthesis & respiration*

LP.3.0 Reproduction: This learning goal is not addressed.

(L) Earth and Space Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the composition, processes and interactions of Earth's systems, as well as an understanding of Earth's history.

Essential Questions:
- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- Why do we need to know about the Solar System and planets?
- How do we explain where we are in space and time?

(S) Essential Learning – Earth and Space Structures: The Earth and its systems are composed many different materials including liquids, solids and gases. These systems are separated into different systems based the chemical and physical properties of the materials.

ES.1.0 Earth and Planetary Materials: Students identify Earth materials based on their chemical and physical properties.

ES.1.1 Students identify mineral samples based on their density and other physical properties, such as color, hardness and crystal shape.
Example: *Lab activities involving mass, volume and density*

ES.2.0 Landforms: Students understand how the chemical and physical properties of Earth's materials affect its landforms.

ES.2.1 Students know that water running downhill is the dominant process in shaping the landscape and that different earth material are more resistant to erosion.

ES.3.0 Planetary Systems: Students understand that radiant energy from the Sun is a major source of energy for the Earth and know how radiation occurs.

ES.3.1 Students know how differential heating of the Earth results in circulation patterns in the atmosphere and oceans that distribute heat globally.

(I) Essential Learning Expectation – Earth and Space Interrelationships: Interrelationships between the objects in space affects the motion of those objects as well as the transfer of energy within the system. The accepted age of the Earth is based on the definite chemical properties of the matter that makes up the system.

EI.1.0 <u>Weather, Climate and Change</u>: Students understand that energy transfer in Earth's systems affects our weather and climate.

EI.2.0 <u>Living Organisms</u> This learning goal is not addressed in this course.

EI.3.0 <u>Earth's History</u>: The Solar System and original elements formed from a nebular cloud of dust and gas 4.6 billion years ago.

EI.3.1 Students know how half-lives and radioisotopes are used to determine the age of the Earth and historical artifacts including those of Montana Native Americans.
Example: *Half Life Lab using pennies to demonstrate the half life of an element*

EI.4.0 <u>Catastrophic Events:</u> This learning goal is not addressed in this course.

EI.5.0 <u>Planetary Systems</u>: Student understands that the force of gravity in different planetary systems will affect the motion of an object and the gravitational forces acting on that object.

EI.5.1 Students will understand and calculate the gravitational force between the objects in our Solar System.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances drive future scientific endeavors.

HT.1.0 <u>Technology</u>: Students identify specific fields of science and technology, major milestones in science that have impacted science, technology, and society including those contributions made by Montana Native Americans.

HT.1.1 Students identify specific fields of science and technology and relate current technology to occupations within each field.
Example: *GIS applications using ArcGIS software and GPS units*

HT.1.2 Students describe scientific or technological innovation that impacts communities, cultures, and societies including those contributed by Montana Native Americans.
Example: *Native American Unit with stories from their culture*

HT.1.3 Students will use scientific tools to collect graph and analyze data.
Example: *Water Quality monitoring using Vernier sensors*

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 <u>Resources</u>: Students understand how natural resources are used in society.

HR1.1 Students identify how various rocks and minerals are used by Montana Native Americans in tribal life.
Example: *Native American unit*

HR1.2 Students research the extraction, refining, uses and economics of natural resources in Montana.
Examples: *Wind energy with wind turbine installed at HS and Fuel Cell Car (hydrogen energy)*

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 <u>Culture</u>: Students identify scientific contributions made by different cultures and how scientific developments have impacted human activity and culture including contributions by Montana Native Americans.

HI.1.1 Students understand Native American practices and innovations of mixed use, sustainable living, and simple machines and medicine.
Example: http://www.healingtherapies.info/Native-American%20Medicine.htm

HI.1.2 Students understand how trappers and homesteaders brought new knowledge and tools to Native American culture and visa versa.
Example: *GIS mapping of Native American influences*

HI.1.3 Students understand the role various immigrants played in the development of Montana societies and industries.

Examples: Gold and silver mining – Irish, English, German, Scandinavian
Coal mining – Welsh, Slavic, Italian, Finns;
Agriculture – Germans, Scandinavians, Dutch, Hutterites
Lumber – Norwegians, Swedes, Danes, Finns
Industrial mining & railroad – African Americans, Japanese, Italian

Reference: Montana – A History of Two Centuries by Michael P. Malone, Richard B. Roeder & William L. Lang

Lewistown Public Schools

Science Curriculum
Earth Science

Essential Question(s):
- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of ninth grade, all students understand that
- the physical world may be described through the application of chemical reactions, chemical formulas, and physical, theoretical and mathematical models;
- abiotic objects may be identified and classified through the application of common classification schemes;
- the Earth has several layers including lithosphere, hydrosphere, and atmosphere that interact with each other and the universe;
- the Earth is constantly changing as a result of a variety of factors including human impact; current events reflect local issues as well as regional, national and global issues;
- science and technology are the results of human activity throughout history that help us assimilate new information that connects past to present;
- observation is a key inquiry process used by Montana American Indians;
- Montana American Indians have been affected by and made significant contributions to scientific and technological knowledge.

Essential Skills: Throughout ninth grade science students develop skills with an emphasis on scientific inquiry including the ability to
- identify and communicate testable questions, safely plan and conduct experimental investigations, communicate results, and communicate
- utilize technological applications such as spreadsheets, projectors and data collection tools to collect, analyze and communicate data results.

Content Standards: In ninth grade students demonstrate transfer of knowledge in the areas of physical science, earth and space science and place-based issues with an emphasis on the natural world. Each content standard should be addressed through inquiry-based investigations with appropriate technology using the process standards listed below.

Process Standards: Using the inquiry process students identify a testable question, determine dependent and independent variables, formulate testable hypotheses, plan and predict the outcome of an investigation, safely conduct scientific investigations using appropriate tools to make measurements, gather, compare and analyze data and communicate the results of an investigation using technological applications. Emphasis is placed upon the development of inferences supported by evidence as well as the development of effective models in order to understand and explain scientific concepts and phenomena.

(P) Physical Science: As a result of inquiry-based curriculum activities all students will develop an understanding of properties and the changes of properties in matter, motions and forces, and transfer of energy.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes "it" "it" and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms. Matter can be classified by physical and chemical properties. Phases/states of matter are dependent upon the quantity of energy present in the system.

PM.1.0 <u>Structure:</u> Students describe the history of atomic theory, structure of an atom including the properties of the subatomic particles. Students understand the differences between atoms, elements, molecules and compounds.

PM.1.1 Students explain role of scientists over time in the development of atomic theory.
Example: *explore the website http://atomictimeline.net/index.php*

PM.1.2 Students explain properties of subatomic particles.
Example: *Location, mass, charge, and importance of a proton, a neutron, and an electron – use the Internet to research http://www.nyu.edu/pages/mathmol/textbook/atom.html*

PM.1.3 Students identify the differences between atoms, elements, molecules and compounds.
Example: *Given ball and stick models represent and produce colored drawings of an atom, atoms of different elements, a molecule, and a compound.*
Example: *Given a symbol/chemical formula identify as an element, molecule, or compound.*

PM.1.4 Students will know the terminology associated with the periodic table.
Example: *Know what horizontal rows and vertical columns are called on the periodic table.*

PM.1.5 Students explain the properties of atoms and ions in terms of subatomic particles and their role in number of valence electrons and energy levels.
Example: *Diagram and explain the difference between a sodium atom and a sodium cat ion, and the difference between a chlorine atom and a chlorine ion using Bohr models.*

PM.1.6 Students identify the trends within the periodic table with respect to number of valence electrons and number of energy levels.
Example: *Draw Bohr models for elements 1-20*

PM.1.7 Students explain isotopes and average atomic mass
Example: Calculate number of protons, electrons, and neutrons given atomic number and mass number.
Example: Calculate average atomic mass for an element given relative abundance of its isotopes.

PM.2.0 <u>Properties:</u> Students use the periodic table to predict the similarities and differences in the properties of elements based upon valence electrons and energy levels. Students will be able to describe and classify objects based on their chemical and physical properties.

PM.2.1 Students identify objects based on physical and chemical characteristic properties.
Example: *density, magnetism, boiling pt., solubility, combustibility, etc.—Inquiry activities*
Example: Using inquiry processes, students analyze a density column

PM.2.2 Students understand that mixtures can be separated as a result of the different physical properties of the component parts.
Example: *Separate a solid mixture based on solubility, density, and/or crystallization into its component substances*

PM.2.3 Students understand that in a closed system mass does not change regardless of physical or chemical changes that may occur (Conservation of Mass).
Example: physical change (ice melting), chemical change (baking soda and vinegar)

PM.3.0 <u>Changes</u>: Students describe forms of energy, energy transformations, and the impact of energy on states of matter.

PM.3.1 Students understand that the state of matter is dependent upon amount of energy present in the substance.
Example: *heat transfer, phase change*

PM.3.2 Students understand that substances have unique melting/freezing and boiling points.
Example: Using probe ware, students explore these concepts.

PM.3.3 Students identify and compare simple chemical and physical changes.
Example: *rust, boiling and baking soda/vinegar*

PM.3.4 Students explain the difference between ionic, covalent, polar, hydrogen and metallic bonds.
Example: *TBD*

PM.3.5 Students identify types of chemical reactions.

Example: *TBD*

(F) Essential Learning Expectation – Force, Motion and Energy: Forces act upon objects and impact their motion. Motion can be described in terms of position, direction, and speed. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, and sound. Energy is transferred in many ways.

PF.1.0 Types of Force: Students identify the basic characteristics of motion.

PF.1.1 Students identify Newton's Laws of Motion.
Example: emphasize concepts through Earth in Space

PF.2.0 Forms of Energy: Students describe energy in relation to the characteristics of heat and recognize that energy can change forms.

PF.2.1 Students understand that heat moves in predictable ways – conduction, convection and radiation.
Example: *relate to electromagnetic radiation and movement of heat energy in the solar system*
Example: http://coolcosmos.ipac.caltech.edu/cosmic_classroom/light_lessons/thermal/transfer.html
Example: www.wisc-online.com/objects/index_tj.asp?objID=SCE304 - 23k

PF.2.2 Students recognize that energy is conserved but can change forms such as light to heat, electricity to light, motion to heat (friction).
Example: *greenhouse effect*

PF.2.3 Students understand the difference between heat and temperature.
Example: relate to infrared astronomy and thermal radiation
http://coolcosmos.ipac.caltech.edu/cosmic_classroom/light_lessons/thermal/differ.html

PF.2.4 Students know how to identify the characteristic properties of waves, such as diffraction, refraction and the Doppler effect.
Example: *TBD*

PF.3.0 Mechanical Systems: This learning goal is not addressed.

(L) Life Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the characteristics, structures and function of living things, the processes and diversity of life, and how living organisms interact with each other and their environment.

(S) Essential Learning Expectation – Living Systems: This ELE is not addressed.

LS.1.0 Characteristics of Living Things: This learning goal is not addressed.

LS.2.0 Characteristics of Living Environments: This learning goal is not addressed.

LS.3.0 Structure and Function: This learning goal is not addressed.

LS.4.0 Diversity and Adaptation: This learning goal is not addressed.

(P) Essential Learning - Life Process: This ELE is not addressed.

LP.1.0 Growth: This learning goal is not addressed.

LP.2.0 Cycles: This learning goal is not addressed.

LP.3.0 Reproduction: This learning goal is not addressed.

(E) Earth and Space Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the composition, structures, processes and interactions of the Earth systems, Earth's history, and objects in space.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?
- Why does the Earth shake, rattle and roll?

(S) Essential Learning Expectation – Earth and Space Structures: The universe is composed of galaxies, stars and other astronomical bodies, including our own Milky Way galaxy and Solar System. The Earth system is classified into structures within the Earth, hydrosphere and atmosphere.

ES.1.0 Earth and Planetary Materials: Students identify Earth materials based on their chemical and physical properties.

ES.1.1 Students identify mineral samples based on their density and other physical properties, such as color, hardness and crystal shape.
Example: *TBD*

ES.2.0 Earth Structures: Students model and explain the external features of the earth within the context of plate tectonics and constructive and destructive forces. Students understand how the chemical and physical properties of Earth's materials affect its landforms.

ES.2.1 Students know that water running downhill is the dominant process in shaping the landscape and that different earth material are more resistant to erosion.
Example: TBD

ES.2.2 Using inquiry processes students explore convection currents in the mantle and explain how it results in plate tectonics resulting in mountain building and trenches.
Example: volcanoes, faults, ridges, etc.

ES.2.3 Students describe the process of erosion and deposition and the resulting landforms.
Example: web based exploration of rock cycle as context for erosion, moraines, and cirques

ES.2.4 Students will describe bathymetric features common to ocean basins.
Example: Charting a common profile of the ocean floor.

ES.2.5 Students will distinguish chemical and physical properties of ocean water.
Example: Density as it compares to temperature and salinity.

ES.2.6 Students will analyze the cause and effects of waves, tides, and currents.
Example: Interaction of water motions as it pertains to specific oceanic structures.

ES.3.0 Planetary Systems: Students describe and explain components of the universe (i.e. solar system, stars, and galaxies) and how they have been discovered. Students will describe Earth, Moon, planets, and other objects in space in terms of size and structure.

ES.3.1 Students describe and model the motion and tilt of earth in relation to the sun and the resulting impact on earth (including day/night, seasons).
Example: Use angle of separation and change in length of day.

ES.3.2 Students describe the Earth, Moon, planets and other objects in space in terms of relative size, composition, location and movement.
Example:
http://hubblesite.org/sci.d.tech/behind_the_pictures/meaning_of_color/index.shtml

ES.3.3 Students explain theories of the origin and evolution of the Earth and Solar System.
Example: TBD

(I) Essential Learning Expectation – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere and hydrosphere has profound effects on processes within Earth systems. There are common interrelationships between physical bodies in our Solar System and the universe.

EI.1.0 Weather, Climate and Change: Students identify and explain seasons. Students observe and describe local and global weather and demonstrate how weather conditions are measured. Students describe change in global climate as a result of Earth's motion and tilt.

EI.1.1 Students describe the composition of the atmosphere.
Example: http://msteacher.org/return_list_science.aspx?id=1237

EI.1.2 Students explain how the atmosphere interacts with land and oceans to impact large scale weather patterns.
Example: Uneven heating and cooling

EI.1.3 Students identify and use tools to measure weather phenomenon.
Example: thermometers, wind vanes, rain gauges, psychrometers, barometers, anemometers, weather balloons, weather station models, weather maps, and web-based exploration

EI.1.4 Students will investigate factors that affect local weather conditions.
Example: Orographic lifting and water sources.

EI.1.5 Students understand how Earth's positioning affects seasons and climate.
Example: Using inquiry processes, investigate northern hemisphere's tilt toward or away from the sun and the resulting seasons.
Example: Investigate why the northern latitudes have snow instead of rain in winter.

EI.2.0 Earth's Energy System: Students understand that radiant energy from the Sun is a major source of energy for the Earth and know how radiation occurs.

EI.2.1Students know how differential heating of the Earth results in circulation patterns in the atmosphere and oceans that distribute heat globally.
Example: *TBD*

EI.3.0 Living Organisms: Students investigate fossils and compare to living organisms, making inferences about life long ago as well as how organisms are affected by the environment.

EI.3.1 Using the fossil record, students predict what the environment was like long ago.
Example: http://science-ed.pnl.gov/teachers/plans/Fossils_Part3_1'08_v1.pdf

EI.3.2 Students examine the similarities and differences between fossils and live organisms
Example: *TBD*

EI.4.0 Earth's History: Students will acknowledge the age of the earth and notice how age is proportionate to current earth structures.

ES.4.1 Students will relate surface features to the tectonic movement resulting from internal forces.
Example: Mountains, folding and faulting.

ES.4.2 Students will interpret major concepts used to describe the geologic history of the earth.

Example: Rocks, fossils, radioactive dating, depositional layering, and uniformitarianism.

EI.5.0 <u>Catastrophic Events</u>: Students will be introduced to various theories that have made instantaneous changes to the earth.

ES.5.1 Students analyze the possibility of catastrophic events on different portions of the earth's surface.
Example: Global warming, tsunamis, earthquakes, and impacts.

EI.6.0 <u>Planetary Systems</u>: Students describe the movement and interactions of the Earth, Moon and planets in our solar system.

EI.6.1 Students model and explain the motion and tilt of the Earth relative to the Sun, including the concepts of day, night, seasons, and year.
Example: Use inquiry processes to explore physical models

EI.5.2 Students model and explain how the relationship of the earth moon and sun causes the phases of the moon.
Example: *Using inquiry processes, discover how much of a sphere is illuminated as it revolves around the student's head.*

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances that drive future scientific endeavors.

HT.1.0 <u>Technology</u>: Students identify specific fields of science and technology, and major milestones and innovations in science that have impacted science, technology, and society.

HT.1.1 Students describe the specific fields of science and technology as they relate to occupations within those fields.
Example: http://www.ideafinder.com/history/timeline.htm Research: Tsvetl, Galileo, Newton, Archimedes

HT.1.2 Students describe a scientific or technological innovation that impacts communities, cultures, and societies (including Native Americans).
Example: http://news.nationalgeographic.com/news/2004/09/0914_040913_information_about_indians.html, Stonehenge, medicine wheels, Anasazi

HT.1.3 Students simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public.
Example: Internet, professional journals

HT.1.4 Students demonstrate proficiency in use of hardware and software related to their scientific investigations.
Example: Spreadsheets and graphing, Databases, Probe ware and other data collection devices, Presentation software, word processing, simulations, calculators, etc.

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 Resources: Students use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.

HR1.1 Students discuss how the use of natural resources effects their community/world, and how overuse of resources can have adverse effects on climate and society.
Example: Mining on the moon, Mars and Earth

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 Culture: Students identify scientific contributions made by different cultures including how scientific developments have impacted human activity and culture.

HI.1.1 Students describe how science and technology have impacted Montana American Indians and other indigenous people.
Example: http://www.epa.gov/OSP/tribes/sciinf/projects.htm

HI.1.2 Students identify the key inquiry processes used by Montana American Indians and other indigenous people.

Example: Observation of light projected through a pinhole as indicator for crop planting, http://www.epa.gov/osp/tribes/sciinf/waysknow.htm

Lewistown Public Schools

Science Curriculum
Biology

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of tenth grade, all students understand that:

- Scientific inquiry is an essential process that allows students to conduct meaningful investigations;
- The results of a scientific investigation are always open to revision by further investigations;
- Populations evolve through genetic change that leads to adaptation, speciation and the diversity of life.
- The structure in living organisms is directly related to function;
- Living systems involve interactions among organisms and their environment;
- There are connections and interactions among technology, science and society;
- Science and technology are the results of human activity throughout history, including many examples from Montana American Indian cultures.

Essential Skills: By the end of tenth grade, students will develop skills for scientific inquiry including the ability to:

- Design, safely conduct, evaluate, and summarize the results of scientific investigations;
- Utilize technology to collect, analyze and communicate data and results;
- Review evidence, draw logical conclusions, and communicate and defend results;
- Develop inferences supported by evidence;
- Effectively use models in order to understand and explain scientific concepts and phenomena.

Content Standards: By the end of tenth grade students will have developed an understanding of the characteristics, structures and function of living things, the processes and diversity of life, how living organisms interact with each other and their environment, and how populations evolve through genetic change. Each content standard should be addressed through inquiry-based investigations with appropriate technology using the process standards listed above.

- Biology content standards focus on the following areas of study:
- Science as a process, including the scientific method;
- Cellular and molecular biology, including biochemistry and cell structure and function;
- Ecology, including ecosystems, populations and communities and the environment;
- Genetics, including meiosis, Mendelian genetics and molecular genetics;
- Evolution, including mechanisms of evolution, population genetics and the history of life on Earth;
- Diversity of life, including microbes, plants and animals.

Process Standards: Using scientific inquiry students will generate testable questions and hypotheses, identify independent and dependent variables as well as other variables that must be controlled, and gather data, and perform experiments. Using technology, students will analyze data, draw conclusions and communicate their findings. Students will understand and use safety precautions when working in the laboratory.

(P) Physical Science: As a result of inquiry-based curriculum activities students in Biology will develop an understanding of how chemistry and physics directly apply to our knowledge of living systems.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms. Matter can be classified by physical and chemical properties. Organisms are a dynamic system of elements, compounds and organic macromolecules.

PM.1.0 <u>Structure</u>: Students classify, describe, and manipulate physical models of matter in terms of atoms, elements, molecules and compounds.

PM.1.1 The student will identify the building blocks of matter.
Example: The students create a model of an atom.

PM.1.2 The student will differentiate between chemical bonds.
Example: The students identify bonds in molecules found in organisms.

PM.2.0 <u>Properties</u>: Students classify, describe, and manipulate physical models of compounds.

PM.2.1 The student will describe the four major organic macromolecules.
Example: The students construct a paper model of DNA.

PM.2.2 The student will apply the principles of biochemistry.
Example: The students create a model of glucose.

PM.3.0 <u>Changes</u>: Students examine and identify simple chemical and physical changes and describe forms of energy and energy transformations.

PM.3.1 The student will explain the processes involved in chemical reactions.
Example: The students correctly balance the photosynthetic reaction.

PM.3.2 The students analyze an enzyme-catalyzed reaction.
Example: The students design and conduct an experiment to measure the effects of catalase concentration on reaction rate.

(F) Essential Learning Expectation – Force, Motion and Energy: Energy transformations are essential to life on Earth.

PF.1.0 <u>Types of Force</u>: This learning goal is not addressed.

PF.2.0 <u>Forms of Energy</u>: Students describe energy and recognize that energy can change forms.

PF.2.1 The students predict the results of an endothermic reaction.
Example: The students design and conduct an experiment to measure the effect of various conditions on the rate of photosynthesis.

PF.3.0 <u>Mechanical Systems</u>: This learning goal is not addressed.

(L) Life Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the characteristics, structures and function of living things, the processes and diversity of life, and how living organisms interact with each other and their environment.

Essential Questions:
- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How did life begin, how has it changed and how might it change in the future?
- How is life interdependent on the Earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems: The structure in living organisms is directly related to function. Organisms evolve through genetic changes that lead to adaptation. Living systems are interactions between organisms and their environment.

LS.1.0 <u>Characteristics of Living Things</u>: Students describe the specific characteristics shared by all living things.

LS.1.1 The students define the seven characteristics of life.
Example: The students distinguish between living and non-living examples.

LS.2.0 <u>Characteristics of Living Environments</u>: Students explain cause and effect relationships between nonliving and living components within ecosystems and individual response to the changes in the environment.

L.2.1 The student understands that abiotic factors play a role in living systems.
Example: Using climographs students correctly identify biomes.

LS.3.0 <u>Structure and Function</u>: Students identify structures and systems of living organisms and relate those structures to function.

L.3.1 Students correlate structure and function of adaptations.

Example: Students compare and contrast features of homologous structures.

LS.3.2 Students recognize that all living organisms require energy to grow and develop, respond to their environment, and reproduce. The cell is the basic component for maintaining life.

Example: Students trace energy flow through a cell and through an entire ecosystem.

Example: Students create a self-sustaining ecosystem.

Example: Students identify the parts of the cell that are involved in capturing and using energy

LS.3.3 Students coorelate structure and function of plants and animals and how those are used to classify organisms.

Example: Students show the difference between the major divisions of plants and growing an angiosperm.

Example: Student show the difference between the major phylums of animals through dissecions.

LS.4.0 <u>Diversity and Adaptation</u>: Students understand that populations evolve through genetic change that leads to adaptation, speciation and the diversity of life.

L.4.1 Students understand the principles of population genetics.

Example: Students model genetic equilibrium in a gene pool.

(P) Essential Learning Expectation - Life Process: All living organisms are made of cells that grow and develop. All living organisms obtain materials and use energy. Living things reproduce, grow and develop. Taken as a group, living things change over time.

LP.1.0 <u>Growth</u>: Students describe and explain the complex processes involved in energy use in cell maintenance, growth, repair and development.

LP.1.1 Students understand that ATP is required for cellular metabolism.

Example: The students compare respiration rates between various organisms.

LP.1.2 Students apply principles of diffusion to living systems.

Example: Students utilize a semi-permeable membrane to measure osmosis.

LP.2.0 <u>Cycles</u>: Students compare and contrast the life cycles of various organisms.

LP.2.1 Students examine the cell cycle.

Example: Using microscopes students identify phases of the cell cycle in onions and whitefish.

LP.2.2 Students compare the life cycles of plants and animals.

Example: Students correctly identify differences in animal and plant life cycles.

LP.3.0 <u>Reproduction</u>: Students understand that reproduction is essential to the continuation of every species. Students comprehend the molecular basis of heredity (DNA) and explain how it contributes to the diversity of life.

LP.3.1 Students appreciate how meiosis contributes to genetic diversity in sexually reproducing individuals.
Example: Students are able to differentiate between meiosis and mitosis.

LP.3.2 Students understand that DNA contains instructions for gene expression.
Example: Students model transcription and translation in protein synthesis.

LP.3.3 Students apply principles of genetics.
Example: Using Punnett squares students predict inheritance patterns in genetic crosses.

(E) Earth and Space Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the processes and interactions of the Earth systems, Earth's history, and objects in space.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- How do we explain where we are in space and time?

(I) Essential Learning Expectation – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere and hydrosphere has profound effects on processes within Earth systems.

EI.1.0 <u>Weather, Climate and Change</u>: Students explain the difference between local and global weather and climate.

EI.1.1 Students will explain the components of the atmosphere and hydrosphere and how they interact to create weather and climate.
Example: Students examine the impact humans have on global climate change.

EI.2.0 <u>Living Organisms</u>: Students describe how climate affects living systems.

EI.2.1 Student understands how precipitation and temperature determine the composition of communities.
Example: Students research a specific biome and construct a poster.

EI.3.0 <u>Earth's History</u>: Students investigate fossil evidence and make inferences about the history of life on Earth.

ES.2.1 Students examine the history of life on Earth.
Example: Students construct a timeline illustrating the history of life on Earth.

ES.2.2 Students compare and contrast characteristics of relative and absolute dating.

Example: Students determine the relative age of rock layers based on the law of superposition.

EI.4.0 <u>Catastrophic Events</u>: Students describe how catastrophic events have shaped life on Earth.

EI.5.1 Students explain the impacts of geologic change on biological systems.
Example: Students examine the impacts of continental drift on major extinctions and adaptive radiations.

EI.5.0 <u>Planetary Systems</u>: This learning goal is not addressed.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances that drive future scientific endeavors.

HT.1.0 Students identify major milestones in science that have impacted science, technology, and society, including those contributed by Montana Native Americans.

HT.1.1 Students analyze how individual events can have a profound effect on the progression of science, such as the discovery of DNA structure.
Example: Students view a program on the discovery of DNA.

HT.1.2 Students appreciate how different worldviews can influence the progression of science.
Example: Students compare and contrast the environmental practices of Native Americans and European immigrants on Montana ecosystems.

HT.2.0 Students describe specific fields of science and technology as they relate to occupations within those fields.

HT.2.1 Students apply technology to lab activities and realize that the effective use of technology is critical to many career paths.
Example: Using gel electrophoresis, students analyze bacterial genetics.

HT.3.0 Students describe a scientific or technological innovation that impacts communities, cultures, and/or societies.

HT.3.1 Students appreciate the impact technology has had on scientific advancement.
Example: Using class activities and the internet, students research the development of technology that has led to major discoveries, such as the Human Genome Project.

HT.4.0 Students simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public.

HT.4.1 Students use technology to create and share findings of their group's experiment.
Example: Students use a spreadsheet application to compile, share, and interpret experimental data.

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 Students use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.

HR1.1 Students analyze local natural resource policies.
Example: Students will engage in a panel discussion on bison management.

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 Students identify scientific contributions made by different cultures and how scientific developments have impacted human activity and culture including Montana Native Americans.

HI.1.1 Students recognize the impacts that Native Americans have had on modern ecological practices.
Example: Students describe the use of fire as a range management tool.

Lewistown Public Schools

Science Curriculum
Applied Biology/Chemistry

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of Applied Bio-Chemistry, all students will demonstrate an understanding of the interaction of matter and energy and use current models to make predictions and evaluate the impact of science and technology on human societies. This interaction is investigated through the use of laboratory techniques, manipulation of chemical properties, patterns, chemical quantities, and problem solving with practical applications that should include examples from environmental, nuclear, and inorganic content areas.

Essential Skills: Throughout Applied Bio-Chemistry students develop skills for scientific inquiry including the ability to:

- Identify and generate a testable question, safely construct, plan and implement safe controlled investigations, make logical inferences based on observations, accurately interpret data and communicate results;
- Utilize technological applications such as spreadsheets, projectors and data collection tools to collect, analyze and communicate data results.

Content Standards: Students will use existing models of matter and energy to develop and form models for understanding chemical systems. These models will emphasize the following topics:

- Atomic structure and the Periodic Table;
- Chemical names, formulas, quantities, bonding and equations;
- States of matter;
- Water and aqueous systems;
- Acids, bases, salts and buffers and;
- Conservation of Mass and Energy;
- Polar and nonpolar molecules;
- Inter and intra molecular forces;
- Exothermic and exothermic reactions;
- Cells, including diffusion, photosynthesis and cellular respiration;
- Renewable and nonrenewable energy sources;
- Ecology
- Forensic science

Process Standards: In meeting the Applied BioChemistry standards students will use scientific inquiry and technology as a means of problem solving, effective communication and evaluation of learning. Students will utilize the languages of biology and chemistry, discuss problem-solving strategies, and use safety precautions with chemicals and equipment.

(P) Physical Sciences: As a result of the curriculum activities in science all students should develop an understanding of properties of objects and materials, position and motion of objects and light, heat, electricity and magnetism.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter can be described using characteristics including shape, density, pH, charge, electronegativity, ionization energy, bonds, state and energy. Given one or more of these characteristics, predictions can be made about other characteristics.

PM.1.0 <u>Structure</u>: Students classify, describe, evaluate and manipulate models of matter in terms of phases of matter, atomic structure, types of bonding, arrangement on the periodic table, molecular geometry, and electron configurations/orbital diagrams.

PM.1.1 Students identify the parts and properties of the parts of an atom in the current atomic model.

PM.1.2 Students understand the molecular structure of water.
Example: http://msteacher.org/epubs/science/science21/science.aspx

PM.1.3 Students compare water as a pure substance versus as a mixture in natural aquatic systems.

PM.2.0 <u>Properties</u>: Students explore, define, categorize and evaluate properties of matter, bonding, physical and chemical properties, and periodic trends.

PM.2.1 Students know how to use the periodic table.
Example: *Students will be able to make predictions about an element based on its placement on the periodic table. Predictions will include mass, charge, electro negativity, ionization energy, valence electrons, oxidation numbers and bonding abilities.*

PM.2.2 Students demonstrate an understanding that molecules are described as matter, have mass and take up space.

PM.2.3 Students use chemical and physical properties to compare water quality of a variety of water sources.
Example: *pH, DO, turbidity*

PM.2.3 Students demonstrate and understanding of and be able to recognize acids and bases.

Example: *Using chemical formulas and inquiry, students will be able to predict which compounds are acids and which compounds are bases.*

PM.2.4 Students recognize that fresh water is a limited resource with unique characteristics essential to life on Earth.
Example: Students identify the unique characteristics of water.

PM.3.0 <u>Changes</u>: Students describe, analyze, and evaluate energy changes due to physical changes, chemical reactions and changes, and nuclear changes.

PM.3.1 Students demonstrate an understanding of the Law of Conservation of Matter.

PM.3.2 Students demonstrate an understanding of polar molecules and solubility.

(F) Essential Learning Expectation – Force, Motion and Energy: Energy is an important variable in determining the forces that affect the interaction of atoms and molecules.

PF.1.0 Types of Force: Students will identify and explain types of bonding, intermolecular forces, intramolecular forces, strong nuclear forces, and hydrogen bonding.

PF.1.1 Students demonstrate an understanding of the role of various forces on bonding.
Example: Using inquiry and an understanding of intermolecular and intramolecular forces students will be able to make predictions about the physical properties of unknown substances.

PF.2.0 <u>Forms of Energy</u>: Students calculate, compare and contrast energy types in the form of potential, kinetic, radiant, and transfer related to conservation of energy. Students will also calculate and analyze graphs of energy.

PF.2.1 Students demonstrate an understanding that chemical potential energy is due to the arrangement of atoms in a system and that energy is conserved in chemical reactions.
Example: *Using an understanding of exothermic and endothermic reactions students will create hot and cold packs.*

PF.2.2 Students predict changes in relative energy associated with changes in states of matter.

PF.2.3 Conservation of energy and matter is expressed in chemical formulas and balanced equations.
Example: *Students predict potential reactants or products in a chemical equation write and name the chemical formulas for those reactants or products and identify reaction type and probable bonds.*

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycle and environments of organisms.

Essential Question:
How is life interdependent on the Earth's conditions or other life?

LS.2.0 <u>Characteristics of Living Environments</u>: Students explain cause and effect relationships between abiotic and biotic components within ecosystems.

LS.2.1 Students understand the major source of energy in an ecosystem is sunlight and that energy passes from organism to organism in an energy pyramid (food web).

LS.2.2 Students understand the interdependent nature of populations and communities.
Example: predator/prey

(E) Earth and Space Science: As a result of the curriculum activities all students should develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

Essential Questions:
- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?

(S) Essential Learning Expectation – Earth and Space Structures: The Earth is comprised of diverse limited resources that are essential to life.

ES.1.0 <u>Earth and Planetary Materials</u> – Students understand and explain the special properties of water in terms of hydrogen bonding and relate hydrogen bonding to properties of polarity in terms of di-pole interactions. Students predict if a substance will dissolve in another substance.

ES.1.1 Students recognize that fresh water is a limited resource with unique characteristics essential to life on Earth.
Example: Students will be able to identify the unique characteristics of water.

ES.2.0 <u>Landforms –</u> Students understand the concept of watersheds and their key physical components.

ES.2.1 Students differentiate between watersheds based on key physical features.
Example: inquiry activities in Project WET: Discover a Watershed

ES.2.2 Students understand that all land areas exist within a watershed.
Example: Project WET, Discover a Watershed

ES.3.0 <u>Planetary Systems</u> – This learning goal is not addressed.

(I) Essential Learning Expectation – Earth and Space Interrelationships – Patterns, Cycles and Change; Climate is dependent on the interaction of matter and energy.

EI.1.0 <u>Weather, Climate and Change</u>: Students observe and describe local and global climates and demonstrate how climate differences affect biomes.

EI.1.1 Students understand the relationship between different climates and the ecosystems that are present within them.

EI.4.0 Earth's History – This learning goal is not addressed.

EI.5.0 Catastrophic Events– This learning goal is not addressed.

EI.6.0 Planetary Systems– This learning goal is not addressed.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technology advances that drive future scientific endeavors.

HT.1.0 Students identify major milestones in science that have impacted science, technology, and society, including those contributed by Montana Native Americans.

HT.1.1 Students analyze how individual events can have a profound effect on the progression of science, such as the advancement of modern surgery.

HT.2.0 Students describe specific fields of science and technology as they relate to occupations within those fields.

HT.2.1 Students apply technology to lab activities and realize that the effective use of technology is critical to many career paths.

Example: Using the Internet as a resource, students will research an assigned topic and create a multimedia presentation for the class.

HT.3.0 Students describe a scientific or technological innovation that impacts communities, cultures, and/or societies.

HT.3.1 Students appreciate the impact technology has had on scientific advancement.

(R) Essential Learning Expectation – Resources; The Earth has many renewable and nonrenewable resources that are available to human societies. How we use these resources create positive and/negative impacts that can be influenced by our actions.

HR.1.0 Students will explore local resources and relate data found, with the use of Internet, virtual chemistry lab, and news articles to compare local versus worldwide impacts of water quality.

HR1.1 Students recognize that fresh water is a limited resource with unique characteristics essential to life on Earth.

Example: Students will be able to identify the unique characteristics of water.

Example: Using inquiry and an understanding of water students will identify threats to the sustainable use of water and present possible solutions to alleviate those threats.

HR.1.2 Conservation of energy and matter is expressed through the use of chemical formulas and balanced equations in which potential reactants or products are predicted and correctly identified.

Example: Students will be able to predict potential reactants or products in a chemical equation write and name the chemical formulas for those reactants or products and identify reaction type and probable bonds.

Example: Students will examine the effect of fossil fuels on the environment and climate. Students will evaluate other sources of energy and present findings based on cost, efficiency and impact on environment, climate and society.

(I) Essential Learning Expectation – Culture; Science and technology impact and are impacted upon by culture and society.

HI.1.0 Students will explore native peoples' applications of scientific ideologies for use in their daily lives.

HI.1.1 Students recognize observation as an important part of science and the impact of observation on American Indian life in Montana.

Example: Students will identify example of chemistry used by American Indians in Montana (i.e. dyes, medicines and shelters) and explain how those examples work.

Lewistown Public Schools

Science Curriculum
Chemistry

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of Chemistry, all students will demonstrate the ability to understand the interactions of matter and energy using the inquiry process. This interaction is investigated through the use of laboratory techniques, manipulation of chemical properties, patterns, chemical quantities, and problem-solving applications. Scientific methodology is employed in experimental and analytical investigations, and concepts are illustrated with practical applications that should include examples from environmental, nuclear, and inorganic content areas.

Essential Skills: Throughout Chemistry students develop skills for scientific inquiry including the ability to:

- Identify and generate a testable question; safely construct, plan and implement safe controlled investigations: make logical inferences based on observations; accurately interpret data and communicate results;
- Utilize technological applications such as spreadsheets, projectors and data collection tools to collect, analyze and communicate data results.

Content Standards: The Chemistry standards focus on student growth in understanding the nature of science. This scientific view defines the idea that explanations of nature are developed and tested using observations, experimentation, models, evidence, and systematic processes. The nature of science includes the concepts that scientific explanations are based on logical thinking; are subject to rules of evidence; are consistent with observational, inferential, and experimental evidence; are open to rational critique; and are subject to refinement and change with the addition of new scientific evidence. The nature of science includes the concept that science can provide explanations about nature, can predict potential consequences of actions, but cannot be used to answer all questions. Chemistry content standards emphasize focus on content in the study of the following:

- Science as a process;
- Matter and change;
- Scientific measurement;
- Atomic structure, including electrons;
- Nuclear Chemistry;
- Periodic Table;
- Ionic, metallic and covalent bonding;
- Chemical names and formulas, quantities and reactions;
- Stoichiometry;
- States of matter, including behavior of gases and solutions;
- Thermochemistry;
- Reaction Rates and Equilibrium, including oxidation-reduction reactions;
- Acids, Bases and Salts.

Process Standards: Technology will be employed, where feasible, to measure, make observations, and evaluate data collected in laboratory activities. Students will understand and use safety precautions with chemicals and equipment. The process standards emphasize qualitative and quantitative study of substances and the changes that occur in them. In meeting the chemistry standards, students will be encouraged to make inquiries, share their ideas, use the language of chemistry, discuss problem-solving strategies, and communicate effectively.

(P) Physical Sciences: As a result of the curriculum activities in science all students should develop an understanding of properties of objects and materials, position and motion of objects and light, heat, electricity and magnetism.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and exhibits a variety of properties. Matter can be classified according to phases, types of chemical bonding, molecular geometry, and electron configurations. Matter is arranged accordingly on the periodic table using these classifications.

PM.1.0 <u>Structure</u>: Students classify, describe, evaluate and manipulate models of matter in terms of phases of matter, atomic structure, types of bonding, arrangement on the periodic table, molecular geometry, and electron configurations/orbital diagrams.

PM.1.1 Students name and list all parts of the atom.
Example: *Analyze and complete charts counting protons, neutrons and electrons for atom, ions and isotopes.*

PM.1.2 Students understand early experiments that lead to the current model of the atom and their historical significance.
Example: Aristotle, Dalton, Thompson, Rutherford, Chadwick & Bohr

PM.1.3 Students differentiate between, and name, ionic, covalent and metallic bonds.
Example: Chemical Names and Formulas, Bonding properties lab, model single, double, triple bonds; Draw structural formulas of molecules using Lewis dot structures

PM.1.4 Students determine geometry of simple molecules.
Example: explain molecular geometry of VSEPR Theory

PM.1.5 Students write and interpret electron configurations and orbital diagrams for any atom, or ion.
Example: Discuss Aufbau Principle, Hund's Rule and Pauli "Exclusion Principle", and Quantum Mechanical Model

PM.2.0 <u>Properties</u>: Students explore, define, categorize and evaluate properties of matter, bonding, physical and chemical properties, colligative, and periodic trends.

PM.2.1 Students explore chemical and physical properties and changes of matter.
Example: Chemical and Physical Changes Lab; Copper Wire in a Solution of Silver Nitrate Lab

PM.2.2 Students understand the properties of the states of matter.
Example: Phase change labs; Gas Law equations and calculations; Gas law labs

PM.2.3 Students understand the physical and chemical properties of elements, compounds and mixtures.
Example: Aluminum Lab, Solutions Lab, Density

PM.2.4 Students understand basic periodic trends.
Example: Worksheets for practicing trends

PM.2.5 Students understand chemical properties of elements are determined by the number of valence electrons.
Example: Formation of ions

PM.2.6 Students understand, apply and identify properties of acids and bases and neutralization reactions.
Examples: Titration labs 1, 2 and 3, Properties of Acids and Bases Lab, pH calculations

PM.3.0 <u>Changes</u>: Students describe, analyze, and evaluate energy changes due to physical changes, chemical reactions and changes, and nuclear changes.

PM.3.1 Students understand endothermic and exothermic reactions.
Example: Specific Heat Labs

PM.3.2 Students understand and make predictions of nuclear reactions.
Example: students write nuclear reactions for alpha and beta decay reactions
Example: fission and fusion discussions and examples

PM.3.3 Students understand and calculate quantitative measurements based on balanced chemical reactions.
Example: Percent Yield labs and calculations, Quantitative Analysis Lab, practice stoichiometric calculations

PM.3.4 Students write, balance, interpret and identify types and parts of chemical reactions.
Example: Examples of Chemical Reactions Lab, Precipitation Reactions, Oxidation-Reduction reactions, Acid-Base reactions

PM.3.5 Students distinguish and write the common types of chemical reactions.
Example: Write and predict chemical for synthesis, decomposition, single-replacement, double-displacement and combustion reactions.

PM.3.6 Students identify and know how to manipulate factors that control reaction rates.
Example: Calculations for Kw, Ka, Kb, Keq and Q, Le Chatelier's Principle, application of Haber Process

(F) Essential Learning Expectation – Force, Motion and Energy: Intermolecular and intramolecular forces are responsible for chemical bonds. Energy is associated with all bonding and the making and breaking of bonds.

PF.1.0 Types of Force: Students will identify and explain types of bonding, intermolecular forces, intramolecular forces, strong nuclear forces, and hydrogen bonding.

PF.1.1 Students describe or define inter- and intramolecular forces.
Example: *Classroom discussions about types of inter- and intramolecular forces.*

PF.1.2 Students understand that nuclear reactions depend on the strong nuclear force.
Example: *Students will practice nuclear decay reactions and gain knowledge through discussions of nuclear decay.*

PF.2.0 <u>Forms of Energy</u>: Students calculate, compare and contrast energy types in the form of potential, kinetic, radiant, and transfer related to conservation of energy. Students will also calculate and analyze graphs of energy.

PF.2.1 Students calculate, relate and apply relationship betweens frequency, wavelength and energy of parts of the electromagnetic spectrum.
Example: $E = h\nu$ *and* $c = \nu\lambda$ *calculations*

PF.2.2 Students construct and analyze graphs of energy.
Example: *Phase change diagrams, Phase diagrams,*

PF.2.3 Students relate and transfer knowledge of the Kinetic Molecular Theory to states of matter.
Example: Behavior of Gases Lab,

PF.3.0 <u>Mechanical Systems</u>: This learning goal is not addressed.

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycles and environments of organisms.

(S) Essential Learning Expectation – Living Systems: This ELE not addressed.

LS1.0 <u>Characteristics of Living Things</u>: This learning goal is not addressed.

LS.2.0 <u>Characteristics of Living Environments</u>: This learning goal is not addressed.

LS.3.0 <u>Structure and Function</u>: This learning goal is not addressed.

LS.4.0 <u>Diversity and Adaptation</u>: This learning goal is not addressed.

(P) Essential Learning Expectation - Life Process: This ELE not addressed.

LP.1.0 <u>Growth</u>: This learning goal is not addressed.

LP.2.0 <u>Cycles</u>: This learning goal is not addressed.

LP.3.0 <u>Reproduction</u>: This learning goal is not addressed.

(E) Earth and Space Science: As a result of the curriculum activities all students should develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

Essential Questions:
What is our world made of, how has it changed and how will it continue to change?
What evidence is used to help us interpret Earth's history?

(S) Essential Learning Expectation – Earth and Space Structures: Many concepts in space have been determined by the use of spectroscopy and evaluation of light properties. Radioactive decay is commonly used to date geologic structures. Water is a unique substance with special properties including a permanent di-pole moment.

ES.1.0 <u>Earth and Planetary Materials</u>: Students explore spectroscopy, describe the electromagnetic spectrum and identify individual elements from analyzing line spectra. Students understand and explain the special properties of water in terms of hydrogen bonding and relate hydrogen bonding to properties of polarity in terms of di-pole interactions. Students predict if a substance will dissolve in another substance.

ES.1.1 Students transfer knowledge of spectroscopy to the identification of elements using their spectra, both on Earth and in space and in the field of forensics science.
Example: Flame Test Lab

ES.1.2 Students understand the unique properties of water.
Example: Class discussion of polarity, specific heat, density, geometry; Solutions Lab (like-dissolves-like); Phase change diagrams and lab

ES.2.0 <u>Landforms</u> (geomorphology): This learning goal is not addressed.

ES.3.0 <u>Planetary Systems</u>: This learning goal is not addressed.

(I) Essential Learning Expectation – Earth and Space Interrelationships – Patterns, Cycles and Change: The half-life of radioactive substances may be used to determine the age of specific materials found on the Earth's surface.

EI.1.0 <u>Weather, Climate and Change</u>: This learning goal is not addressed.

EI.2.0 <u>Living Organisms</u>: This learning goal is not addressed.

EI.3.0 <u>Earth's History</u>: Students understand the concept of half-life to determine the age of Earth materials and artifacts.

EI.3.1 Students calculate and understand the concept of half-life of radioactive substances.
Example: Half-life calculations, discuss which radio-isotopes are appropriate for aging specific materials

EI.4.0 <u>Catastrophic Events</u>: This learning goal is not addressed.

EI.5.0 <u>Planetary Systems</u>: This learning goal is not addressed.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technology advances that drive future scientific endeavors.

HT.1.0 Students explore how science has impacted society and technology.

HT.1.1 Students understand that the advancement of our understanding of the atom is directly dependent on the advancement of technology and vice versa.
Example: MRI, STM, Annenberg video series, Waves and Particles video

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 Students will explore local resources and relate data found, with the use of Internet, virtual chemistry lab, and news articles to compare local versus worldwide impacts.

HR1.1 Students read and/or discuss local current events that relate to natural resources in Fergus and surrounding counties.
Example: Dependent upon current events (for example: Big Spring Creek, Snowy Mountains, MSU and UM research).

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways as science, technology and human activities are interrelated.

HI.1.0 Students will explore native peoples' applications of scientific ideologies for use in their daily lives.

HI.1.1 Students explain some of the ways Native Americans utilized chemistry in their daily lives in the past and in the present.

Example: Students will provide a writing sample explaining some aspect of the way Native Americans utilized chemistry in their daily lives in the past or in the present.

Lewistown Public Schools

Science Curriculum
Physics

Essential Questions:
- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: Through laboratory investigations and other experiences students understand that
- An unbalanced force results in acceleration within a system;
- The motion that results from the unbalanced force can be in one and two dimensions;
- The duration that the unbalanced force is proportional to the change in momentum of the system;
- Mechanical energy in an isolated system is conserved and experiences transformations between various forms of kinetic and potential energies;
- Wave motion is one way in which energy can be transferred within a system;
- Optics is the study of how electromagnetic waves in the visible spectrum transfer energy within a system;
- Unbalanced forces can occur in nature at the atomic level in the form of static electricity;
- When the resulting unbalanced forces are too great for electrons to remain in the static state, electron motion "current" occurs. In most metals, this current is governed by Ohm's Law.

Essential Skills: Throughout Physics, students develop skills for scientific inquiry including the ability to
- Identify and communicate a testable question;
- If appropriate, formulate or recognize, and then apply, a suitable mathematical algorithm that resolves the testable question;
- Create a safety plan if a laboratory investigation is to be implemented;
- Conduct an array of experimental investigations;
- Utilize technological applications such as spreadsheets and data collection tools (sonic wave generators, graphing calculators, computers, photo-gates, etc) to collect, analyze and communicate data results.

Content Standards: Physics content standards emphasize a focus on content in the study of the following:
- Measurements and calculations using metric units;
- Motion corresponding to kinematics equations related to distance, displacement, speed, velocity, and acceleration;
- Interpretation of graphs involving any combination of distance, time velocity, acceleration, and force;
- Newton's laws, including trajectories;
- Addition and subtraction of vectors including collinear, non-collinear, sine, cosine, tangent, Pythagorean Theorem, law of Sines, law of Cosines;
- Centripetal force and centripetal acceleration;
- Linear momentum including conservation of momentum, change of momentum, impulse;
- Kinetic, potential, and thermal energy;
- Simple Harmonic Motion;
- Wave properties related to water, sound, and light (frequency, wavelength and velocity);
- Reflective properties of light related to plane and curved mirrors;
- Refractive properties of light related to convex and concave lenses;
- Static electricity (Coulomb's Law, induction and conduction);
- Simple circuit constituents (voltage, current, and resistance) as they relate to series and parallel DC-circuits.

Process Standards: Physics process standards emphasize the use of conceptual and mathematical modeling and laboratory investigations. By the end of physics, all students will utilize the essential skills enumerated above to explore the content standards through inquiry and pre-designed laboratory investigations as well as the Internet, learning through a variety of educational experiences.

(P) Physical Science: Students demonstrate understanding of properties, forms, changes, and interactions of physical systems.

Essential Questions:
How does our understanding of physical science help us explain the connections among matter, time, space & energy?
What are energy and matter and what is their relationship?
What gives matter its unique qualities?
How do the properties of matter affect its behavior?

(M) Essential Learning Expectation - Matter is the material substance of the universe that has mass, occupies space, and is convertible to energy. There are four states of matter: solid, liquid, vapor, and plasma. Phases/states of matter are dependent upon the quantity of energy and/or the pressure present in the system.

Essential Questions:
What matters in the study of Matter?
How do we explain the interactions between Matter?

PM.1.0 <u>Structure:</u> Matter consists of small building blocks of protons, neutrons, and electrons. Students will explore the structure in the atom in the study of electricity.

PM.1.1 The student will able to explain the electron movement necessary to charge objects by conduction and induction.
Example: Students will perform an electroscope experiment in which they will charge an electroscope by conduction and induction and explain the processes involved.

PM.1.2 The student will be able to explain the electron flow that takes place in series and parallel DC circuits.
Example: Castle Labs

PM.2.0 <u>Properties:</u> Students will be introduced to a unit of thermodynamics and develop an understanding of temperature and heat as another form of energy.

P.2.1 The student should be able to state with words and symbols the First Law of Thermodynamics.
Example: The students will perform simple calculations related to the increase of internal energy as work or heat is added to a system: $\Delta U = Q - W$.

P.2.2 The student should be able to state with words and symbols the Second Law of Thermodynamics.

P.2.3 The student should be able to state with words and symbols the Third Law of Thermodynamics.

PM.3.0 <u>Changes:</u> Students will observe, measure and calculate the thermodynamic changes that take place as materials of differing temperatures are added to one another and as an external heat source is added to the system.

PM.3.1 The student should be able to analyze various thermodynamic situations and be able to choose an appropriate mathematical model to explain the energy needs of that situation.
Example: The student should be able to perform a lab to calculate the specific heat of an unknown material using conservation of energy.

(F) Essential Learning Expectation - Force, Motion, Energy: There are four classifications of forces in nature: gravitational, electro-magnetic, and strong and weak nuclear forces. They can be further characterized as a contact force or non-contact force. Motion is the change in position over time. Concepts related to motion include uniform velocity, uniform accelerated motion, centripetal motion, one and two-dimensional motion, and wave motion. Work, energy, and power are utilized in various systems by applying the work-energy relationships.

PF.1.0 <u>Types of Force –</u> There are four classifications of forces in nature: gravitational, electro-magnetic, and strong and weak nuclear forces. They can be further characterized as a contact force or non-contact force. Students will study contact and non-contact forces and their interaction with matter.

PF.1.1 Students investigate the main forces in nature: Gravitational, electromagnetic, and nuclear.
Example: The students will calculate magnitude of the attractive or repulsive force between to charged bodies.

PF.1.2 Students apply basic trigonometric functions of sine, cosine, and tangent to resolve force vectors when analyzing kinematics and dynamics concepts related to one-dimensional motion and two-dimensional motion (projectile and uniform circular motion.
Example: Students will add vector quantities arithmetically when the angle between the vectors is either 0°or 180°.

PF.1.3 Students demonstrate an understanding of Newton's First Law (Inertia):
Example: Students will displace objects of various masses horizontally to determine which object has the greatest inertia.

PF.1.4 Students demonstrate an understanding of Newton's Second Law (Acceleration is directly proportional to force and inversely proportional to mass).
Example: *Students will perform a dynamics lab using computers and photo-gate materials where they will apply various forces to a dynamics cart and measure the acceleration, verifying Newton's 2nd law via summation of forces.*

PF.1.5 Students demonstrate an understanding of Newton's Third Law (Every force is accompanied by an equal and opposite force of the same type).
Example: Use Newton's Third Law in the concept development of the normal force.

PF.2.0 <u>Motion:</u> Motion is the change in position over time. Students study several types of motion including uniform velocity, uniform accelerated motion, centripetal motion, one and two-dimensional motion, and wave motion.

PF.2.1 Students interpret displacement versus time graphs and the connections to average and instantaneous velocity.

Example: Students use a GLX program to investigate this relationship: as the slope between two points on the graph represents the average velocity and the tangent to the curve represents the instantaneous velocity.

PF.2.2 Students will be able to interpret velocity versus time graphs.

Example: Students use a GLX program to investigate this relationship: as the slope between two points on the graph represent the average acceleration and the tangent to the curve represents the instantaneous acceleration and the area underthe curve represents the change in position.

PF.2.3 Students interpret acceleration versus time graphs.

Example: Students use a GLX program to investigate this relationship: as the area under the curve represents the change in velocity.

PF.3.0 <u>Mechanical Systems</u>: Students understand that work, energy, power utilized in various systems by applying the work-energy relationships. Further, students will study the relationships between wave properties and mechanical systems.

PF.3.1 Students demonstrate an understanding of the Energy transformation from potential energy to kinetic energy and visa-versa.

Example: Students perform a laboratory experiment to investigate the energy transformations of a pendulum ball from its highest point to its lowest point.

PF.3.2 Students demonstrate an understanding of work and it relationship to power and energy.

PF.3.3 Students calculate the angle of reflection and refraction using the Law of Reflection and Snell's Law.

Example: The student will perform a lab to analyze a light beam as in strikes an air-glass interface and measure the reflected angle and the refracted angle within the glass. The refracted angle will be used to calculate the index of refraction of the glass.

PF.3.4 Students construct ray diagrams for convex and concave mirrors to predict where the image of an object will be located.

Example: The student will perform a lab to locate the image of object in front of a concave mirror. They will verify the actual location of the image by creating a ray diagram.

PF.3.5 Students construct ray diagrams for convex and concave lenses to predict where the image of an object will be located.

Example: The student will perform a lab to locate the image of object in front of a convex lens. They will verify the actual location of the image by creating a ray diagram.

PF.3.6 Students predict the location of an image of an object for a convex and concave mirror using the mirror equations.

Example: The student will perform a lab to locate the image of object in front of a concave mirror. They will verify the actual location of the image by using the mirror equations.

PF.3.7 Students predict the location of an image of an object for a converging and diverging lens using the lens equations.
Example: The student will perform a lab to locate the image of object in front of a convex lens. They will verify the actual location of the image by using the lens equation.

PF.3.8 Students predict the charge on an electroscope or other objects resulting from induction and conduction.
Example: The student perform a lab in which the student will investigate the final charge on an electroscope when charging the electroscope by conduction and induction using a rubber rod and charged with wool.

PF.3.9 Students determine the force between charges using Coulomb's Law: $F = kQ_1Q_2/d^2$.
Example: The student will calculate the force between charges of 10.0μC and 20.0μC when separated by 30.0cm.

PF.3.10 Students investigate series and parallel circuits.
Example: Castle Lab

P.3.11 Students investigate magnetic fields, electric fields, and the relationship between them.
Example: Castle Labs

P.3.12 Students evaluate the relationship between momentum and impulse.

P.3.13 Students demonstrate an understanding of the conservation of linear momentum in one and two dimensions.
Example: The students will perform a laboratory investigation with marbles that will collide in one-dimensional and two-dimensional dimensions. The students analyze the initial and final momentums of the system.

P.3.14 Students define simple harmonic motion and locate points of greatest acceleration and velocity of the oscillating body.
Example: Identify the points of greatest acceleration and velocity of a vertically oscillating spring system.

P.3.15 Students evaluate the relationships between the frequency, period, wavelength, and speed of a wave in regard to sound and light both qualitatively and mathematically.
Example: The student will perform a lab to investigate the wavelength of sound.

(L) Life Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the characteristics, structures and function of living things, the processes and diversity of life, and how living organisms interact with each other and their environment.

Essential Questions:
How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
How is life interdependent on the earth's conditions or other life?

(S) Essential Learning Expectation – Living Systems – Living systems encompass a diversity of organisms that are classified according to characteristics (structure, function and organization). Living systems involve interactions among organisms and their environment (biotic and abiotic). Organisms evolve through genetic changes that lead to adaptation.

Essential Question:
What mechanical and electromagnetic waves are perceived by living organism, and what is the process?

LS1.0 <u>Characteristics of Living Things:</u> Students understand that physics plays an important and vital role in how we as humans interact with our surroundings. Students acquire a basic understanding of the nature of eyesight and hearing.

LS.1.1 Students understand how physics is related to eyesight.

Example: The student will learn how the eye detects various electromagnetic radiation and how the eye structure creates images.

LS.1.2 Students understand how physics is related to sound perception.

Example: The student will learn how the ear detects sound waves of different intensities and frequencies.

LS.2.0 <u>Characteristics of Living Environments</u> This learning goal is not addressed.

LS.3.0 <u>Structure and Function:</u> Students identify some human system abnormalities related to sight and hearing and explain possible corrective measures.

LS.3.1 Students understand the difference between myopia and hyperopia eye abnormalities.

Example: The student will perform labs to determine focal lengths of converging and diverging lenses and how it applies to correcting myopia and hyperopia.

LS.3.2 The student will understand how sound waves in air are detected by the human ear.

Example: The student will perform resonance experiments, which will allow the student to predict the most sensitive frequency to the human ear.

LS.4.0 <u>Diversity and Adaptation</u>: This learning goal is not addressed.

(P) Essential Learning Expectation – Life Process: This essential learning is not addressed.

(E) Earth and Space Science: As a result of the curriculum activities all students should develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

Essential Questions:

- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?

(S) Essential Learning Expectation – Earth and Space Structures: The universe is composed of galaxies, stars and other astronomical bodies, including our own Milky Way galaxy and Solar

System. The Earth system is classified into structures within the Earth, hydrosphere and atmosphere.

ES.1.0 Earth and Planetary Materials: This learning goal is not addressed.
ES.2.0 Landforms (geomorphology): This learning goal is not addressed.

ES.3.0 Planetary Systems: Students demonstrate the ability to use the Universal Gravitational Law to calculate the interactive forces between masses and be able to apply the Universal Gravitational Law to satellite and planetary motion.

E.3.1 Students calculate the force of gravity acting on a body using the earth's mass, object's mass, and the distance between their centers.

Example: The student will become proficient at using the universal gravitational force equation.

ES.3.2 Students apply Kepler's Second Law of Planetary Motion to satellite motion.

Example: The students will calculate a satellite's height to obtain a geosynchronous orbit.

(I) Essential Learning Expectation – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere, and hydrosphere has a profound effect on processes within earth systems. There are common interrelationships between physical bodies in our solar system and the universe.

EI.1.0 Weather, Climate and Change: This learning goal is not addressed.

EI.2.0 Living Organisms: This learning goal is not addressed.

EI.3.0 Earth's History: This learning goal is not addressed.

EI.4.0 Catastrophic Events: This learning goal is not addressed.

EI.5.0 Planetary Systems: Students explain that planetary systems are held together by gravitational forces.

E.5.1 Students understand that planetary and satellite motion is the result of gravitational forces. Further, the student will understand that the gravitational force is centripetal in nature and by applying the Universal Gravitational Law formula and the centripetal formula the student will find the period of rotation of satellites, the force necessary to keep the satellite in a particular orbit, and the velocity necessary to maintain a given orbit.

Example: The students will calculate a satellite's height to obtain a geosynchronous orbit.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and

benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances that drive future scientific endeavors.

HT.1.0 Students identify specific fields of science and technology, major milestones in science that have impacted science, technology, and society including those contributions made by Montana Native Americans.

HT.1.1 Students describe renewable energy technologies being explored today.

(R) Essential Learning Expectation - Resources – Resources are a critical part of today's society. Many of our natural resources are non-renewable and the students will be able to provide several ways to conserve energy.

HR.1.0 Students understand how natural resources are used in society.

HR.1.1 Students evaluate some advantages of using florescent bulbs over incandescent bulbs.

(I) Essential Learning Expectation - Culture: Historically, Native Americans, as a culture, had to apply many physics concepts in their everyday survival. The students will explore some of the ways Native Americans utilized physics in their daily lives in the past and in the present.

HI.1.0 Students identify scientific contributions made by different cultures and how scientific developments have impacted human activity and culture including contributions by Montana Native Americans.

HI.1.1 Students describe some of the ways Native Americans utilize(d) physics in their daily lives in the past and in the present.

Example: The students will provide a writing sample for the second semester of physics by explaining some aspect of the way Native Americans utilized physics in their daily lives in the past or in the present.

Lewistown Public Schools

Science Curriculum
AP Biology

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of AP Biology, all students understand that scientific inquiry is an essential process that allows students to conduct meaningful investigations; the results of a scientific investigation are always open to revision by further investigations; populations evolve through genetic change that leads to adaptation, speciation and the diversity of life; the structure in living organisms is directly related to function; living systems involve interactions among organisms and their environment; there are connections and interactions among technology, science and society; and, science and technology are the results of human activity throughout history, including many examples from Montana American Indian cultures.

Essential Skills: By the end of AP Biology, students develop skills for scientific inquiry including the ability to

- design, safely conduct, evaluate, and summarize the results of scientific investigations;
- utilize technology to collect, analyze and communicate data and results;
- review evidence, draw logical conclusions, and communicate and defend results;
- develop inferences supported by evidence;
- use effective models in order to understand and explain scientific concepts and phenomena.

Content Standards:

AP Bioogy content standards are governed by the AP Program and emphasize an extensive study of the following content topics:

I. Molecules and Cells
- A. Chemistry of Life
- B. Cells
- C. Cellular Energetics

II. Heredity and Evolution
- A. Heredity
- B. Molecular Genetics
- C. Evolutionary Biology

III. Organisms and Populations
- A. Diversity of Organisms
- B. Structure and Function of Plants and Animals
- C. Ecology

For a comprehensive list of AP required topics, see the following topic list for AP Biology Standards.

Process Standards: Using scientific inquiry students will generate testable questions and hypotheses, identify independent and dependent variables and variables that must be controlled. Using technology when feasible, students gather data, and perform experiments analyze data, draw conclusions and effectively communicate their findings. Students will understand and use safety precautions when working in the laboratory.

(P) Physical Science: As a result of inquiry-based curriculum activities students in AP Biology will develop an understanding of how chemistry and physics directly apply to our knowledge of living systems.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes "it" "it" and why/how is it doing that?

(M) Essential Learning Expectation- Matter: Matter exists in a variety of forms. Matter can be classified by physical and chemical properties. Organisms are a dynamic system of elements, compounds and organic macromolecules.

PM.1.0 <u>Structure</u>: Students classify, describe, and manipulate physical models of matter in terms of atoms, elements, molecules and compounds.

PM.1.1 Students identify the building blocks of matter.
Example: The students create a model of an atom.

PM.1.2 Students differentiate between chemical bonds.
Example: The students identify bonds in molecules found in organisms.

PM.2.0 <u>Properties</u>: Students classify, describe, and manipulate physical models of compounds.

PM.2.1 Students describe the four major organic macromolecules.
Example: The students construct a paper model of DNA.

PM.2.2 Students apply the principles of biochemistry.
Example: The students create a model of glucose.

PM.3.0 <u>Changes</u>: Students examine and identify simple chemical and physical changes and describe forms of energy and energy transformations.

PM.3.1 Students explain the processes involved in chemical reactions.
Example: The students correctly balance the photosynthetic reaction.

PM.3.2 Students analyze an enzyme-catalyzed reaction.

Example: The students design and conduct an experiment to measure the effects of catalase concentration on reaction rate.

(F) Essential Learning Expectation– Force, Motion and Energy: Energy transformations are essential to life on Earth.

PF.1.0 <u>Types of Force</u>: This learning goal is not addressed.

PF.2.0 <u>Forms of Energy</u>: Students describe energy and recognize that energy can change forms.

P.2.1 Students predict the results of an endothermic reaction.
Example: The students design and conduct an experiment to measure the effect of various conditions on the rate of photosynthesis.

PF.3.0 <u>Mechanical Systems</u>: This learning goal is not addressed.

(L) Life Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the characteristics, structures and function of living things, the processes and diversity of life, and how living organisms interact with each other and their environment.

Essential Questions:
- What is life?
- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How did life begin, how has it changed and how might it change in the future?
- How is life interdependent on the earth's conditions or other life?

(S) Essential Learning Expectation– Living Systems: The structure in living organisms is directly related to function. Organisms evolve through genetic changes that lead to adaptation. Living systems are interactions between organisms and their environment.

LS.1.0 <u>Characteristics of Living Things</u>: Students describe the specific characteristics shared by all living things.

L.1.1 Students define the seven characteristics of life.
Example: The students distinguish between living and non-living examples.

LS.2.0 <u>Characteristics of Living Environments</u>: Students explain cause and effect relationships between nonliving and living components within ecosystems and individual response to the changes in the environment.

L.2.1 Students understand that abiotic factors play a role in living systems.
Example: Using climographs students correctly identify biomes.

LS.3.0 <u>Structure and Function</u>: Students identify structures and systems of living organisms and relate those structures to function.

L.3.1 Students correlate structure and function of adaptations.

Example: Students compare and contrast features of homologous structures.

LS.4.0 <u>Diversity and Adaptation</u>: Students understand that populations evolve through genetic change that leads to adaptation, speciation and the diversity of life.

LS.4.1 Students understand the principles of population genetics.
Example: Students model genetic equilibrium in a gene pool.

(P) Essential Learning Expectation - Life Process: All living organisms are made of cells that grow and develop. All living organisms obtain materials and use energy. Living things reproduce, grow and develop. Taken as a group, living things change over time.

LP.1.0 <u>Growth</u>: Students describe and explain the complex processes involved in energy use in cell maintenance, growth, repair and development.

LP.1.1 Students understand that ATP is required for cellular metabolism.
Example: The students compare respiration rates between various organisms.

LP.1.2 Students apply principles of diffusion to living systems.
Example: Students utilize a semi-permeable membrane to measure osmosis.

LP2.0 <u>Cycles</u>: Students compare and contrast the life cycles of various organisms.

LP.2.1 Students examine the cell cycle.
Example: Using microscopes students identify phases of the cell cycle in onions and whitefish.

LP.2.2 Students compare the life cycles of plants and animals.
Example: Students correctly identify differences in animal and plant life cycles.

LP.3.0 <u>Reproduction</u>: Students understand that reproduction is essential to the continuation of every species. Students comprehend the molecular basis of heredity (DNA) and explain how it contributes to the diversity of life.

LP.3.1 Students appreciate how meiosis contributes to genetic diversity in sexually reproducing individuals.
Example: Students are able to differentiate between meiosis and mitosis.

LP.3.2 Students understand that DNA contains instructions for gene expression.
Example: Students model transcription and translation in protein synthesis.

LP.3.3 Students apply principles of genetics.
Example: Using Punnett squares students predict inheritance patterns in genetic crosses.

(E) Earth and Space Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the processes and interactions of the Earth systems, Earth's history, and objects in space.

Essential Questions:

- What is our world made of, how has it changed and how will it continue to change?
- What evidence is used to help us interpret Earth's history?
- How do we explain where we are in space and time?
- Why does the Earth shake, rattle and roll?

(S) Essential Learning Expectation – Earth and Space Structures: This ELE is not addressed.

ES.1.0 Earth and Planetary Materials: This learning goal is not addressed.

ES.2.0 Landforms: This learning goal is not addressed.

ES.3.0 Planetary Systems: This learning goal is not addressed.

(I) Essential Learning Expectation – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere and hydrosphere has profound effects on processes within Earth systems.

EI.1.0 Weather, Climate and Change: Students explain the difference between local and global weather and climate.

EI.1.1 Students will explain the components of the atmosphere and hydrosphere and how they interact to create weather and climate.
Example: Students examine the impact humans have on global climate change.

EI.2.0 Living Organisms: Students describe how climate affects living systems.

EI.2.1 Student understand how precipitation and temperature determine the composition of communities.
Example: Students research a specific biome and construct a poster.

EI.3.0 Earth's History: Students investigate fossil evidence and make inferences about the history of life on Earth.

ES.2.1 Students examine the history of life on Earth.
Example: Students construct a timeline illustrating the history of life on Earth.

ES.2.2 Students compare and contrast characteristics of relative and absolute dating.
Example: Students determine the relative age of rock layers based on the law of superposition.

EI.4.0 Catastrophic Events: Students describe how catastrophic events have shaped life on Earth.

EI.5.1 Students explain the impacts of geologic change on biological systems.
Example: Students examine the impacts of continental drift on major extinctions and adaptive radiations.

EI.5.0 Planetary Systems: This learning goal is not addressed.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances that drive future scientific endeavors.

HT.1.0 Students identify major milestones in science that have impacted science, technology, and society, including those contributed by Montana Native Americans.

HT.1.1 Students analyze how individual events can have a profound effect on the progression of science, such as the discovery of DNA structure.

Example: Students view a program on the discovery of DNA.

HT.1.2 Students appreciate how different worldviews can influence the progression of science.

Example: Students compare and contrast the environmental practices of Natives and European immigrants on Montana ecosystems.

HT.2.0 Students describe specific fields of science and technology as they relate to occupations within those fields.

HT.2.1 Students apply technology to lab activities and realize that the effective use of technology is critical to many career paths.

Example: Using gel electrophoresis, students analyze bacterial genetics.

HT.3.0 Students describe a scientific or technological innovation that impacts communities, cultures, and/or societies.

HT.3.1 Specific Proficiency: Students appreciate the impact technology has had on scientific advancement.

Example: Using class activities and the Internet, students research the development of technology that has led to major discoveries, such as the Human Genome Project.

HT.4.0 Students simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public.

HT.4.1 Students use technology to create and share findings of their group's experiment.
Example: Students use a spreadsheet application to compile, share, and interpret experimental data.

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 Students use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.

HR1.1 Students analyze local natural resource policies.
Example: Students will engage in a panel discussion on bison management.

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activity are interrelated.

HI.1.0 Students identify scientific contributions made by different cultures and how scientific developments have impacted human activity and culture including Montana Native Americans.

HI.1.1 Students recognize the impacts that Native Americans have had on modern ecological practices.
Example: Students describe the use of fire as a range management tool.

AP Biology Required Topic List

I. Molecules and Cells
A. Chemistry of Life
Water
Organic molecules in organisms
Free energy changes
Enzymes
B. Cells
Prokaryotic and eukaryotic cells
Membranes
Subcellular organization
Cell cycle and its regulation
C. Cellular Energetics
Coupled reactions

Fermentation and cellular respiration
Photosynthesis

II. Heredity and Evolution
A. Heredity
Meiosis and gametogenesis
Eukaryotic chromosomes
Inheritance patterns
B. Molecular Genetics
RNA and DNA structure and function
Gene regulation
Mutation
Viral structure and replication
Nucleic acid technology and applications
C. Evolutionary Biology
Early evolution of life
Evidence for evolution
Mechanisms of evolution

III. Organisms and Populations
A. Diversity of Organisms
Evolutionary patterns
Survey of the diversity of life
Phylogenetic classification
Evolutionary relationships
B. Structure and Function of Plants and Animals
Reproduction, growth, and development
Structural, physiological, and behavioral adaptations
Response to the environment
C. Ecology
Population dynamics
Communities and ecosystems
Global issues

Lewistown Public Schools

Science Curriculum
AP Chemistry

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- How do learning, practicing, understanding and applying science affect you and the world you live in?

Essential Understandings: By the end of Chemistry, all students demonstrate the ability to understand the interactions of matter and energy using the inquiry process. This interaction is investigated through the use of laboratory techniques, manipulation of chemical properties, patterns, chemical quantities, and problem-solving applications. Scientific methodology is employed in experimental and analytical investigations, and concepts are illustrated with practical applications that should include examples from environmental, nuclear, and in organic content areas.

Essential Skills: Throughout AP Chemistry students develop skills for scientific inquiry including the ability to:

- Identify and generate a testable question, safely construct, plan and implement safe controlled investigations; make logical inferences based on observations; accurately interpret data and communicate results;
- Utilize technological applications such as spreadsheets, projectors and data collection tools to collect, analyze and communicate data results.

Content Standards: The Chemistry standards focus on student growth in understanding the nature of science. This scientific view defines the idea that explanations of nature are developed and tested using observations, experimentation, models, evidence, and systematic processes. The nature of science includes the concepts that scientific explanations are based on logical thinking; are subject to rules of evidence; are consistent with observational, inferential, and experimental evidence; are open to rational critique; and are subject to refinement and change with the addition of new scientific evidence and the concept that science can provide explanations about nature, can predict potential consequences of actions, but cannot be used to answer all questions.

AP Chemistry content standards are governed by the College Board's AP Program which and emphasizes an extensive study of the following content topics:

I. Structure of Matter
- A. Atomic theory and atomic structure
- B. Chemical bonding
- C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications

II. States of Matter
- A. Gases
- B. Liquids and solids
- C. Solutions

III. Reactions
- A. Reaction types

B. Stoichiometry
C. Equilibrium
D. Kinetics
E. Thermodynamics

For a comprehensive list of AP required topics, see the following topic list for AP Chemistry Standards.

Process Standards: AP Chemistry process standards focus student understanding and use of safety precautions with chemicals and equipment. These standards emphasize qualitative and quantitative study of substances and the changes that occur in them. In meeting the chemistry standards, students will be encouraged to make inquiries, share their ideas, use the language of chemistry, discuss problem-solving strategies, and communicate effectively. Technology will be employed, where feasible, to measure, make observations, and evaluate data collected in laboratory activities.

(P) Physical Sciences: As a result of the curriculum activities in science all students should develop an understanding of properties of objects and materials, position and motion of objects and light, heat, electricity and magnetism.

Essential Questions:

- How does our understanding of physical science help us explain the connections among matter, time, space & energy?
- What are energy and matter and what is their relationship?
- What gives matter its unique qualities?
- How do the properties of matter affect its behavior?
- What makes different sorts of matter distinct and why/how is it doing that?
- How do things work?

(M) Essential Learning Expectation - Matter: Matter exists in a variety of forms and exhibits a variety of properties. Matter can be classified according to phases, types of chemical bonding, molecular geometry, and electron configurations. Matter is arranged accordingly on the periodic table using these classifications.

PM.1.0 <u>Structure</u>: Students classify, describe, evaluate and manipulate models of matter in terms of phases of matter, atomic structure, and types of bonding, arrangement on theperiodic table, molecular geometry, and electron configurations/orbital diagrams.

PM.1.1 Students understand early models of the atoms and their historical significance and justify evidence for the atomic theory.

PM.1.2 Students will determine atomic masses by chemical and physical means.
Example: *Calculations, Book problems, Class discussion, Lab work*

PM.1.3 Students determine the atomic number and mass number for atoms and isotopes.
Example: *Calculations, Book problems, Class discussion, Lab work*

PM.1.4 Students understand electron energy levels and their relationship to atomic spectra, quantum numbers, atomic orbitals

Example: *Lab: Flame Test and Spectroscopy*

PM.1.5 Students understand periodic relationships including atomic radii, ionization energies, electron affinities, oxidation states.
Example: *Lab: Periodicity and Prediction, Practice AP problems*

PM.1.6 Students differentiate between various binding forces including ionic, covalent, metallic, hydrogen bonding, Van der Waals (including London dispersion forces).
Example: Produce a concept map relating the above terms. Practice AP problems

PM.1.7 Students understand the relationship between binding forces and states, structure and properties of matter.
Example: Calculations, Book problems, Class discussion

PM.1.8 Students understand how bond polarity and electronegativity relates to binding forces.
Example: Calculations, Book problems, Class discussion, Lab work; Lab: Molecular Geometries of Molecular compounds

PM.1.9 Students use various molecular models to describe chemical structures of molecules, including Lewis structures; valence bond: hybridization of orbitals, resonance, sigma and pi bonds; and VSEPR theory.
Example: Lab: Covalent compounds and molecular structure; Lab: Molecular Geometries of Molecular compounds; Practice AP problems

PM.1.10 Students understand and predict geometry of molecules and ions, including structural isomerism of simple organic molecules, and the relation of properties to structure.
Example: Lab: Covalent compounds and molecular structure Lab: Molecular Geometries of Molecular compounds. Practice AP problems

PM.1.11 Students understand nuclear chemistry including nuclear equations, half-lives, and Radioactivity.
Example: Balance nuclear equations, calculate half-life

PM.2.0 Properties: Students explore, define, categorize and evaluate properties of matter, including states of matter, bonding, physical and chemical properties, colligative properties, and periodic trends.

PM.2.1 Students understand and are able to calculate laws of ideal gases including partial pressures.
Example: Lab: Determining molecular mass of a gas. Practice AP problems

PM.2.2 Students describe the kinetic-molecular theory.
Example: Calculations, Book problems, Class discussion, Lab work

PM.2.3 Students interpret the ideal gas laws on the basis of the kinetic-molecular theory.
Example: Calculations, Book problems, Class discussion, Lab work, Lab: Determining molecular mass of a gas

PM.2.4 Students relate Avogadro's hypothesis and the mole concept to the kinetic-molecular Theory.

Example: Calculations, Book problems, Class discussion, Lab work, Lab: Determining molecular mass of a gas

PM.2.5 Students describe the dependence of kinetic energy of molecules on temperature.
Example: Diagrams of particles at different phases

PM.2.6 Students understand deviations from ideal gas laws.
Example: Discuss low temp, high pressure, Lab: Determining molecular mass of a gas

PM.2.7 Students describe liquids and solids from the kinetic-molecular viewpoint.
Example: Discuss motion of particles in various phases

PM.2.8 Students draw and interpret phase diagrams of one-component systems.
Example: Construct phase diagrams

PM.2.9 Students discuss changes of state, including critical points and triple points.
Example: Calculations, Book problems, Class discussion, Lab work

PM.2.10 Students describe the structure of solids, include discussion of lattice energies.
Example: Calculations of lattice energy, Book problems, Class discussion, Lab work

PM.2.11 Students describe the types of solutions and factors affecting solubility.
Example: Lab solubility rules; Lab: Solutions

PM.2.12 Students understand methods of expressing concentration and perform calculations.
Example: Calculations, Book problems, Class discussion, Lab work; Lab: Acid/Base Titration #1; Practice AP problems

PM.2.13 Students state Raolt's Law and its relationship to colligative properties, including osmosis.
Example: Lab: Boiling point elevation

PM.2.14 Students describe the qualitative aspects of non-ideal solution behavior.
Example: Lab: solutions

PM.3.0 Changes: Students describe, analyze, and evaluate changes, including energy changes, due to physical changes, chemical reactions and changes, and nuclear changes.

PM.3.1 Students understand acid-base reactions including concepts of Arrhenius, Bronsted-Lowry, and Lewis, coordination complexes and amphoterism.
Example: Lab: small-scale colorimetric pH meter Lab: pH and indicators Lab: Lewis Acids: Practice AP problems

PM.3.2 Students understand precipitation reactions.
Example: Lab: solubility rules: Practice AP problems

PM.3.3 Students understand oxidation-reduction reactions in terms of; oxidation number, the role of the electron, and its application in electrochemistry, including electrolytic and galvanic cells, Faraday's laws, standard half-cell potentials, the Nernst equation, and prediction of the direction of redox reactions

Example: Calculations, Book problems, Class discussion, Lab work;Lab: Activity of metals, Balance redox reactions; Practice AP problems

PM.3.4 Students use concepts of stoichiometry to determine quantities of ionic and molecular species present in chemical systems: use net ionic equations

Example: Calculations, Book problems, Class discussion, Lab work; Lab: % water in a hydrate; Lab: Determining the simplest formula of a compound Formulate reaction prediction, Practice AP problems

PM.3.5 Students balance equations including those for redox reactions.

Example: Calculations, Book problems, Class discussion, Lab work; Reaction prediction workbook; Practice AP problems

PM.3.6 Students calculate mass and volume relations with emphasis on the mole concept including empirical formula and limiting reactants.

Example: Calculations, Book problems, Class discussion, Lab work,Stoichiometry calculations, Lab: Molar mass of condensable vapor;: Practice AP problems

PM.3.7 Students describe the concept of dynamic equilibrium in both physical and chemical contexts, make predictions using Le Chatelier's principle, and understand the concept of equilibrium constants.

Example: Calculations, Book problems, Class discussion, Lab work,Lab: Understanding Le Chatelier's principle, Practice AP problems

PM.3.8 Students calculate equilibrium constants for gaseous reactions: Kp, Kc

Example: Calculations, Book problems, Class discussion, Lab work; Practice AP problems

PM.3.9 Students calculate equilibrium constants for reactions in solution, such as: constants for acids and bases pK, pH; solubility product constants, Ksp, and their applications to precipitation and the dissolution of slightly soluble compounds; common ion effect; buffers; and hydrolysis

Example: Calculations, Book problems, Class discussion, Lab work, Practice AP problems

PM.3.10 Students understand the concept of rate of reaction.

Example: Calculations, Book problems, Class discussion, Lab work, Lab: Factors affecting rate, Lab: the study of the kinetics of a reaction, Practice AP problems

PM.3.11 Students use experimental data and graphical analysis to determine reaction order, rate constants, and reaction rate laws.

Example: Calculations, Book problems, Class discussion, Lab work, Lab: the study of the kinetics of a reaction, Practice AP problems

PM.3.12 Students determine the effect of temperature change on rates.

Example: Calculations, Book problems, Class discussion, Lab work, Lab: the study of the kinetics of a reaction: Practice AP problems

PM.3.13 Students understand the concept of energy of activation and the effect of catalysts on energy of activation.

Example: Calculations, Book problems, Class discussion, Lab work, Lab: the study of the kinetics of a reaction, Practice AP problems

PM.3.14 Students understand and interpret the relationship between the rate-determining step and a mechanism.
Example: Calculations, Book problems, Class discussion, Lab work Lab: the study of the kinetics of a reaction, Practice AP problems

PM.3.15 Students understand the concept of state functions.
Example: Class discussion

PM.3.16 Students state the first law of thermodynamics and understand how it relates to: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion; and calorimetry.
Example: Calculations, Book problems, Class discussion, Lab work; Lab: Specific heat of a Metal, Energy calculations, Practice AP problems

PM.3.17 Students state the second law of thermodynamics and understand how it relates to: entropy; free energy of formation; free energy of reaction; dependence of change in free energy on enthalpy and entropy changes.
Example: Calculations $\Delta G = \Delta H - T\Delta S$, Book problems, Class discussion, LabWork, Practice AP problems

PM.3.18 Students understand the relationship of change in free energy to equilibrium constants and electrode potentials.
Example: Calculations, Book problems, Class discussion, Lab work; Practice AP problems

(F) Essential Learning Expectation – Force, Motion and Energy: Intermolecular and intramolecular forces are responsible for chemical bonds. Energy is associated with all bonding and the making and breaking of bonds.

PF.1.0 Types of Force: Students identify and explain types of bonding, intermolecular forces, intramolecular forces, strong nuclear forces, and hydrogen bonding.

PF.1.1 Students demonstrate knowledge of the electrical force that rules atoms behavior.
Example: Evaluate the role of electrons in interactions between atoms

PF.1.2 Students describe or define inter- and intramolecular forces.
Example: Classroom discussions about types of inter- and intramolecular forces.(Vander Waals, H- bonding)

PF.1.3 Students understand that nuclear reactions depend on the strong nuclear force.
Example: Students will practice nuclear decay reactions and gain knowledge through discussions of nuclear decay. Compare and contrast alpha particles, beta particles and gamma rays. Predict the products of various elements that undergo radioactive decay.

PF.2.0 Forms of Energy: Students calculate, compare and contrast energy types in the form of potential, kinetic, radiant, and transfer related to conservation of energy. Students will also calculate and analyze graphs of energy.

PF.2.1 Students calculate, relate and apply relationship betweens frequency, wavelength and energy of parts of the electromagnetic spectrum.
Example: $E = h\nu$ and $c = \nu\lambda$ calculations

PF.2.2 Students construct and analyze graphs of energy.
Example: Phase change diagrams, Phase diagrams, Logger Pro Endo/ExothermicLab

PF.2.3 Students relate and transfer knowledge of the Kinetic Molecular Theory to states of matter.
Example: Behavior of Gases Lab, computer animations of Kinetic energy of phasesof matter

PF.3.0 Mechanical Systems: This learning goal not addressed.

(L) Life Science: As a result of the curriculum activities all students begin to develop an understanding of the characteristics of organisms, life cycles and environments of organisms.

(S) Essential Learning Expectation – Living Systems: Living systems involve many chemical reactions and interactions. Chemistry is an integral part of all living things.

LS1.0 Characteristics of Living Things: This learning goal not addressed.

LS.2.0 Characteristics of Living Environments: This learning goal is not addressed.

LS.3.0 Structure and Function: This learning goal is not addressed.

LS.4.0 Diversity and Adaptation: This learning goal not addressed.

(P) Essential Learning Expectation - Life Process: Students will investigate and understand basic needs and life processes of plants and animals including growth, survival needs, cycles and similarities among offspring and their parents.

LP.1.0 Growth: This learning goal is not addressed

LP2.0 Cycles: This learning goal is not addressed

LP.3.0 Reproduction: This learning goal is not addressed

(E) Earth and Space Science: As a result of the curriculum activities all students should develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

(S) Essential Learning Expectation – Earth and Space Structures: Many concepts in space have been determined by the use of spectroscopy and evaluation of light properties.

Radioactive decay is commonly used to date geologic structures. Water is an abiotic component of the earth with unique properties.

ES.1.0 Earth and Planetary Materials: Students understand and explain the special properties of water in terms of hydrogen bonding and specifically di-pole interactions. Students describe the electromagnetic spectrum and through exploration of spectroscopy they will be able to identify individual elements from analyzing line spectra.

ES.1.1 Students transfer knowledge of spectroscopy to the identification of elements using their spectrum, both on Earth and in space and in the field of forensics science.
Example: Spectral Analysis of Fluorescent Lights Lab, Flame Test Lab

ES.1.2 Students understand the unique properties of water.
Example: Class discussion of polarity, specific heat, density, geometry. Phase change diagrams and lab

ES.1.3 Students will predict if a substance will dissolve in another substance based on their understanding of solubility.
Example: Solutions Lab (like-dissolves-like)

ES.2.0 Landforms (geomorphology): This learning goal not addressed.

ES.3.0 Planetary Systems: This learning goal not addressed.

(I) Essential Learning Expectation - Earth and Space Interrelationships – Patterns, Cycles and Change: The half-life of certain elements can be used to determine the age of the Earth, some materials and artifacts.

EI.1.0 Weather, Climate and Change: This learning goal not addressed.

EI.2.0 Living Organisms: This learning goal not addressed.

EI.3.0 Earth's History: Students understand the concept of half-life to determine age of Earth materials and artifacts.

EI.3.1 Students calculate and understand the concepts of half-life problems of radioactive substances. Example: Half-life calculations, discuss which radio-isotopes are appropriate for aging specific materials

EI.4.0 Catastrophic Events: This learning goal not addressed.EI.5.0 Planetary Systems: This learning goal not addressed.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the

surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technology advances that drive future scientific endeavors.

HT.1.0 Students explore how science has impacted society and technology.

HT.1.1 Students understand that the advancement of our understanding of the atom is directly dependent on the advancement of technology and vice versa.
Example: MRI, STM, Annenberg video series, Waves and Particles video

(R) Essential Learning Expectation – Resources: Natural resources are unique to each region. Scientific evidence can be used to understand and manage natural resources. The search for, processing of, and use of resources has beneficial and/or detrimental impacts on both regional and global systems.

HR.1.0 Students explore local resources and relate data found, with the use of Internet, virtual chemistry lab, and news articles to compare local versus worldwide impacts.

HR1.1 Students read and/or discuss local current events that relate to natural resources in Fergus and surrounding counties.

(I) Essential Learning Expectation – Culture: Many different cultures make contributions to science and technology. These advances affect different societies in different ways. Science, technology and human activities are interrelated.

HI.1.0 Students explore native peoples' applications of scientific ideologies for use in their daily lives.

HI.1.1 Students explain some of the ways Native Americans utilized chemistry in their daily lives in the past and in the present.
Example: Students will provide a writing sample explaining some aspect of the way Native Americans utilized chemistry in their daily lives in the past or in the present.

AP Chemistry Required Topic List

I. Structure of Matter (20%)

A. Atomic theory and atomic structure
   1. Evidence for the atomic theory
   2. Atomic masses; determination by chemical and physical means
   3. Atomic number and mass number; isotopes
   4. Electron energy levels: atomic spectra, quantum numbers, atomic orbitals
   5. Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states

B. Chemical bonding
   1. Binding forces
      a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals (including London dispersion forces)
      b. Relationships to states, structure, and properties of matter
      c. Polarity of bonds, electronegativities
   2. Molecular models
      a. Lewis structures
      b. Valence bond: hybridization of orbitals, resonance, sigma and pi bonds
      c. VSEPR
   3. Geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes; dipole moments of molecules; relation of properties to structure

C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications

II. States of Matter (20%)

A. Gases
   1. Laws of ideal gases
      a. Equation of state for an ideal gas
      b. Partial pressures
   2. Kinetic molecular theory
      a. Interpretation of ideal gas laws on the basis of this theory
      b. Avogadro's hypothesis and the mole concept
      c. Dependence of kinetic energy of molecules on temperature
      d. Deviations from ideal gas laws

B. Liquids and solids
   1. Liquids and solids from the kinetic-molecular viewpoint
   2. Phase diagrams of one-component systems
   3. Changes of state, including critical points and triple points
   4. Structure of solids; lattice energies

C. Solutions
   1. Types of solutions and factors affecting solubility
   2. Methods of expressing concentration (use of normalities is not tested)
   3. Raoult's law and colligative properties (nonvolatile solutes); osmosis
   4. Non-ideal behavior (qualitative aspects)

III. Reactions (35–40%)

A. Reaction types
    1. Acid-base reactions; concepts of Arrhenius, Brønsted-Lowry and Lewis; coordination complexes; amphoterism
    2. Precipitation reactions
    3. Oxidation-reduction reactions
        a. Oxidation number
        b. The role of the electron in oxidation-reduction
        c. Electrochemistry: electrolytic and galvanic cells; Faraday's laws; standard half-cell potentials; Nernst equation; prediction of the direction of redox reactions

B. Stoichiometry
    1. Ionic and molecular species present in chemical systems: net ionic equations
    2. Balancing of equations, including those for redox reactions
    3. Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants

C. Equilibrium
    1. Concept of dynamic equilibrium, physical and chemical; Le Chatelier's principle; equilibrium constants
    2. Quantitative treatment
        a. Equilibrium constants for gaseous reactions: Kp, Kc
        b. Equilibrium constants for reactions in solution
            (1) Constants for acids and bases; pK; pH
            (2) Solubility product constants and their application to precipitation and the dissolution of slightly soluble compounds
            (3) Common ion effect; buffers; hydrolysis

D. Kinetics
    1. Concept of rate of reaction
    2. Use of experimental data and graphical analysis to determine reactant order,rate constants and reaction rate laws
    3. Effect of temperature change on rates
    4. Energy of activation; the role of catalysts
    5. The relationship between the rate-determining step and a mechanism

E. Thermodynamics
    1. State functions
    2. First law: change in enthalpy; heat of formation; heat of reaction; Hess's law;
        a. heats of vaporization and fusion; calorimetry
        b. Second law: entropy; free energy of formation; free energy of reaction; dependence of change in free energy on enthalpy and entropy changes
        c. Relationship of change in free energy to equilibrium constants and electrode potentials

IV. Descriptive Chemistry

Knowledge of specific facts of chemistry is essential for an understanding of principles and concepts. These descriptive facts, including the chemistry involved in environmental and societal issues, should not be isolated from the principles being studied but should be taught

throughout the course to illustrate and illuminate the principles. The following areas should be covered:

1. Chemical reactivity and products of chemical reactions
2. Relationships in the periodic table: horizontal, vertical and diagonal with examples from alkali metals, alkaline earth metals, halogens and the first series of transition elements
3. _Introduction to organic chemistry: hydrocarbons and functional groups (structure, nomenclature, chemical properties)

V. Laboratory

The differences between college chemistry and the usual secondary school chemistry course are especially evident in the laboratory work. The AP Chemistry Exam includes some questions based on experiences and skills students acquire in the laboratory:

- making observations of chemical reactions and substances
- recording data
- calculating and interpreting results based on the quantitative data obtained
- communicating effectively the results of experimental work

Lewistown Public Schools

Science Curriculum
AP Physics

Essential Questions:

- What is science and why is it important?
- How do we explain the interactions in our world through our understanding of science?
- What does learning, practicing, understanding and applying science mean to you and the world you live in?

Essential Understandings: By the end of AP Physics, all students shall demonstrate the ability to understand that an unbalanced force results in acceleration within a system; the motion that results from the unbalanced force can be in one and two dimensions; the duration that the unbalanced force is proportional to the change in momentum of the system; mechanical energy in an isolated system is conserved and experiences transformations between various forms of kinetic and potential energies; wave motion is one way in which energy can be transferred within a system; optics is the study of how electromagnetic waves in the visible spectrum transfer energy within a system; unbalanced forces can occur in nature at the atomic level in the form of static electricity; and, when the resulting unbalanced forces are too great for electrons to remain in the static state, electronmotion "current" occurs. In most metals, this current is governed by Ohm's Law.

Essential Skills: Throughout AP Physics, students develop skills for scientific inquiry including the ability to:

- Identify and communicate a testable questions, create a safety plans and conduct experimental investigations.
- Utilize technological applications such as spreadsheets and data collection tools (sonic wave generators, graphing calculators, computers, photo-gates) to collect, analyze and communicate data results.

Content Standards:

AP Physics content standards are governed by the AP Program and emphasize an extensive study of the following content topics:

I. Newtonian Mechanics
- A. Kinematics
- B. Newton's Laws of Motion
- C. Work, energy, power
- D. Systems of particles, linear momentum
- E. Circular motion and rotation
- F. Oscillations and gravitation

II. Fluid Mechanics and Thermal Physics
- A. Fluid Mechanics
- B. Temperature and heat
- C. Kinetic theory and thermodynamics

III. Electricity and Magnetism

A. Electrostatics
B. Conductors, capacitors, dielectrics
C. Electric circuits
D. Magnetic Fields
E. Electromagnetism

IV. Waves and Optics .

A. Wave motion (including sound)
B. Physical optics
C. Geometric optics

V. Atomic and Nuclear Physics .

A. Atomic physics and quantum effects
B. Nuclear physics

For a comprehensive list of AP required topics, see the following topic list for AP Chemistry Standards.

Process Standards: AP Physics process standards emphasize the use of conceptual and mathematical modeling and laboratory investigations. Throughout AP Physics, all students will utilize the essential skills enumerated above to explore the content through inquiry and pre- designed laboratory investigations as well as the Internet and learning through a variety of educational resources.

(P) Physical Science: Students demonstrate understanding of properties, forms, changes, and interactions of physical systems.

Essential Questions:

How does our understanding of physical science help us explain the connections among matter, time, space & energy?
What are energy and matter and what is their relationship?
What gives matter its unique qualities?
How do the properties of matter affect its behavior?

(M) Essential Learning Expectation – Matter: Matter is the material substance of the universe that has mass, occupies space, and is convertible to energy. There are four states of matter: solid, liquid, vapor, and plasma. Phases/states of matter are dependent upon the quantity of energy and/or the pressure present in the system.

Essential Question – What matters in the study of Matter?

PM.1.0 <u>Structure:</u> Matter consists of small building blocks of protons, neutrons, and electrons. Students will explore the structure in the atom in the study of electricity.

PM.1.1 Students explain the electron movement necessary to charge objects by conduction and induction.

Example: The students will perform an electroscope lab to investigate electron flow in

the process of charging the electroscope by conduction and induction.

PM.1.2 Students accurately calculate the electrostatic force between static charges using Coulomb's Law.

Example: The student will perform calculations using the following formula: $F=kQ_1Q_2 / r^2$

PM.1.3 Students accurately calculate the direction and magnitude of the electrical field strength at a particular location due to a single point charge or multiple charges using Coulomb's Law or Gauss's Law.

PM.1.4 Students predict the magnitude and the direction of the electrical potential due to a single or multiple point charges.

PM.1.5 Students predict the magnitude and direction of the field strength and electrical potential at a particular location between plates of a parallel plate capacitor.

PM.1.6 Students explain the electron flow that takes place in series and parallel DC circuits and employ Kirchhoff's Laws and Ohm's Law to series and parallel circuits.

Example: Perform a lab in which they will investigate series and parallel circuits.

PM.1.7 Students explain what happens to the voltage, current and charge over time in an RC-Circuit.

Example: Set up a demonstration of an RC-Circuit that incorporates the use of multi-meters to observe the voltage and current in a RC-Circuit over time.

PM.1.8 Students explain what happens to the voltage, current and charge over time in a LR-Circuit.

Example: Demonstration of an LR-Circuit that incorporates the use of multi-meters to observe the voltage and current in a LR-Circuit over time.

PM.1.9 Predict the direction of the magnetic field due to current in a wire, Ampere's Law.

Example: Observe a demonstration of Ampere's Law.

PM.1.10 Explain the direction of current induced in a loop of wire due to a changing magnetic field, Lenz's Law.

Example: Observe a demonstration of Lenz's Law.

PM.1.11 Explain the direction of force on a current carrying wire in a magnetic field using concepts of magnetic flux and Faraday's Law.

Example: Observe a demonstration of Faraday's Law.

PM.1.12 Explain the concepts of alpha and beta decay.

Example: The nuclide $^{214}Pb_{82}$ *emits an electron and becomes nuclide X. From the following choices the student should be able to select which of the following gives the mass number and atomic number of nuclide X.*

<u>Mass Number-Atomic Number</u> A) 210-80 B) 210-81 C) 213-83 D) 214-81 E) 214-83

PM.1.13 Calculate the half-life of a radioactive decaying atom.

Example: A radioactive atom has a half-life of 10 years. The student will calculate the time it takes for the mass of the radioactive atom to reach one-eighth its original mass?

PM.1.14 Calculate the kinetic energy imparted to the parent nucleus and the beta particular after beta decay.

PM.1.15 Explain the photoelectric effect.

PM.1.16 Explain the Bohr model of the atom and predict the energy of a photon during a transition from one energy level to another.

Example: Determine the wavelength of light emitted when a hydrogen atom makes a transition from the n=5 to the n=2 energy level according to the Bohr model.

PM.2.0 <u>Properties:</u> Students develop an understanding of thermodynamics, specifically temperature and heat as another form of energy.

PM.2.1 Students state, with words and symbols, the First Law of Thermodynamics.

Example: Perform simple calculations related to the increase of internal energy as work or heat is added to a system: $\Delta U = Q + W$, where "Q" is the heat added to the system and "W" is the work done to the system.

PM.2.2 Students state, with words and symbols, the Second Law of Thermodynamics.

Example: The Second Law of Thermodynamics states that heat flows naturally from a hot object to a cold object; heat will not flow spontaneously from a cold object to a hot object.

PM.2.3 Students state, with words and symbols, the Third Law of Thermodynamics.

Example: Reaching absolute zero is impossible to attain.

PM.2.4 Given a gas P-V graph, students evaluate: The temperature of a particular point given the pressure and corresponding volume; the internal energy of the gas at the same point; the change in internal energy between two points, iIdentify the isochoric, isobaric, isothermal, and adiabatic process potentially in a P-V graph; the net change in entropy of a cyclic process is equal to zero. The change in entropy is equal to the following: $\Delta S = Q / T$; the work performed on or by the gas between two points; and, the heat added or removed from the gas between two points using $Q = nC_v \Delta T$, or $Q = nC_p \Delta T$, or $\Delta U = Q + W$

Example: Analyze multiple sets of P-V curve problems that are provided to them that addresses each of the above proficiencies

PM.3.0 <u>Changes:</u> Students observe, measure and calculate the thermodynamic changes that take place as materials of differing temperatures are added to one another and as an external heat source is added to the system.

PM.3.1 Analyze various thermodynamic situations and be able to choose an appropriate mathematical model to explain the energy needs of that situation.

Example: Perform a lab to calculate the specific heat of an unknown material using conservation of energy. Perform a lab to calculate the heat of fusion for ice to water.

(F) Essential Learning Expectation - Force, Motion and Energy: There are four classifications of forces in nature, gravitational, electro-magnetic and strong and weak nuclear forces. The interaction of these forces help explain motion, energy, momentum and simple harmonic motion.

Essential Question – How do we explain the interactions between matter?

PF.1.0 <u>Types of Force</u> – There are four classifications of forces in nature. They are gravitational, electro-magnetic, and strong and weak nuclear forces. They can be further characterized as a contact force or non-contact force. The students will study contact and non-contact forces and their interaction with matter.

PF.1.1 Students investigate the main forces in nature: gravitational, electromagnetic, and nuclear.
Example: The students will calculate magnitude of the attractive or repulsive force between two charged bodies.

PF.1.2 Students apply basic trigonometric functions of sine, cosine, and tangent to resolve force vectors when analyzing kinematics and dynamics concepts related to one-dimensional motion and two-dimensional motion (projectile and uniform circular motion).
*Example: Students will add vector quantities arithmetically when the angle between the vectors is **either** 0°or 180°. Students add vector quantities vectorily when the angle between the vectors is **between** 0°and 180°.*

PF.1.3 Students demonstrate an understanding of Newton's First Law (Inertia).
Example: Students will displace objects of various masses horizontally to determine which object has the greatest inertia.

PF.1.4 Students demonstrate an understanding of Newton's Second Law (Acceleration is directly proportional to force and inversely proportional to mass).
Example: *Students will perform a dynamics lab using computers and photo-gate materials where they will apply various forces to a dynamics cart and measure the acceleration, verifying Newton's 2nd law via summation of forces.*

PF.1.5 Students demonstrate an understanding of Newton's Third Law (Every force is accompanied by an equal and opposite force of the same type).
Example: Use Newton's Third Law in the concept development of the normal force.

PF.1.6 Students demonstrate and understanding the relationship between density and specific gravity.

PF.1.7 Students employ Pascal's Principle to a hydrostatic fluid.
Example: Given the force applied to a piston of a given radius, the student should be able to calculate the transferred force to a piston of a larger piston in the hydro static line by the following relationship: $F_1 / A_1 = F_2 / A_2$

PF.1.8 Students apply Archimedes' Principle to objects immersed in a fluid.
Example: The student will perform an investigation in which they will determine the buoyant force on a submerged metal sample.

PF.2.0 **<u>Motion:</u> Motion is the change in position over time. Students study several types of motion including uniform velocity, uniform accelerated motion, centripetal motion, one and two-dimensional motion, and wave motion.**

PF.2.1 Students accurately interpret velocity versus time graphs.

Example: Students use a CBL program to investigate this relationship: as the slope between two points on the graph represent the average acceleration and the tangent to the curve represents the instantaneous acceleration and the area under the curve represents the change in position.

PF.2.2 Students accurately interpret acceleration versus time graphs.

Example: Students use a CBL program to investigate this relationship: as the area under the curve represents the change in velocity.

PF.3.0 **<u>Mechanical Systems</u>: Students understand that work, energy, power utilized in various systems by applying the work-energy relationships and the relationships between wave properties and mechanical systems.**

PF.3.1 Students demonstrate an understanding of the energy transformation from potential energy to kinetic energy and visa-versa.

Example: Student will perform a laboratory experiment to investigate the energy transformations of a pendulum ball from its highest point to its lowest point.

PF.3.2 Students demonstrate an understanding of work and it relationship to power and energy.

Example: Students will analyze the amount of work and power expended by students as they run up a flight of stairs at timed intervals. They will also summarize the related work-energy relationship.

PF.3.3 Students calculate the angle of reflection and refraction using the Law of Reflection and Snell's Law.

Example: The student will perform a lab to analyze a light beam as in strikes an air-glass interface and measure the reflected angle and the refracted angle within the glass. The refracted angle will be used to calculate the index of refraction of the glass.

PF.3.4 Students construct ray diagram for convex and concave mirrors to predict where the image of an object will be located.

Example: The student will perform a lab to locate the image of object in front of a concave mirror. They will verify the actual location of the image by creating a ray diagram.

PF.3.5 Students construct ray diagrams for convex and concave lenses to predict where the image of an object will be located.

Example: The student will perform a lab to locate the image of object in front of a convex lens. They will verify the actual location of the image by creating a ray diagram.

PF.3.6 Students predict the location of an image of an object for a convex and concave mirror using the mirror equations.

Example: The student will perform a lab to locate the image of object in front of a concave mirror. They will verify the actual location of the image by using the mirror equations.

PF.3.7 Students predict the location of an image of an object for a converging and diverging lens using the lens equations.

Example: The student will perform a lab to locate the image of object in front of a convex lens. They will verify the actual location of the image by using the lens equation.

PF.3.8 Students predict the charge on an electroscope or other objects resulting from induction and conduction.

Example: The student performs a lab in which the student will investigate the final charge on an electroscope when charging the electroscope by conduction and induction using a rubber rod and charged with wool.

PF.3.9 Students determine the force between charges using Coulomb's Law: $F = kQ_1Q_2/d^2$

Example: The student will calculate the force between charges of 10.0μC and 20.0μC when separated by 30.0cm.

PF.3.10 Students investigate series and parallel circuits.

Example: The student will perform a lab in which they will create series and parallel circuits to predict voltage and current variations based on resistance changes. Then they will use multi-meters to measure the electrical current and electrical potential in the circuit.

PF.3.11 Students investigate magnetic fields, electric fields, and the relationship between them.

Example: The student will witness several demonstrations related to magnetic fields and electric fields. The student will then write a brief essay explaining their observations and the relationship between magnetic fields and electric fields.

PF.3.12 Students evaluate the relationship between momentum and impulse.

Example: Mathematical modeling of real-life situations such as a tennis ball bouncing off a wall.

PF.3.13 Students demonstrate an understanding of the conservation of linear momentum in one and two dimensions.

Example: The students will perform a laboratory investigation with marbles that will collide in one-dimensional and two-dimensional dimensions. The students analyze the initial and final momentums of the system.

PF.3.14 Students define simple harmonic motion and be able to locate points of greatest acceleration and velocity of the oscillating body.

Example: The students should be able to identify the points of greatest acceleration and velocity of a vertically oscillating spring system.

PF.3.15 Students evaluate the relationships between the frequency, period, wavelength, and speed of a wave in regard to sound and light both qualitatively and mathematically.

Examples: The student will perform a lab to investigate the relationship between frequency, period, wavelength and speed of water waves created in a wave tank. The student will perform a lab to investigate the wavelength of sound.

PF.3.16 Students apply the concept of conservation of angular momentum to simple rotating systems.

Example: If the student is given the speed of a planet around a star at a given distance, the student should be able to calculate the speed of the planet around that star at a different distance from that star using: $I_1 \omega_1 = I_2 \omega_2$

(L) Life Science: As a result of inquiry-based curriculum activities all students will develop an understanding of the characteristics, structures and function of living things, the processes and diversity of life, and how living organisms interact with each other and their environment.

Essential Questions:

- How do systems, structures (form and function) and behavior patterns of organisms enable them to survive and interact with their environment?
- How is life interdependent on the earth's conditions or other life?

(S) Essential Learning Expectations – Living Systems: Living systems encompass a diversity of organisms that are classified according to characteristics (structure, function and organization). Living systems involve interactions among organisms and their environment (biotic and abiotic). Organisms evolve through genetic changes that lead to adaptation.

Essential Question – Which mechanical and electromagnetic waves are perceived by living organism, and by what process?

LS.1.0 <u>Characteristics of Living Things:</u> Students understand that physics plays an important and vital role in how we as humans interact with our surroundings. The Students will acquire a basic understanding of the nature of eyesight and hearing.

LS.1.1 Students understand how physics is related to eyesight.

Example: The student will learn how the eye detects various electromagnetic radiation and how the eye structure creates images.

LS.1.2 The student will understand how physics is related to sound perception.

Example: The student will learn how the ear detects sound waves of different intensities and frequencies.

LS.2.0 <u>Characteristics of Living Environments:</u> This learning goal is not addressed.

LS.3.0 <u>Structure and Function:</u> Students identify some human system abnormalities related to sight and hearing and explain possible corrective measures.

LS.3.1 Students understand the difference between myopia and hyperopia eye abnormalities.

Example: The student will perform labs to determine focal lengths of converging and diverging lenses and how it applies to correcting myopia and hyperopia.

LS.3.2 Students understand how sound waves in air are detected by the human ear.
Example: The student will perform resonance experiments, which will allow the student to predict the most sensitive frequency to the human ear.

LS.4.0 <u>Diversity and Adaptation</u>: This learning goal is not addressed.

(P) Essential Learning Expectation – Life Process: This ELE is not addressed.

(E) Earth and Space Science: As a result of the curriculum activities all students develop an understanding of properties of earth materials, objects in the sky and changes in earth and sky.

Essential Questions:
- Why do we need to know about the Solar system and planets?
- How do we explain where we are in space and time?

(S) Essential Learning Expectation – Earth and Space Structures: The universe is composed of galaxies, stars and other astronomical bodies, including our own Milky Way galaxy and Solar System. The Earth system is classified into structures within the Earth, hydrosphere and atmosphere.

ES.1.0 <u>Earth and Planetary Materials</u>: This learning goal is not addressed.

ES.2.0 <u>Landforms (geomorphology)</u>: This learning goal is not addressed.

ES.3.0 <u>Planetary Systems</u>: Students demonstrate the ability to use the Universal Gravitational Law to calculate the interactive forces between masses and be able to apply the it to satellite and planetary motion.

ES3.1 Students calculate the force of gravity acting on a body using the earth's mass, object's mass, and the distance between their centers.
Example: The student will become proficient at using the universal gravitational force equation.

ES.3.2 Student applies Kepler's Second Law of Planetary Motion to satellite motion.
Example: The students will calculate a satellite's height to obtain a geosynchronous orbit.

(I) Essential Learning Expectation – Earth and Space Interrelationships: The dynamic nature of the lithosphere, atmosphere, and hydrosphere has a profound effect on processes within earth systems. There are common interrelationships between physical bodies in our solar system and the universe.

EI.1.0 <u>Weather, Climate and Change:</u> This learning goal is not addressed.

EI.2.0 <u>Living Organisms:</u> This learning goal is not addressed.

EI.3.0 <u>Earth's History:</u> This learning goal is not addressed.

EI.4.0 <u>Catastrophic Events:</u> This learning goal is not addressed.

EI.5.0 <u>Planetary Systems</u>: Students explain that planetary systems are held together by gravitational forces.

EI.5.1 Students understand that planetary and satellite motion is the result of gravitational forces and that gravitational force is centripetal in nature. By applying the Universal Gravitational Law formula and the centripetal formula the student will find the period of rotation of satellites, the force necessary to keep the satellite in a particular orbit, and the velocity necessary to maintain a given orbit.

Example: The students will calculate a satellite's height to obtain a geosynchronous orbit.

(H) Place Based Issues (Human Relationships with the Environment): The Earth is comprised of diverse limited resources that are essential to life and our society. Our society has grown to depend on science and technology as well as these resources to maintain our way of life. This dependence has had many positive and negative impacts, which can be influenced by our actions. As a result of inquiry-based curriculum activities all students will use scientific evidence to analyze local, regional and global scientific issues with an emphasis on the Big Spring Creek and Judith River watersheds, as well as the surrounding Judith, Snowy, Little Belt and Moccasin mountain areas. All students will develop an understanding of personal health, population, resources and environment, natural hazards, risks and benefits and science, technology and society.

Essential Questions:

- How did I get here, how do I explain what is going on here, how do I impact this place and how does this place impact me?
- Which impact is more significant – humans on the earth or the earth on humans?
- How do developments in science and technology affect our lives and where we live?
- How can we be a part of nature, not apart from it?

(T) Essential Learning Expectation – Technology: Our lives and our community are shaped in many ways by the advances in science and technology. Science and technology are reciprocal in that science drives technological advances that drive future scientific endeavors.

HT.1.0 Students identify specific fields of science and technology, and major milestones and innovations in science that have impacted science, technology, and society.

HT.1.1 Students describe renewable energy technologies being explored today.

Example: Students research and write a short paper on current development of renewable energy technologies.

(R) Essential Learning Expectation -Resources – Resources are a critical part of today's society. Many of our natural resources are non-renewable and the students will be able to provide several ways to conserve energy.

HR.1.0 Students use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts.

HR.1.1 Students evaluate some advantages of using florescent bulbs over incandescent bulbs.

Example: Students perform a lab using incandescent and florescent bulbs and then calculate the efficiency of these light bulbs.

(I) Essential Learning Expectation -Culture: Historically Native Americans as a culture, had to apply many physics concepts in their everyday survival. The students will explore some of the ways Native Americans utilized physics in their daily lives in the past and in the present.

HI.1.0 Students identify scientific contributions made by different cultures and how scientific developments have impacted human activity and culture.

HI.1.1 Students will explain some of the ways Native Americans utilized physics in their daily lives in the past and in the present.

Example: Students will provide a writing sample for the second semester of physics by explaining some aspect of the way Native Americans utilize(d) physics in their daily lives in the past or in the present.

AP Chemistry Required Topic List

I. Newtonian Mechanics

A. Kinematics (including vectors, vector algebra, components of vectors, coordinate systems, displacement, velocity and acceleration)
   1. Motion in one dimension
   2. Motion in two dimensions, including projectile motion

B. Newton's Laws of Motion
   1. Static equilibrium (first law)
   2. Dynamics of a single particle (second law)
   3. Systems of two or more objects (third law)

C. Work, energy, power
   1. Work and work–energy theorem
   2. Forces and potential energy

3. Conservation of energy
4. Power

D. Systems of particles, linear momentum
   1. Center of mass
   2. Impulse and momentum
   3. Conservation of linear momentum, collisions

E. Circular motion and rotation
   1. Uniform circular motion
   2. Torque and rotational statics

F. Oscillations and gravitation
   1. Simple harmonic motion (dynamics and energy relationships)
   2. Mass on a spring
   3. Pendulum and other oscillations
   4. Newton's law of gravity
   5. Orbits of planets and satellites
      a. Circular

II. Fluid Mechanics and Thermal Physics

B. Fluid Mechanics
   1. Hydrostatic pressure
   2. Buoyancy
   3. Fluid flow continuity
   4. Bernoulli's equation

B. Temperature and heat
   1. Mechanical equivalent of heat
   2. Heat transfer and thermal expansion

C. Kinetic theory and thermodynamics
   1. Ideal gases
      a. Kinetic model
      b. Ideal gas law
   2. Laws of thermodynamics
      a. First law (including processes on pV diagrams)
      b. Second law (including heat engines)

III. Electricity and Magnetism

A. Electrostatics
   1. Charge and Coulomb's law
   2. Electric field and electric potential (including point charges)

B. Conductors, capacitors, dielectrics
   1. Electrostatics with conductors
   2. Capacitors
      a. Capacitance
      b. Parallel plate

C. Electric circuits
   1. Current, resistance, power
   2. Steady-state direct current circuits with batteries and resistors only
   3. Capacitors in circuits
      a. Steady state

D. Magnetic Fields
   1. Forces on moving charges in magnetic fields

2. Forces on current-carrying wires in magnetic fields
3. Fields of long current-carrying wires

E. Electromagnetism
1. Electromagnetic induction (including Faraday's law and Lenz's law)

IV. Waves and Optics

A. Wave motion (including sound)
1. Traveling waves
2. Wave propagation
3. Standing waves
4. Superposition

B. Physical optics
1. Interference and diffraction
2. Dispersion of light and the electromagnetic spectrum

C. Geometric optics
1. Reflection and refraction
2. Mirrors
3. Lenses

V. Atomic and Nuclear Physics

A. Atomic physics and quantum effects
1. Photons, the photoelectric effect, Compton scattering, x-rays
2. Atomic energy levels
3. Wave-particle duality

B. Nuclear physics
1. Nuclear reactions (including conservation of mass number and charge)
2. Mass–energy equivalence

Science Adoption Materials

Grade Level	Topic	Title	Publisher	Copyright
Kindergarten	General Science	HSP Science	Harcourt	2009
First Grade	General Science	Houghton Mifflin Science	Houghton Mifflin	2007
Second Grade	General Science	Houghton Mifflin Science	Houghton Mifflin	2007
Third Grade	Life, Earth & Physical Science	Houghton Mifflin Science	Houghton Mifflin	2007
Fourth Grade	Life, Earth & Physical Science	Houghton Mifflin Science	Houghton Mifflin	2007
Fifth Grade	Physical Science	Houghton Mifflin Science - Physical Science	Houghton Mifflin	2007
Sixth Grade	Earth Science	Glencoe Science – Earth Science	Glencoe/McGraw-Hill	2008
Seventh Grade	Life Science	Glencoe Life Science	Glencoe	2002
Eighth Grade	Physical Science	Introduction to Physical Science	Glencoe/McGraw-Hill	2008
Ninth Grade	Earth Science			
Tenth Grade	Biology	Glencoe Biology	Glencoe/McGraw-Hill	2009
Tenth-Twelfth Grades	Chemistry	World of Chemistry	McDougal/Little	2002
Tenth-Twelfth Grades	Physics	Physics: Principles & Problems	Glencoe	2008
Eleventh & Twelfth Grade	Applied Bio-Chemistry & Forensics	Environmental Science	Pearson	2008
Eleventh & Twelfth Grade	Applied Bio-Chemistry & Forensics	Forensic Science	Prentice Hall	2007
Eleventh-Twelfth Grades	Advanced Placement Biology	Biology	Campbell	2009
Eleventh & Twelfth Grade	Advanced Placement Chemistry	Chemistry: The Central Science	Pearson	2009
Eleventh & Twelfth Grade	Advanced Placement Physics	Physics for Scientists & Engineers	Pearson	2008

Montana Science Content Standards
Introduction

In 2005 the Montana Board of Public Education initiated the Standards Revision Project to assure Montana citizens that its public schools are providing **all** children of our great state with challenging academic expectations. The Montana Board of Public Education is charged with the responsibility of leading a process of standards revision that meets the following guiding principles.

Revised learning standards which are academic in focus, rigorous but attainable, readily understandable, and designed to measure the progress of students toward meeting them, will lead to the improvement of Montana's schools and a brighter future for our people.

Revised standards must clearly and consistently identify what students should know, understand and be able to do. Parents, educators, and the greater Montana community must be involved in the revision process. Revised standards will provide a framework to help guide local curriculum and instruction, encouraging school districts and teachers to place emphasis on critical areas of learning. In addition, standards should be measured and made known to the Montana public.

With the vital purpose of improving Montana's schools as our goal, the Montana Board of Public Education sets forth the following criteria to guide the Standards Revision:

1. Standards will be academic in nature and content specific.
2. Standards will be challenging and rigorous.
3. Standards will be clear, understandable and free of jargon.
4. Standards will be measurable.
5. Standards will address diversity specifically fulfilling the commitment to implementing MCA 20-1-501, Indian Education for All.

With the purpose of developing a successful and useful product, the Montana Board of Public Education sets forth the following process to guide the Montana Standards Revision:

1. 1Use the existing Montana Standards Framework - current accreditation program delivery and foundation standards, content and performance standards and
    a. benchmarks, and existing structure (4^{th}, 8^{th}, and upon graduation);
2. Use proven practices from Montana classrooms;
3. Consider international, national and other states' standards;
4. Consider entrance expectations for workplace and postsecondary education;
5. Consider achievement and other related data;
6. Consider other research e.g., Education Northwest, School Redesign Network, National Study of School Evaluation, etc.;
7. Consider comments from professional education associations;
8. Consider comments from tribal and school district educators;
9. Consider recommendations from the Montana Advisory Council for Indian Education; and
10. Involve the Montana public.

Pursuant to Article X Sect 1(2) of the Constitution of the state of Mo ntana and statutes §20-1-501 and §20-9-309 2(c) MCA, the implementation of these standards must incorporate th e distinct and unique cultural heritage of Montana American Indians.

Components of the Science Content Standards Framework

The Science Content Standards Framework is a set of agreements, rationales, and rules that provides the foundation for standards-based science education in Montana. This framework is the blueprint for further development of key components, such as Essential Learning Expectations, Performance Rubrics, and curriculum. The content standards framework contains:

- K-12 content standards;
- rationale for each content standard;
- benchmarks at the end of grade 4, end of grade 8, and upon graduation;
- performance descriptors at the levels of novice, nearing proficiency, proficient and advanced;
- a glossary; and
- works cited.

In order to use this framework effectively, it is essential to understand the distinctions between and intended purpose of its various components.

Content Standards: The six science content standards indicate what all students should know, understand, and be able to do in science. Their purpose is to guide the science curriculum and to communicate the breadth of the science to be taught to all students. A district's curriculum should be designed so that learning encompasses all six standards.

Rationales: Outlines the fundamental reasons for each of the content standards and provides the basis for the knowledge and skills included in the benchmarks.

Benchmarks: The benchmarks define expectations for students' scientific knowledge and skills along a developmental continuum. They define expectations for proficient students at the end of grade 4, end of grade 8, and upon graduation. Their purpose is to state clearly and specifically what the students should know and be able to do within each content standard. A district's curriculum should include the entire progression of knowledge contained in the benchmarks.

Performance Descriptors: Performance descriptors define how well students apply the knowledge and skills they have acquired. They gauge the level to which benchmarks have been attained in terms of range, frequency, facility, depth, creativity and quality. Achievement of curricular goals is assessed by the performance descriptors.

Science is an inquiry process used to investigate natural phenomena, resulting in the formation of theories verified by directed observations. Inquiry challenges students to solve problems by observing and collecting data and constructing inferences from those data. In doing so, students acquire knowledge and develop a rich understanding of concepts, principles, models, and theories (National Research Council, *National Science Education Standards* 214). Inquiry requires the use of scientific thinking skills to address open-ended problems through non-prescriptive procedures and allows students to construct their own knowledge of the specific concepts. This validates different ways of gathering, synthesizing and communicating knowledge. Scientific theories are challengeable and changeable. Data used to support or contradict them must be reproducible.

A goal of science education ". . . is to help students recognize the difference between personal opinion and knowledge gained through scientific investigation and debate" (*Science Framework for the 2005 National Assessment of Educational Progress* 8). "Inquiry is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. Students will engage in selected aspects of inquiry as they learn the scientific way of knowing the natural world, but they also should develop the capacity to conduct complete inquiries" (National Research Council, *National Science Education Standards* 23).

Although science as a body of knowledge is ever changing, the processes of science are constant. In scientific inquiry, a problem is identified, pertinent data is gathered, hypotheses are formulated, experiments are performed, the results are interpreted, and conclusions are drawn. Science education strengthens students' investigative skills and fosters their understanding of the world. Students acquire and apply critical thinking and problem-solving skills necessary to participate as citizens in dynamic, global technological societies. Thinking skills, for example, observing, measuring, classifying, predicting, deducing, and inferring are given meaning by the context of the subject matter being studied (*Science Framework for the 2005 National Assessment of Educational Progress* 8).

The unifying concepts and processes of science provide connections between and among traditional scientific disciplines. The unifying concepts and processes woven into the Montana Standards for Science include: systems, order, and organization; evidence, models and explanation; constancy, change, and measurement; evolution and equilibrium; and form and function. These concepts and processes must be experienced in a developmentally appropriate manner during K-12 science education.

Science Content Standard 1

Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.

Rationale

Students must understand the process of science—how information is gathered, evaluated and communicated to others. Learning by inquiry mirrors the process of science itself. The knowledge and skills related to scientific inquiry enable students to understand how science works. Inquiry allows students to construct an understanding of scientific facts, principles, concepts and applications. In addition, scientific inquiry stimulates student interest, motivation and creativity.

Safety is a fundamental concern in all experimental science. Appropriate safety procedures must be applied when storing, using, and caring for materials.

Benchmarks

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
1.1 develop the abilities necessary to safely conduct scientific inquiry, including (a step-by-step sequence is not implied): (a) asking questions about objects, events, and organisms in the environment, (b) planning and conducting simple investigations	**1.1** identify a question, determine relevant variables and a control, formulate a testable hypothesis, plan and predict the outcome of an investigation, safely conduct scientific investigation, and compare and analyze data	**1.1** generate a question, identify dependent and independent variables, formulate testable, multiple hypotheses, plan an investigation, predict its outcome, safely conduct the scientific investigations, and collect and analyze data
1.2 select and use appropriate tools including technology to make measurements (including metric units) and represent results of basic scientific investigations	**1.2** select and use appropriate tools including technology to make measurements (in metric units), gather, process and analyze data from scientific investigations	**1.2** select and use appropriate tools including technology to make measurements (in metric units), gather, process and analyze data from scientific investigations using appropriate mathematical analysis, error analysis, and graphical representation

Science Content Standard 1

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
1.3 use data to describe and communicate the results of scientific investigations	**1.3** review, communicate and defend results of investigations, including considering alternative explanations	**1.3** review evidence, communicate and defend results, and recognize that the results of a scientific investigation are always open to revision by further investigations. (e.g., through graphical representation or charts)
1.4 use models that illustrate simple concepts and compare those models to the actual phenomenon	**1.4** create models to illustrate scientific concepts and use the model to predict change (e.g., computer simulation, stream table, graphic representation)	**1.4** analyze observations and explain with scientific understanding to develop a plausible model (e.g., atom, expanding universe)
1.5 identify a valid test in an investigation	**1.5** identify strengths and weakness in an investigation design	**1.5** identify strengths, weaknesses, and assess the validity of the experimental design of an investigation through analysis and evaluation
1.6 identify how observations of nature form an essential base of knowledge among the Montana American Indians	**1.6** compare how observations of nature form an essential base of knowledge among the Montana American Indians	**1.6** explain how observations of nature form an essential base of knowledge among the Montana American Indians

Science Content Standard 2

Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.

Rationale

Matter exists in a variety of forms. All physical interactions involve changes in energy. Therefore, knowledge of matter and energy is essential to interpreting, explaining, predicting, and influencing change in our world.

Benchmarks

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
2.1 create mixtures and separate them based on different physical properties (e.g., salt and sand, iron filings and soil, oil and water)	**2.1** classify, describe, and manipulate the physical models of matter in terms of: elements, and compounds, pure substances and mixtures, atoms, and molecules	**2.1** describe the structure of atoms, including knowledge of (a) subatomic particles and their relative masses, charges, and locations within the atom, (b) the electrical and nuclear forces that hold the atom together, (c) fission and fusion, and (d) radioactive decay
2.2 examine, measure, describe, compare and classify objects in terms of common physical properties	**2.2** examine, describe, compare and classify objects and substances based on common physical properties and simple chemical properties	**2.2** explain how the particulate-level structure and properties of matter affect its macroscopic properties, including the effect of (a) valence electrons on the chemical properties of elements and the resulting periodic trends in these properties, (b) chemical bonding,(c) molecular geometry and intermolecular forces, (d) kinetic molecular theory on phases of matter, and (e) carbon-carbon atom bonding on biomolecules

Science Content Standard 2

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
2.3 identify the basic characteristics of light, heat, motion, magnetism, electricity and sound	**2.3** describe energy and compare and contrast the energy transformations and the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves	**2.3** describe the major features associated with chemical reactions, including (a) giving examples of reactions important to industry and living organisms, (b) energy changes associated with chemical changes, (c) classes of chemical reactions, (d) rates of reactions, and (e) the role of catalysts
2.4 model and explain that matter exists as solids, liquids, and gases and can change from one form to another	**2.4** model and explain the states of matter are dependent upon the quantity of energy present in the system and describe what will change and what will remain unchanged at the particulate level when matter experiences an external force or energy change	**2.4** identify, measure, calculate, and analyze relationships associated with matter and energy transfer or transformations, and the associated conservation of mass
2.5 identify that the position of an object can be described by its location relative to another object and its motions described, and measured by external forces acting upon it	**2.5** describe and explain the motion of an object in terms of its position, direction, and speed as well as the forces acting upon it	**2.5** explain the interactions between motions and forces, including (a) the laws of motion and (b) an understanding of the gravitational and electromagnetic forces
2.6 identify, build, and describe mechanical systems and the forces acting within those systems	**2.6** identify, build, describe, measure, and analyze mechanical systems (e.g., simple and complex compound machines) and describe the forces acting within those systems	**2.6** explain how energy is stored, transferred, and transformed, including (a) the conservation of energy, (b) kinetic and potential energy and energy contained by a field, (c) heat energy and atomic and molecular motion, and (d) energy tends to change from concentrated to diffuse
2.7 observe, measure and manipulate forms of energy: sound, light, heat, electrical, magnetic	**2.7** give examples and describe how energy is transferred and conserved (e.g.; electric to light and heat [light bulb], chemical to mechanical [fuel to propulsion])	**2.7** describe how energy and matter interact, including (a) waves, (b) the electromagnetic spectrum, (c) quantization of energy, and (d) insulators and conductors

Science Content Standard 3

Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment.

Rationale

Students gain a better understanding of the world around them if they study a variety of organisms, both microscopic and macroscopic. Through the study of similarities and differences of organisms, students learn the importance of classification and the diversity of living organisms. The understanding of diversity helps students understand biological evolution and life's natural processes (e.g., cycles, growth, and reproduction). Structure, function, body organization, growth and development, health and disease are important aspects to the study of life. The study of living systems provides students important information about how humans critically impact Earth's biomes.

Benchmarks

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
3.1 identify that plants and animals have structures and systems that serve different functions for growth, survival, and reproduction	**3.1** compare the structure and function of prokaryotic cells (bacteria) and eukaryotic cells (plant, animal, etc.) including the levels of organization of the structure and function, particularly with humans	**3.1** investigate and use appropriate technology to demonstrate that cells have common features including differences that determine function and that they are composed of common building blocks (e.g., proteins, carbohydrates, nucleic acids, lipids)
3.2 identify, measure, and describe basic requirements of energy and nutritional needs for an organism.	**3.2** explain how organisms and systems of organisms obtain and use energy resources to maintain stable conditions (e.g., food webs, photosynthesis, respiration)	**3.2** describe and explain the complex processes involved in energy use in cell maintenance, growth, repair and development
3.3 describe and use models that trace the life cycles of different plants and animals and discuss how they differ from species to species	**3.3** communicate the differences in the reproductive processes of a variety of plants and animals using the principles of genetic modeling (e.g., Punnett squares)	**3.3** model the structure of DNA and protein synthesis, discuss the molecular basis of heredity, and explain how it contributes to the diversity of life

Science Content Standard 3

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
3.4 explain cause and effect relationships between nonliving and living components within ecosystems; and explain individual response to the changes in the environment including identifying differences between inherited, instinctual, and learned behaviors	**3.4** investigate and explain the interdependent nature of populations and communities in the environment and describe how species in these populations adapt by evolving	**3.4** predict and model the interaction of biotic and abiotic factors that affect populations through natural selection, and explain how this contributes to the evolution of species over time
3.5 create and use a classification system to group a variety of plants and animals according to their similarities and differences	**3.5** create and use a basic classification scheme to identify plants and animals	**3.5** generate and apply biological classification schemes to infer and discuss the degree of divergence between ecosystems

Science Content Standard 4

Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space.

Rationale

By studying Earth, its composition, history and the processes that shape it, students gain a better understanding of the planet on which they live. Changes in lithosphere, atmosphere, and hydrosphere have profound effects on human existence. Knowledge of the Solar System and the universe helps students make predictions about Earth and informed decisions about the future.

Benchmarks

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
4.1 describe and give examples of Earth's changing features	**4.1** model and explain the internal structure of the Earth and describe the formation and composition of Earth's external features in terms of the rock cycle and plate tectonics and constructive and destructive forces	**4.1** understand the theory of plate tectonics and how it explains the inter-relationship between earthquakes, volcanoes, and sea floor spreading
4.2 describe and measure the physical properties of Earth's basic materials (including soil, rocks, water and gases) and the resources they provide	**4.2** differentiate between rock types and mineral types and classify both by how they are formed and the utilization by humans	**4.2** identify and classify rocks and minerals based on physical and chemical properties and the utilization by humans (e.g., natural resources, building materials)
4.3 investigate fossils and make inferences about life, the plants, animals, and the environment at that time	**4.3** use fossils to describe the geological timeline	**4.3** explain scientific theories about how fossils are used as evidence of changes over time
4.4 observe and describe the water cycle and the local weather and demonstrate how weather conditions are measured	**4.4** describe the water cycle, the composition and structure of the atmosphere, and the impact of oceans on large-scale weather patterns	**4.4** collect and analyze local and regional weather data to make inferences and predictions about weather patterns; explain factors influencing global weather and climate; and describe the impact on Earth of fluctuations in weather and climate (e.g., drought, surface and ground water, glacial instability)

Science Content Standard 4

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
4.5 identify seasons and explain the difference between weather and climate	**4.5** describe and model the motion and tilt of Earth in relation to the sun, and explain the concepts of day, night, seasons, year, and climatic changes	**4.5** explain the impact of terrestrial, solar, oceanic, and atmosphere conditions on global climatic patterns
4.6 identify objects (e.g., moon, stars, meteors) in the sky and their patterns of movement and explain that light and heat comes from a star called the sun	**4.6** describe the Earth, moon, planets and other objects in space in terms of size, force of gravity, structure, and movement in relation to the sun	**4.6** describe the origin, location, and evolution of stars and their planetary systems in respect to the solar system, the milky way, the local galactic group, and the universe
4.7 identify technology and methods used for space exploration (e.g., star parties, space shuttles, telescopes)	**4.7** identify scientific theories about the origin and evolution of the Earth and the solar system	**4.7** relate how evidence from advanced technology applied to scientific investigations (e.g., large telescopes and space-borne observatories), has dramatically impacted our understanding of the origin, size, and evolution of the universe

Science Content Standard 5

Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.

Rationale

Our world and human activity is shaped in many ways by the advances in science. Science and technology are parallel in that science drives technological advances and these advances drive future scientific endeavors. Many different cultures contribute to science and technology. These advances affect different societies in different ways. It is vital that students understand the interrelationships of science, technology and human activity.

Benchmarks

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
5.1 describe and discuss examples of how people use science and technology	**5.1** describe the specific fields of science and technology as they relate to occupations within those fields	**5.1** predict how key factors (e.g., technology, competitiveness, and world events) affect the development and acceptance of scientific thought
5.2 describe a scientific or technological innovation that impacts communities, cultures, and societies	**5.2** apply scientific knowledge and process skills to understand issues and everyday events	**5.2** give examples of scientific innovation challenging commonly held perceptions
5.3 simulate scientific collaboration by sharing and communicating ideas to identify and describe problems	**5.3** simulate collaborative problem solving and give examples of how scientific knowledge and technology are shared with other scientists and the public	**5.3** evaluate the ongoing, collaborative scientific process by gathering and critiquing information
5.4 use scientific knowledge to make inferences and propose solutions for simple environmental problems	**5.4** use scientific knowledge to investigate problems and their proposed solutions and evaluate those solutions while considering environmental impacts	**5.4** analyze benefits, limitations, costs, consequences, and ethics involved in using scientific and technological innovations (e.g., biotechnology, environmental issues)
5.5 identify how the knowledge of science and technology influences the development of the Montana American Indian cultures	**5.5** describe how the knowledge of science and technology influences the development of the Montana American Indian cultures	**5.5** explain how the knowledge of science and technology applies to contemporary Montana American Indian communities (e.g., natural resources development, management and conservation)

Science Content Standard 6

Students understand historical developments in science and technology.

Rationale

Students need to understand that scientific knowledge was influenced greatly by societal influences. They also need to know that scientific and technological advances have influenced society. For instance, the development of the atom bomb and the discovery that microbes cause disease both had a major impact on society. Therefore, the use of history in school science programs is necessary to clarify different aspects of scientific discovery, to understand that scientific knowledge is publicly shared and to understand the role that science has played in the development of various cultures.

Benchmarks

A proficient student will:

End of Grade 4	End of Grade 8	Upon Graduation
6.1 give historical examples of scientific and technological contributions to communities, cultures and societies, including Montana American Indian examples	**6.1** give examples of scientific discoveries and describe the interrelationship between technological advances and scientific understanding, including Montana American Indian examples	**6.1** analyze and illustrate the historical impact of scientific and technological advances, including Montana American Indian examples
6.2 describe how scientific inquiry has produced much knowledge about the world and a variety of contributions toward understanding events and phenomenon within the universe	**6.2** identify major milestones in science that have impacted science, technology, and society	**6.2** trace developments that demonstrate scientific knowledge is subject to change as new evidence becomes available
6.3 describe science as a human endeavor and an ongoing process	**6.3** describe and explain science as a human endeavor and an ongoing process	**6.3** describe, explain, and analyze science as a human endeavor and an ongoing process

National Science Education Standards: An Overview

In a world filled with the products of scientific inquiry, scientific literacy has become a necessity for everyone. Everyone needs to use scientific information to make choices that arise every day. Everyone needs to be able to engage intelligently in public discourse and debate about important issues that involve science and technology. And everyone deserves to share in the excitement and personal fulfillment that can come from understanding and learning about the natural world.

Scientific literacy also is of increasing importance in the workplace. More and more jobs demand advanced skills, requiring that people be able to learn, reason, think creatively, make decisions, and solve problems. An understanding of science and the processes of science contributes in an essential way to these skills. Other countries are investing heavily to create scientifically and technically literate work forces. To keep pace in global markets, the United States needs to have an equally capable citizenry.

The National Science Education Standards present a vision of a scientifically literate populace. They outline what students need to know, understand, and be able to do to be scientifically literate at different grade levels. They describe an educational system in which all students demonstrate high levels of performance, in which teachers are empowered to make the decisions essential for effective learning, in which interlocking communities of teachers and students are focused on learning science, and in which supportive educational programs and systems nurture achievement. The Standards point toward a future that is challenging but attainable—which is why they are written in the present tense.

The intent of the Standards can be expressed in a single phrase: Science standards for all students. The phrase embodies both excellence and equity. The Standards apply to all students, regardless of age, gender, cultural or ethnic background, disabilities, aspirations, or interest and motivation in science. Different students will achieve understanding in different ways, and different students will achieve different degrees of depth and breadth of understanding depending on interest, ability, and context. But all students can develop the knowledge and skills described in the Standards, even as some students go well beyond these levels.

By emphasizing both excellence and equity, the Standards also highlight the need to give students the opportunity to learn science. Students cannot achieve high levels of performance without access to skilled professional teachers, adequate classroom time, a rich array of learning materials, accommodating work spaces, and the resources of the communities surrounding their schools. Responsibility for providing this support falls on all those involved with the science education system.

Implementing the Standards will require major changes in much of this country's science education. The Standards rest on the premise that science is an active process. Learning science is something that students do, not something that is done to them. "Hands-on" activities, while essential, are not enough. Students must have "minds-on" experiences as well.

The Standards call for more than "science as process," in which students learn such skills as observing, inferring, and experimenting. Inquiry is central to science learning. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations. In this way, students actively develop their understanding of science by combining scientific knowledge with reasoning and thinking skills.

The importance of inquiry does not imply that all teachers should pursue a single approach to teaching science. Just as inquiry has many different facets, so teachers need to use many different strategies to develop the understandings and abilities described in the Standards.

Nor should the Standards be seen as requiring a specific curriculum. A curriculum is the way content is organized and presented in the classroom. The content embodied in the Standards can be organized and presented with many different emphases and perspectives in many different curricula.

Instead, the Standards provide criteria that people at the local, state, and national levels can use to judge whether particular actions will serve the vision of a scientifically literate society. They bring coordination, consistency, and coherence to the improvement of science education. If people take risks in the name of improving science education, they know they will be supported by policies and procedures throughout the system. By moving the practices of extraordinary teachers and administrators to the forefront of science education, the Standards take science education beyond the constraints of the present and toward a shared vision of the future.

Hundreds of people cooperated in developing the Standards, including teachers, school administrators, parents, curriculum developers, college faculty and administrators, scientists, engineers, and government officials. These individuals drew heavily upon earlier reform efforts, research into teaching and learning, accounts of exemplary practice, and their own personal experience and insights. In turn, thousands of people reviewed various drafts of the standards. That open, iterative process produced a broad consensus about the elements of science education needed to permit all students to achieve excellence.

Continuing dialogues between those who set and implement standards at the national, state, and local levels will ensure that the Standards evolve to meet the needs of students, educators, and society at large. The National Science Education Standards should be seen as a dynamic understanding that is always open to review and revision.

Science Content Standards

The science content standards outline what students should know, understand, and be able to do in the natural sciences over the course of K-12 education. They are divided into eight categories:

- Unifying concepts and processes in science.
- Science as inquiry.
- Physical science.
- Life science.
- Earth and space science.
- Science and technology.
- Science in personal and social perspective.
- History and nature of science.

The first category is presented for all grade levels, because the understandings and abilities associated with these concepts need to be developed throughout a student's educational experiences. The other seven categories are clustered for grade levels K-4, 5–8, and 9–12.

Indian Education for All

Lewistown Public Schools is committed to developing for all students an understanding of American and Montana Indian people and their histories, fostering respect for their cultures. In view of the unique role of the American Indian peoples in the development of the United States and the experience of Montana tribes in particular, their history and culture will be integrated wherever appropriate in the instruction of Lewistown students, in accordance with the state constitution, statues, and curriculum standards.

ESSENTIAL UNDERSTANDINGS REGARDING MONTANA INDIANS

1. There is great diversity among the 12 tribal Nations of Montana in their languages, cultures, histories, and governments. Each Nation has a distinct and unique cultural heritage that contributes to modern Montana.
2. There is great diversity among individual American Indians as identity is developed, defined, and redefined by many entities, organizations, and people. There is a continuum of Indian identity ranging from assimilated to traditional and this is unique to each individual. There is no generic American Indian.
3. The ideologies of Native traditional beliefs and spirituality persist into modern day life as tribal cultures, traditions and languages are still practiced by many American Indian people and are incorporated into how tribes govern and manage their affairs. Additionally, each tribe has their own oral history beginning with their genesis that is a valid as written histories. These histories pre-date the “discovery” of North America.
4. Reservations are land that have been reserved by the tribes for their own use through treaties and was not “given” to them. The principle that land should be acquired from the Indians only through their consent with treaties involved three assumptions:
    a. That both parties to treaties were sovereign powers.
    b. Those Indian tribes had some form of transferable title to the land.
    c. That acquisition of Indian lands was solely a government matter not to be left to individual colonists.
5. There were many federal policies put into place throughout American history that have impacted Indian people and shape who they are today. Much of Indian history can be related through several major federal policy periods.
6. History is a story most often related through the subjective experience of the teller. Histories are being rediscovered and revised. History told from an Indian perspective conflicts with what most of mainstream history tells us.
7. Under the American legal system, Indian tribes have sovereign powers separate and independent from the federal and state governments. However, the extent and breadth of tribal sovereignty is not the same for each tribe.

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	18

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☒ **Action - Indiv.**

ITEM TITLE: APPROVE CHANGES TO THE FERGUS HIGH SCHOOL RENAISSANCE HANDBOOK

Requested By: Board of Trustees **Prepared By:** Jerry Feller **Date:** 01/09/2012

SUMMARY:

The Board of Trustees needs to approve the recommendation for changes to the selection process for Valedictorian and Salutatorian that are outlined in the Fergus High School Renaissance Handbook as presented by Principal Jerry Feller at the December 12, 2011, Board Meeting.

SUGGESTED ACTION: Approve Changes to the Fergus High School Renaissance Handbook

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 19

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☒ **Action - Indiv.**

ITEM TITLE: APPROVE ACCEPTING THE TEAM NUTRITION TRAINING MINI-GRANT FUNDS

Requested By: Board of Trustees **Prepared By:** Cindy Giese/Matt Lewis **Date:** 01/09/2012

SUMMARY:

The Board of Trustees needs to approve the request to accept a mini-grant from the Office of Public Instruction for participating in the Team Nutrition Training Program as outlined on the attachment.

Lewistown Public Schools was chosen by the Office of Public Instruction (OPI) as one of four schools to participate in the Breakfast Expansion Project which is part of the Team Nutrition Training Program. For participating in this project OPI is awarding the district with a $500 mini-grant.

SUGGESTED ACTION: Approve Accepting Team Nutrition Training Mini-Grant Funds

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

Attachment D– Guidance for Interpreting Cost Principles of Mini-Grants

Use of Team Nutrition Training Grant Funds for Mini-Grants

State agencies that award Team Nutrition (TN) Training Grants in the form of mini-grants to local school districts and/or schools are expected to:

- Provide oversight to these mini-grant recipients to ensure that expenditures authorized under the mini-grants are allowable, allocable, and reasonable.

- Ensure that all expenditures are consistent with all local, State, and Federal policies, regulations, and procedures.

- Ensure that the expenditure does not exceed that which would be incurred by a prudent person under similar circumstances and would qualify as a sound business practice.

- Ensure that *schools* that receive mini-grants are enrolled as TN Schools.

- Ensure that Team Nutrition mini-grant funds support one or more of the Team Nutrition strategies and deliver Team Nutrition messages of healthy eating and being physically active. Team Nutrition strategies and nutrition messages must be part of the objectives and work plan of the mini-grant recipient.

  The TN three behavior-oriented strategies include:
  - Provide ***training and technical assistance*** to child nutrition foodservice professionals to enable them to prepare and serve nutritious meals that appeal to students and meet the recommendations of the Dietary Guidelines for Americans.
  - Promote ***nutrition curriculum and education*** in schools through multiple communication channels to reinforce positive nutrition messages and encourage students to make healthy food and physical activity choices as part of a healthy lifestyle.
  - Build ***school and community support*** for creating healthy school environments that are conducive to healthy eating and physical activity.

- Ensure that all activities and expenses specified in the mini-grants support and promote children's participation in the school meal programs.

Some general guidance for allowability of selected items of cost under the Cost Principles:

Food Cost

Team Nutrition funds may be used to pay for food if the food is part of a specific educational activity. For example, conducting a classroom taste test of specific fruits or

vegetables, or demonstrating the making of simple, healthy snacks, is a reasonable request. The use of the food must be related to nutrition education activities specified under objectives of the mini-grant proposal or work plan. Team Nutrition funds should **not** be used to purchase a meal for anyone.

Food and Nutrition Equipment
Team Nutrition funds may **not** be used to purchase foodservice operation equipment, such as salad bar equipment, refrigerators, food processors, etc. However, small mobile kitchen equipment to be used for classroom food preparation demonstration or hands on food experiences may be permissible **if** such activities are part of the integrated nutrition education lessons specified under the objectives of the proposed mini-grants. Teachers' commitment to teach nutrition in the classroom and share the use of the purchased mobile kitchen equipment among other teachers within the same school building, if applicable, should be clearly indicated in the mini-grant proposal. A total expenditure of food and nutrition-related equipment purchases should not exceed 10% of the total mini-grant awarded.

Medical Equipment
Team Nutrition funds may **not** be used to purchase medical equipment or health services related to health assessments such as obtaining clinical data on nutritional status, chronic disease or chronic disease risk assessment. Therefore, measurement of height, weight, skin fold thickness, blood pressure, cholesterol, and blood glucose and iron level are not allowable costs under the TN grant. Although the Body Mass Index (BMI) concept may still be part of the nutrition education component for the age-appropriate students, obtaining the height and weight status should come from the school nurses' office, students' health care provider or the individual student's knowledge.

Physical Activity
Eating healthy and being physically active are desired behavior outcomes of TN. States are encouraged to coordinate with community, youth and recreational organizations, and others whose primary mission is to make regular opportunities for physical activity accessible to students. Educational and program materials developed with TN funds to promote and reinforce physical activity for all target audiences must include messages that link nutrition and physical activity, such as "balance your day with food and play" (Eat Smart. Play Hard.™). While it might be permissible to use mini-grant funds to purchase posters, pamphlets, audiovisuals, and small, consumable supplies such as a few classroom jump ropes or hoola hoops to help teachers promote life-long physical activity habits as part of a classroom nutrition education activity, Team Nutrition funds are **not** intended to purchase pedometers or award pins for everyone, or to subsidize the regular physical education program in the school. The costs associated with physical activities should not significantly detract from funds for promoting healthy eating.

Team Nutrition funds may **not** be used to purchase playground equipment, exercise or sports' equipment, sports lessons (swimming, skating, etc.) or to pay for the services of a for-profit physical fitness organization. Students should not be given the message that they must belong to a health club in order to be physically active. Schools are

encouraged to look to other funding sources for physical activity such as forming partnerships with local non-profit organizations such as the YMCA, YWCA, Sierra Club and others in providing the kind of resources that might continue to supplement this type of activity when the Team Nutrition grant dollars are no longer available at the school.

Promotional/Incentive Items
The purpose of the Team Nutrition Grants is to promote Team Nutrition messages, not Team Nutrition, itself. Any promotional item or incentive should promote one or more of the Team Nutrition messages or refer the target audience to a website that provides the Team Nutrition messages. Any cost associated with such promotions or incentives must be reasonable in comparison to the mini-grant funding.

Staff Development and/or Substitute Pay
If adequate funding is available and acceptable to the State agency, Team Nutrition funds may be used to hire a substitute for the teacher, school administrator, or school foodservice staff representative to attend training, participate in planning sessions or other avenues for staff development in nutrition education. For accounting purposes, a record of who attended the session, how long it lasted, and the purpose of the session is required.

Gardening
It is recognized that some of the Team Nutrition materials promote activities related to gardening, and gardening is an excellent way to involve the entire school, parents, and the community in a Team Nutrition activity. If the plans submitted by the mini-grant recipient(s) specify a gardening activity, Team Nutrition funds may be used to purchase a reasonable amount of supplies (e.g., seeds, potting soil and starter pots) for classroom gardening projects or even a few shovels and hoes for a school gardening project. Funds may **not** be used to purchase bulk soils such as topsoil, irrigation supplies, fencing or any type of large equipment such as a tiller or greenhouse.

Schools are encouraged to partner with local gardening supply sources for creating sustainability of the gardening project after the TN Training Grant period. Schools may also contact their local Cooperative Extension office to see if there is a Master Gardeners' program that can assist with the gardening project.

Summary
There is limited funding to accomplish Team TN's important goal of improving children's lifelong eating and physical activity habits. State agencies will want to ensure that the best use of the limited funding is achieved. In approving mini-grant requests, a positive answer should always be sought to the following questions:

1. Is the cost applicable to my grant and the mini-grant's objectives?
2. Is the cost allowable according to program cost principles?
3. Is the cost reasonable?

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 20

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☒ **Action - Indiv.**

ITEM TITLE: APPROVE REQUEST FOR EXTENDED LEAVE OF ABSENCE

Requested By: Board of Trustees **Prepared By:** Jason Butcher **Date:** 01/09/2012

SUMMARY:

The Board of Trustees needs to approve an extension of leave beyond the standard 30 days for maternity leave as requested by Maggie Hodik in the attached letter.

According to the 2010-2012 Collective Bargaining Agreement, extended leave of absence without salary shall be provided for such reasons as family illness, involuntary military service, and maternity. Requests shall be made in writing, stating the desired length of time of the leave. The teaching employee shall be informed in writing as to the action taken by the Board of Trustees on the request for leave.

SUGGESTED ACTION: Approve Extended Leave of Absence

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

Lewistown School District
215 7th Avenue South
Lewistown, MT 59457
January 3, 2012

Dear School Board Members:

On November 21, 2011 I gave birth to our first child who we named Owen Vincent. I have been on maternity leave since then and have enjoyed the time I have been able to spend with him.

Jodi Henderson is my substitute and has been doing a wonderful job. I was fortunate to have her spend time with me in the classroom prior to my maternity leave. By doing this, she was able to become familiar with my lessons and routines and was well prepared to take over when the time came. We are also in regular communication and I am always available to answer any questions that she may have.

My mother will be coming from the western side of the state to watch our son once I return to work. I realize that the usual time given for maternity leave is 30 days; however, due to the fact that my mother will not be able to be here until a little later, I am requesting to have 33 days of maternity leave which would put my return date as Monday, January 23, 2012.

I appreciate you considering this 3 day extension and thank you for your time.

Sincerely,

Maggie Hodik
Resource Teacher
Garfield Elementary

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	21

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☒ **Action - Indiv.**

ITEM TITLE: APPROVE APPOINTMENT TO THE CENTRAL MONTANA FOUNDATION BOARD OF DIRECTORS

Requested By: Board of Trustees **Prepared By:** Superintendent **Date:** 01/09/2012

SUMMARY:

Jason Butcher, Superintendent, represents the Lewistown Public Schools on the Board of Directors for the Central Montana Foundation (CMF). Mr. Butcher's current term expired on December 31, 2011.

The Board of Trustees needs to approve the appointment of Jason to the CMF Board of Directors for another term.

SUGGESTED ACTION: Approve Appointment to the Central Montana Foundation Board of Directors

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date 01/09/2012

Agenda Item No. 22

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☒ **Action - Indiv.**

ITEM TITLE: APPROVE PERSONNEL REPORT

Requested By: Board of Trustees **Prepared By:** Jason Butcher **Date:** 01/09/2012

SUMMARY:

Attached is the Personnel Report for your review.

SUGGESTED ACTION: Approve All Items

☒ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

LEWISTOWN PUBLIC SCHOOLS
LEWISTOWN, MONTANA

PERSONNEL REPORT FOR BOARD ACTION

DATE: January 9, 2012

EMPLOYEE NAME	*POSITION*	*LOCATION*	*RECOMMENDED ACTION*	*EFFECTIVE DATE*	*COMMENTS*
HODGES, Sheryl	Resource Paraprofessional	Fergus High School	Approve letter of resignation	June 1, 2012	See attached letter.

Sheryl Hodges
820 West Erie Street
Lewistown, MT 59457

January 3, 2012

To: Jason Butcher, Superintendent & Board of Trustees
Lewistown School District #1
217 7th Avenue South
Lewistown, MT 59457

Dear Mr. Butcher and Board Members:

It is with some regret but also with eager anticipation that I inform you of my earlier than planned retirement from my position as Special Education Paraprofessional at Fergus High School due to personal reasons effective as of the end of the 2011-2012 school year.

It has been a unique and very rewarding experience to work with my student starting in spring of 2007 when he was in 8th grade and continuing throughout his high school years plus 2011-2012. I will always remember with joy his face beaming with intense excitement and awe along with his shrieks of delight during his participation in band as well as his observation in the percussion class and choir. Music is the best & most joyful part of his life. I have been so proud to be there to share his activities with his band class during Homecoming Parades, band concerts, graduations and of course being there for him during his participation in his own graduation exercises in May of 2011. We have developed, and worked on many other new learning experiences as well. I have faith he will continue to thrive, learn and develop further skills throughout his life wherever he goes, with whomever he is with.

I want to thank my student's team members and staff in Fergus High School, everyone at the Lewistown CO-OP who assisted my student with his physical therapy, speech and occupational therapy and last but not least, his family. Thank you all for your kind assistance and all of your support.

I am looking forward to family time with my husband as well as our families all around the country. It is indeed time for me and my family.

Sincerely,

Sheryl Hodges
Special Education Paraprofessional
Fergus High School
Lewistown School District #1

EXECUTIVE SESSION

As per the provisions of 2-3-203 Montana Codes Annotated.

The Board Chair, will now call for an Executive Session deeming the demands of individual privacy clearly exceed the merits of public disclosure.

All parties not involved in the Executive Session are asked to leave the Board Room at this time.

LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

BOARD AGENDA ITEM

Meeting Date	**Agenda Item No.**
01/09/2012	23

☐ **Minutes/Claims** ☐ **Board of Trustees** ☐ **Superintendent's Report** ☐ **Action - Consent** ☐ **Action - Indiv.**

ITEM TITLE: **EXECUTIVE SESSION**—SUPERINTENDENT'S EVALUATION

Requested By: Board of Trustees **Prepared By:** _____ **Date:** 01/09/2012

SUMMARY:

The Board of Trustees will go into Executive Session to conduct the Superintendent's Evaluation.

SUGGESTED ACTION: Discussion

☐ **Additional Information Attached** **Estimated cost/fund source** _____

NOTES:

Board Action	Motion	Second	Aye	Nay	Abstain	Other
Bristol						
Irish						
Monger						
Pierce						
Schelle						
Thomas						
Weeden						

THE BOARD OF TRUSTEES OF LEWISTOWN PUBLIC SCHOOLS
Lewistown, Montana

2010-2015 GOALS AND STRATEGIC OBJECTIVES

Lewistown Public Schools, as entrusted by the Lewistown Community, provides children with an accountable, high quality, rigorous education in a safe, nurturing environment; developing the full potential of each child and preparing them for lifelong success in their personal lives and careers, wherever they may be in the world.

Goal Area 1: Measurable Student Achievement

Statement of Intended Outcome, 2010-2015: *Lewistown Public Schools has developed an outstanding educational program that ensures that every student achieves the highest academic performance possible and has multiple opportunities to actively participate in both co-curricular and extra-curricular activities offered by our District. We use a multitude of measures to gauge student performance based on district-created progress goals. We adequately prepare students for their career/job choices and life choices. Our staff is highly supporting and enthusiastic about our differentiated approach to instruction.*

Strategic Objectives:

1. Response to Intervention (RTI) is embraced and consistently implemented by staff in every building in the district and is used to monitor and improve student achievement.
2. The District is consistent in each building in developing and implementing both curricula as well as intervention programs to insure student achievement and success.
3. The District has evaluated the high school graduation requirements and its processes for allowing deviation from the requirements for both college bound and vocation bound students.
4. The District is consistent at all levels in developing and implementing differentiated instruction techniques.

Goal Area 2: Facilities

Statement of Intended Outcome, 2010-2015: *Lewistown Public Schools has developed a state-of-the-art facilities program that meets the needs of our students and staff on a long-term basis. We have prioritized our facility needs and have a plan in place for resources necessary to achieve our facilities program. Our facilities program is fully supported by our community. In planning for our facilities, we have adequately addressed the issue of technology and incorporated that in to our facilities plan.*

Strategic Objectives:

1. Develop a comprehensive plan to address the District's building and facilities needs to insure our physical plant can effectively and efficiently address the needs of our students, staff and community for the next 20 years.
2. Secure community support and funding necessary to implement the comprehensive facilities plan.
3. Use gifting and fund-raising via the Central Montana Foundation to assure long-term funding for critical needs in our buildings and grounds.

Goal Area 3: Community / Parental Engagement

Statement of Intended Outcome, 2010-2015: *Lewistown Public Schools has created an environment of collaboration and transparency with families of students and with our community as a whole. Families of students are actively involved in their children's education. The community is highly engaged in helping provide the best education possible for our children. As a result of our community's and family's commitment to public education, we have established a collaborative approach to solving public education issues that includes our local legislators.*

Strategic Objectives:

1. Develop, implement and maintain a consistent, district-wide effort to involve parents and interested community members in our schools.
2. Implement an accepted and used communication system so that information can be shared quickly and effectively with parents and interested community members and to allow easy and effective communication from parents and interested community members with the Board, administration and district staff.
3. Implement a program whereby those parents and community members interested and willing to advocate for public schools with the legislature and state agencies are empowered to do so.

Goal Area 4: Technology

Statement of Intended Outcome, 2010-2015: *Lewistown Public Schools has developed a technology plan that incorporates regular upgrades of both hardware and software and training of staff on existing and new programs. We have successfully incorporated technology into our facilities and all aspects of our educational program in a methodical and effective manner that prepares our students for the real world. We have systems in place to ensure the safety of our students and compliance with District standards.*

Strategic Objectives:

1. Keep technology infrastructure current and sound (routers, switchers, servers, internet service and work stations). Continue to prevent problems and keep technology accessible (security, filtering, preventative updates).
2. Have implemented steps to leverage social networking and other technology to support better teaching and learning by expanding student-to-student and student-to-faculty connections for collaborating beyond the classroom.
3. Provide staff development to ensure that technology standards are implemented in classrooms district wide.
4. Develop and implement efforts to develop a consistent approach/philosophy by our staff to the use of technology in the classroom as an effective and proven learning tool.
5. Determine how the district should help educate parents about the ways their children use technology (in and out of school, for good and bad reasons).

Goal Area 5: Highly Qualified Staff

Statement of Intended Outcome, 2010-2015: *Lewistown Public Schools has developed a recruitment and retention program to ensure that the District hires and retains high quality, effective personnel. Our teachers and other staff have been provided professional development opportunities that directly correlate to the high academic standards set by the District. Our teachers and other staff have embraced the use of technology into all aspects of our educational programs. The staff shares the vision of the Board in providing differentiated educational programs in order to meet the needs of our students and in achieving the District's high academic standards.*

Strategic Objectives:

1. Implement a consistent, rigorous and fair assessment and evaluation process for staff that is understood and supported by administrators and staff.
2. Professional development is tailored to meet the needs of teachers, administrators, and staff. They are part of the planning and assessment of these opportunities.

<u>Goal Area 6</u>: Fiscal Management/Responsibility

Statement of Intended Outcome, 2010-2015: *Lewistown Public Schools has secured adequate, sustainable funding from the State and has developed a process to prioritize the financial resources that we have according to the educational goals set by the District. We have secured funding sources that are not earmarked for specific causes and have the discretion to determine where funds are needed in order to achieve our high standards and our goals. Through our community engagement initiative, our community understands our budgeting process, they support our schools and they understand our needs and the strategic direction of our District.*

Strategic Objectives:

1. Review all financial processes; streamline and consolidate these processes where possible; find ways to improve efficiencies and accountability in our financial processes while reducing, if possible, staff frustration with them.
2. Seek ways to better involve staff in budget development.
3. Carefully assess specific ways in which we can involve community, staff and the Board in better maintaining a strong and influential presence in the next Montana Legislature (2011).
4. The Lewistown Schools leadership team works with outlying communities to determine what cooperative efforts can be made to make the best use of limited resources.
5. Conclude, prior to August 15, 2011, a review of the Strategic Plan's 1-5 year goals and objectives and insure they still represent appropriate and realistic milestones on our way to our 20-year vision.

School District #1 Mission Statement:

Excellence Today, Success Tomorrow

Core Values of the Lewistown Public Schools:

1. **High Standards**: Lewistown Public Schools upholds high standards and expectations for the Board, staff and students of the District. We strive to provide challenging curriculum taught by innovative leaders in the field of education, utilizing research-based curriculum and implementing best practices.

2. **Student-Centered:** The motivation for everything we do is based upon what is right and best for the children of our community. We ensure the development, well-being and education of students through a variety of academic and extracurricular activities. We assist students in overcoming challenges and help them celebrate their successes, all as part of a plan to maximize the potential of each student.

3. **Effective and Efficient Practices:** Lewistown Public Schools is committed to effective and efficient stewardship of our resources.

4. **Accountability:** Lewistown Public Schools is accountable for all that we do from fiscal management to the performance of students, staff, administration and the Board.

5. **Community Support:** Lewistown Public Schools understands that community support is vital, earned and continually renewed through consistent dedication to quality service. We believe the key to success is found through mutual engagement of the community and the schools, effective interaction between parents, students, staff, administrators, trustees and all elements of the Lewistown Community. We value the trust the community has invested in our public schools and we strive to earn and maintain that trust.

6. **Communication:** Lewistown Public Schools values effective and open communication with parents, students, staff, trustees and the community.

BOARD OF TRUSTEES

Stan Monger, Board Chair
Jeremy Bristol
Joe Irish
Lisa Pierce
Mary Schelle
Barbara Thomas
Monte Weeden

LEWISTOWN PUBLIC SCHOOLS

2011-2012 SCHOOL CALENDAR

A. Pupil Instruction

First Semester — **90 Days**

FIRST QUARTER					DAYS
First Week	Aug	24 -- Aug	26		3
Second Week	Aug	29 -- Sept	2		5
Third Week	Sept	6 -- Sept	9		4
Fourth Week	Sept	12 -- Sept	16		5
Fifth Week	Sept	19 -- Sept	23		5
Sixth Week	Sept	26 -- Sept	30		5
Seventh Week	Oct	3 -- Oct	7		5
Eighth Week	Oct	10 -- Oct	14		5
Ninth Week	Oct	17 -- Oct	19		3
Tenth Week	Oct	24 -- Oct	28		5
					45

SECOND QUARTER					DAYS
First Week	Oct	31 -- Nov	2		3
Second Week	Nov	7 -- Nov	11		5
Third Week	Nov	14 -- Nov	18		5
Fourth Week	Nov	21 -- Nov	22		2
Fifth Week	Nov	28 -- Dec	2		5
Sixth Week	Dec	5 -- Dec	9		5
Seventh Week	Dec	12 -- Dec	16		5
Eighth Week	Dec	19 -- Dec	20		2
Ninth Week	Jan	3 -- Jan	6		4
Tenth Week	Jan	9 -- Jan	13		5
Eleventh Week	Jan	17 -- Jan	20		4
					45

Second Semester — **89 Days**

THIRD QUARTER					DAYS
First Week	Jan	23 -- Jan	27		5
Second Week	Jan	30 -- Feb	3		5
Third Week	Feb	6 -- Feb	10		5
Fourth Week	Feb	13 -- Feb	17		5
Fifth Week	Feb	20 -- Feb	23		4
Sixth Week	Feb	28 -- Mar	2		4
Seventh Week	Mar	5 -- Mar	9		5
Eighth Week	Mar	12 -- Mar	16		5
Ninth Week	Mar	19 -- Mar	23		5
					43

FOURTH QUARTER					DAYS
First Week	Mar	26 -- Mar	30		5
Second Week	Apr	2 -- Apr	4		3
Third Week	Apr	10 -- Apr	13		4
Fourth Week	Apr	16 -- Apr	20		5
Fifth Week	Apr	23 -- Apr	27		5
Sixth Week	Apr	30 -- May	4		5
Seventh Week	May	7 -- May	11		5
Eighth Week	May	14 -- May	18		5
Ninth Week	May	21 -- May	25		5
Tenth Week	May	29 -- Jun	1		4
					46

B. Pupil Instruction Related Days (No School for Students)

		Totals
August 22	All Staff Orientation/PIR	1.0
August 23	PIR	1.0
October 20-21	Staff Development Days - Teachers Convention	2.0
November 2-3	Parent Teacher Conferences **(Evening Only on 2nd, All Day on 3rd)**	1.5
January 16	PIR	1.0
February 27	PIR	1.0
April 7	Parent Teacher Conference Evening ONLY **(Regular School Day for Students)**	0.5
		8.0

2011-2012 Regular Board Meetings

July	25	5:30 p.m.
Aug	8	5:30 p.m.
Aug**	23	7:00 p.m.
Sept	12	7:00 p.m.
Sept	26	7:00 p.m.
Oct	10	7:00 p.m.
Oct	24	7:00 p.m.
Nov	14	7:00 p.m.
Dec	12	7:00 p.m.
Jan	9	7:00 p.m.
Feb	13	7:00 p.m.
Mar	12	7:00 p.m.
Apr	9	7:00 p.m.
May	14	7:00 p.m.
June	11	5:30 p.m.

C. Holidays (Dates Inclusive)

September 5	Labor Day
October 20-21	Fall Vacation (Teachers -- Convention)
November 3	Parent Teacher Conferences (**Vacation Day for Students**)
November 4	Vacation Day
November 23-25	Thanksgiving Vacation
December 21 - January 2	Christmas Vacation
January 16	PIR (**Vacation Day for Students**)
February 24	Vacation Day
February 27	PIR (**Vacation Day for Students**)
April 5-9	Spring Break
May 28	Memorial Day