Moon Area School District Curriculum Map

Course: Physical Science
Grade Level: 8
Content Area: Science
Frequency: Full-Year Course

Big Ideas

Lab Safety/Equipment/Scientific Method

1. Lab safety procedures are established for the safe study of science concepts in the laboratory setting.
2. Lab equipment has specific purposes and functions.
3. Measurements can be made using different tools in science.
4. Data conversions can be made within the metric system.
5. The Engineering Design Process and the Scientific Method are problem solving strategies to help define and solve problems in science and engineering in an organized manner.

Motion/Forces

6. Motion can be defined in terms of speed, velocity, and acceleration.
7. Specific formulas are used calculate an objects, speed, velocity, and acceleration.
8. Forces affect an objects motion and are represented in diagrams as arrows/vectors.
9. Forces can be combined.
10. Gravity and Friction are two forces that affect motion in our universe.
11. Newton's 3 Laws of motion help predict the motion of various objects.

Forces and Fluids

12. Pressure can be defined in terms of Force and Area
13. Specific formulas are used to calculate pressure and density.
14. Buoyancy is an upward pushing force found in all fluids.
15. Archimedes principle helps to determine the value of the buoyant force.
16. Pascal's principle helps to explain how hydraulic devices work.
17. Bernoulli's principle helps to explain how objects fly.

Electricity and Magnetism

18. The atom contains 3 fundamental particles (proton, neutron, electron). Electrons are involved with electricity and magnetism.
19. The law of charges states that like charges repel, and opposite charges attract.
20. Static electricity is non-flowing electricity. Three processes can produce static electricity (friction, conduction, induction).
21. Current electricity is flowing electricity. Ohm's law shows the relationship between Voltage, Current and Resistance.

22. Circuits are complete pathways that conduct electric current. Series and Parallel circuits have advantages and disadvantages. Home circuits have safety features built in (fuses, circuit breakers, GFI's) to protect the home.
23. Metals containing the element Iron are attracted to a magnet.
24. The elements Iron, Cobalt, and Nickel, contain Magnetic Domains which can be arranged to produce a strong magnetic field. Magnets can be permanent or temporary and can be destroyed. An electromagnet can be turned off or on and its strength can be changed.
25. A magnetic field can interact with an electric field to generate electricity.

Work/Simple Machines

26. Work is done when an object moves in the same direction as the applied force. Work is calculated by multiplying force by distance.
27. Power is a measurement of how quickly work is accomplished. Power is calculated by dividing work by time.
28. Machines help people to do work by changing the force or the distance over which the force is applied. There are six types of simple machines (Lever, Incline plane, pulley, screw, wheel and axle, wedge).
29. The Actual and Ideal mechanical advantage of a machine can be calculated and will always be different for each machine. Each machine has a different formula for calculating the IMA.
30. The Efficiency of a machine can be calculated by knowing the work input and work output. Efficiency can be improved by minimizing friction. A machine cannot be 100% efficient.
31. Two or more simple machines working together comprise a compound machine.

Energy

32. Energy is the ability to do work and is measured in units called Joules.
33. The law of conservation of energy states that energy is not created or destroyed it simply changes form.
34. Potential energy is stored energy and exists in the form of Gravitational PE, Chemical PE, and Elastic PE.
35. Gravitational PE is calculated by multiplying Weight x Height.
36. There are Renewable and Non-Renewable forms of energy.
37. Kinetic Energy is energy of motion. To calculate it requires a knowledge of an objects mass and velocity and uses the equation ½ Mass x Velocity x Velocity
38. As an object falls it's PE converts into KE.

Density

39. Density is a measurement of an objects MASS divided by its VOLUME.
40. The Density of Fresh Water is 1g/ml. An object with a Density less than 1g/ml will float up on the surface, an object with a Density equal to 1g/ml will hover in the middle of the water column, and an object with a Density greater than 1g/ml will sink.
41. Density can be calculated for solids, liquids, and gases.

Atomic Structure/Elements/Compounds/Mixtures

42. Atoms are composed of subatomic particles called protons, neutrons, and electrons.
43. The subatomic particles have charges and are in specific areas in an atom: with the protons, and neutrons being in the nucleus, and the electrons are found in energy levels outside the nucleus.
44. The atom is the simplest form of an element that contains all the properties of that element.
45. The periodic table provides information about the structure of an atom.
46. The atomic number tells the number of protons in an atom and from that, the number of electrons can be inferred since all atoms are neutral.
47. The atomic mass number is an average of all the isotopes of an atom. When rounded this number provides the total number of protons and neutrons in the nucleus of an atom.
48. Elements are represented by symbols and are organized by similar properties in a chart call the periodic table.
49. Elements can join with other elements to form compounds.
50. Elements and compounds can be pure, mixtures cannot.
51. When elements combine to form a compound, they lose their individual properties to form something new with different properties.
52. A mixture may contain several elements and/or compounds that do NOT chemically combine. The components of a mixture retain their own properties before and after being mixed.
53. The components of a mixture can be separated by physical means which include, magnetism, filtration, evaporation, centrifugation, and distillation.

Chemical Reactions

54. Elements and compounds can react to create new substances during a chemical reaction.
55. The starting materials in a chemical reaction are called reactants and the ending materials are called products.
56. There are pieces of evidence that help to indicate when a chemical reaction is occurring.
57. The Law of Conservation of Mass states that matter is not created or destroyed during a Chemical Reaction.
58. Chemical reactions can be expressed as chemical equations.
59. Chemical equations must be balanced so they obey the Law of Conservation of Mass.
60. Chemical equations can be classified as Synthesis, Decomposition, Single Replacement, and Double replacement reactions.

Waves/Sound/EMS/Light

61. Waves transfer energy from one place to another.
62. There are two categories of waves: Mechanical and Electromagnetic. Mechanical waves require a medium and electromagnetic do not.
63. Waves have measurable properties called amplitude, wavelength, and frequency.
64. A waves speed can be calculated if the wavelength and frequency are known.
65. Waves can be classified as either transverse waves or longitudinal waves.
66. Sound waves travel as longitudinal mechanical waves and radio, microwave, and light waves travel as transverse electromagnetic waves.
67. The higher the frequency the higher the pitch of a sound.

68. Sounds waves below the human range of hearing produce infra-sounds and above the human range of hearing are called ultrasounds.
69. Sound waves can make an object resonate if their frequencies match.
70. Waves can reflect, refract, and diffract.
71. Waves can experience constructive and destructive interference.

Essential Questions

Lab Safety/Equipment/Scientific Method

1. Why is safety important in the science lab setting and how do scientists stay safe?
2. What tools/instruments are utilized in the lab to take accurate measurements and collect data?
3. How can data conversions be easily made within the metric system?
4. How can certain questions be answered through scientific inquiry and/or technological design?

Motion/Forces

5. How can the speed, velocity, and/or acceleration of an object be calculated?
6. How can forces be combined to determine the net force?
7. How does the force of friction and gravity affect the motion of an object?
8. How is mass a measure of inertia?
9. Which of Newton's 3 laws is best illustrated in a scenario?

Forces and Fluids

10. How can pressure be calculated given the value of a force and area?
11. How does fluid pressure change with altitude and depth?
12. How does an objects density affect whether it floats or sinks in a fluid?
13. Explain why an object floats or sinks in terms of Archimedes principle.
14. How does a hydraulic device multiply force to move or stop a heavy object?
15. How does the flow of a fluid around a wing cause and airplane to fly?

Electricity and Magnetism

16. How do charges interact with each other?
17. How can static electricity be generated on an object?
18. Explain how Voltage, Current, and Resistance affect the flow of electricity.
19. Calculate Ohm's law problems given two out of 3 variables.
20. Explain the advantages and disadvantages of a Series and Parallel Circuit.
21. Explain how a fuse, circuit breaker, lightning rod, and ground wire help protect a home circuit.
22. How are magnetic materials different from non-magnetic materials with respect to their domains.
23. Explain how the strength of an Electromagnet can be changed.

Work/Simple Machines

24. Given a Force and a Distance, Calculate the work done by a person when they use a simple machine.
25. Calculate how powerful a machine is if given a value for work and time.
26. List the Six types of simple machines and describe how to calculate the Actual mechanical advantage and Ideal Mechanical advantage of each.
27. Explain why the IMA will always be greater than the AMA.
28. Explain the concept of Efficiency and why a machine can never be 100% efficient.
29. How is a compound machine different from a simple machine?

Energy

30. Define Energy and explain the difference between Potential energy and Kinetic energy.
31. List the three types of Potential energy.
32. Given Height and Weight solve for the GPE of an object.
33. Given the Mass of an object in Kg and its velocity, solve for its Kinetic energy.
34. Explain how an objects PE and KE change when an object is thrown upwards vs when it falls downwards.

Density

35. Given Mass and Volume solve for the Density of an object.
36. Determine if an object will sink, float, or be buoyed up in fresh water by determining its density.

Atomic Structure/Elements/Compounds/Mixtures

37. Given a diagram of an atom, label the location of the protons, neutrons, and electrons and state the charge (positive, negative, neutral) that each particle contains.
38. Using the periodic table, be able to correctly determine the number of protons, neutrons, and electrons are present in an atom of that element by using the elements atomic number and atomic mass.
39. Given a periodic table as a reference, be able to correctly draw a 2-Dimensional picture of an atom of elements 1-18.
40. Given an element name be able to write its symbol and vice versa for 43 of the most common elements.
41. Compare and contrast the properties of Metallic elements vs Nonmetallic elements.
42. Describe how heat is transferred by conduction, convection, and radiation.
43. Explain why compounds have different properties than the elements that comprise them.
44. Explain why the components of a mixture retain their own properties when mixed.
45. State the different methods that can be used to separate a mixture and when they should be used.
46. Given a mixture of Iron, Sulfur, and Salt, design an experiment to separate out the parts of this mixture.

Chemical Reactions

47. Given a chemical equation label the location of the reactants and products.
48. Describe 4 pieces of evidence that may be used to help determine if a chemical reaction is taking place.
49. Why must all chemical equations be balanced?
50. Given a chemical equation show how to properly balance the equation so the Law of Conservation of Mass is satisfied.
51. Given a chemical equation, classify it as Synthesis, Decomposition, Single Replacement, Double Replacement.

Waves/Sound/EMS/Light

52. Explain the difference between a Mechanical wave and an Electromagnetic wave and give an example of each type of wave.
53. Given a transverse wave, label the amplitude, crest, trough, and wavelength of the wave.
54. Given a longitudinal wave, label the compressions, rarefactions, and wavelength of the wave.
55. Solve for wave speed given frequency and wavelength.
56. Explain why we can see the sun but cannot hear it.
57. Explain the difference between an infra-sound and an ultrasound.
58. Differentiate between the following terms: reflection, refraction, diffraction, and resonance.
59. Give an example of constructive and destructive interference.
60. Construct a device that can create a longitudinal wave that can travel across the room with enough energy to put out a candle flame.

Primary Resource(s) & Technology:

Textbook Series: PEARSON ELEVATE SCIENCE, IXL online software, Microsoft Teams, Promethean Boards, Student Laptops/iPads, Lab equipment

Pennsylvania and/or focus standards referenced at:

www.pdesas.org

www.education.pa.gov

Big Ideas/ EQs	Focus Standard(s)	Assessed Competencies (Key content and skills)	Timeline
		LAB SAFETY/METRIC SYSTEM/ SCIENTIFIC METHOD	August - September (6Weeks)
1-5/1-4	Eligible Content: S8.A.2.2.1 S8.A.2.2.2 S8.A.2.1.3 S8.A.2.1.5 S8.A.1.3.2	• Know and apply the rules of proper lab safety in the eighth-grade science classroom • Know and use pieces of lab equipment properly in the eighth-grade science classroom • Know how to convert measurements within the metric system • Know the steps of the scientific method • Given a science scenario identify the Independent, Dependent, and Control variables. • Apply the engineering design process to solve a problem.	
Big Ideas/ EQs	**Focus Standard(s)**	**Assessed Competencies (Key content and skills)**	**Timeline**
		MOTION AND FORCES	October/November (7weeks)
6-11/5-9	S8.C.3.1.1 S8.B.1.3.2	• Know the difference between an object's speed and velocity • Calculate an object's speed, velocity, acceleration given data. • Know the Universal Law of Gravity • Know that all objects free fall at the same rate regardless of weight differences • Know and identify scenarios of Newton's three laws of motion • Apply Newton's laws to build a functional car project. • Know the various types of friction forces and when they're applicable in certain physical scenarios. • Explain how inertia is related to an objects mass.	

Big Ideas/ EQs	Focus Standard(s)	Assessed Competencies (Key content and skills)	Timeline
		FORCES AND FLUIDS	December (3-4weeks)
12-17/10-15	S8.C.3.1.1	• Know what pressure is and how to calculate it. • Know the difference between an object's density and buoyancy by performing a lab • Know how to use Archimedes principle to calculate an object's buoyant force when in a fluid. • Know real life examples of how Bernoulli's and Pascal's principles are applied.	
Big Ideas/ EQs	**Focus Standard(s)**	**Assessed Competencies (Key content and skills)**	**Timeline**
		ELECTRICITY AND MAGNETISM	January (3-4weeks)
18-25/16-23	S8.C.2.1.3 S8.C.3.1	• Label the names and locations of the subatomic particles inside and atom. Know how electrons are involved with electricity and magnetism. • Explain how charges will interact with each other when brought together. • Explain how static electricity can be produced. • Solve Ohm's law problems given Voltage, Current, and Resistance data. • Compare and contrast a Series Circuit with a Parallel circuit and state advantages and disadvantages of each and where they may be used. • Build simple series and parallel circuits. • List several safety features built into home circuits and explain how they function. • Explain how magnetic materials are different from non-magnetic materials. • Explain how electric fields can interact with magnetic fields by doing a simple motor lab. • Explain how an electromagnet is different from a permanent magnet and how it's strength can be changed.	

Big Ideas/ EQs	Focus Standard(s)	Assessed Competencies (Key content and skills)	Timeline
		WORK/SIMPLE MACHINES	February (3-4weeks)
26-31/24-29	S8.C.3.1.3	• Define work and be able to solve work problems given distance and force data. • Define power and be able to solve power problems given distance, force, and time data. • List the 6 types of simple machines and explain how simple machines make work easier. • Solve for a machine's efficiency using the efficiency equation and explain why machines cannot be 100% efficient. • Solve for a machines Actual Mechanical Advantage. • Solve for a machines Ideal Mechanical Advantage. • Know the difference between Actual and Ideal Mechanical Advantage. • Explain how a compound machine is different from a simple machine.	
Big Ideas/ EQs	**Focus Standard(s)**	**Assessed Competencies (Key content and skills)**	**Timeline**
		ENERGY	March (2weeks)
32-38/30-34	S8.C.3.1.2 S8.C.2.2.1 S8.C.2.2.2 S8.C.2.1.1 S8.C.2.1.3	• Know the definition of energy and how to label it. • State the law of Conservation of Energy. • Know the 3 forms of Potential energy and how to calculate gravitational potential energy given weight and height. • Know how to solve for the Kinetic energy of an object given mass and velocity. • Explain how the potential and kinetic energy changes as an object is thrown upwards and as it falls downward. • Identify the energy changes that occur in a diagram. • Identify examples of renewable and nonrenewable energy resources. • Use the Down Hill Racer project as the culminating activity for the Physics portion of the course to allow the student to demonstrate their understanding of concepts taught from the beginning of the year.	

Big Ideas/ EQs	Focus Standard(s)	Assessed Competencies (Key content and skills)	Timeline
		DENSITY	March (1/2-1week)
39-41/35-36	S8.C.1.1.2	• Solve for the density of an object given its mass and volume. • State if an object will float on top of water, sink, or hover in the middle of the water column by calculating its density. • Know that the density of an object does not change if it is cut in half. • Know that Density is a characteristic property that can help identify and unknown material.	
Big Ideas/ EQs	**Focus Standard(s)**	**Assessed Competencies (Key content and skills)**	**Timeline**
		ATOMIC STRUCTURE/ELEMENTS/COMPOUNDS/MIXTURES	March (3 weeks)
42-53/37-46	S8.C.2.1.2 S8.C.1.1.1	• Know the names, locations, and properties of the subatomic particles that make up an atom. • Know the names and symbols of the 43 most common elements found on the periodic table. • Know how to diagram a 2-D model of an atom for elements 1-18 given the elements atomic number and atomic mass. • Know that metals and non-metals have different properties and where they are located on the periodic table. • Explain how a compound is different from an element. • Explain how a mixture is different from a compound. • Know how to separate the parts of a mixture using several techniques in the lab.	
Big Ideas/ EQs	**Focus Standard(s)**	**Assessed Competencies (Key content and skills)**	**Timeline**
		CHEMICAL REACTIONS	April (4weeks)
54-60/47-51	S8.C.1.1.3	• Identify evidence that a chemical reaction is occurring. • Identify the parts of a chemical equation. • Explain the law of Conservation of Mass. • Know how to balance chemical equations. • Know how to classify chemical equations into one of 4 categories.	

Big Ideas/ EQs	Focus Standard(s)	Assessed Competencies (Key content and skills)	Timeline
		WAVES/SOUND/EMS/LIGHT	May (4weeks)
61-71/52-60	S8.C.2.1.3 S8.C.2.1.1	• Know that waves transfer energy. • Know there are two categories of waves Mechanical and Electromagnetic. • Know the parts of a transverse and a longitudinal wave. • Explain how Mechanical and Electromagnetic waves travel. • State the relationship between frequency and pitch. • Solve for Wave Speed given wavelength and frequency. • Explain when an object may resonate. • Know what reflection, refraction, diffraction, and interference mean. • Construct a device that can create a longitudinal wave powerful enough to put out a candle flame.	