PINE-RICHLAND SCHOOL DISTRICT

Pine-Richland School District

K-12 Science Program Review

May 20, 2024

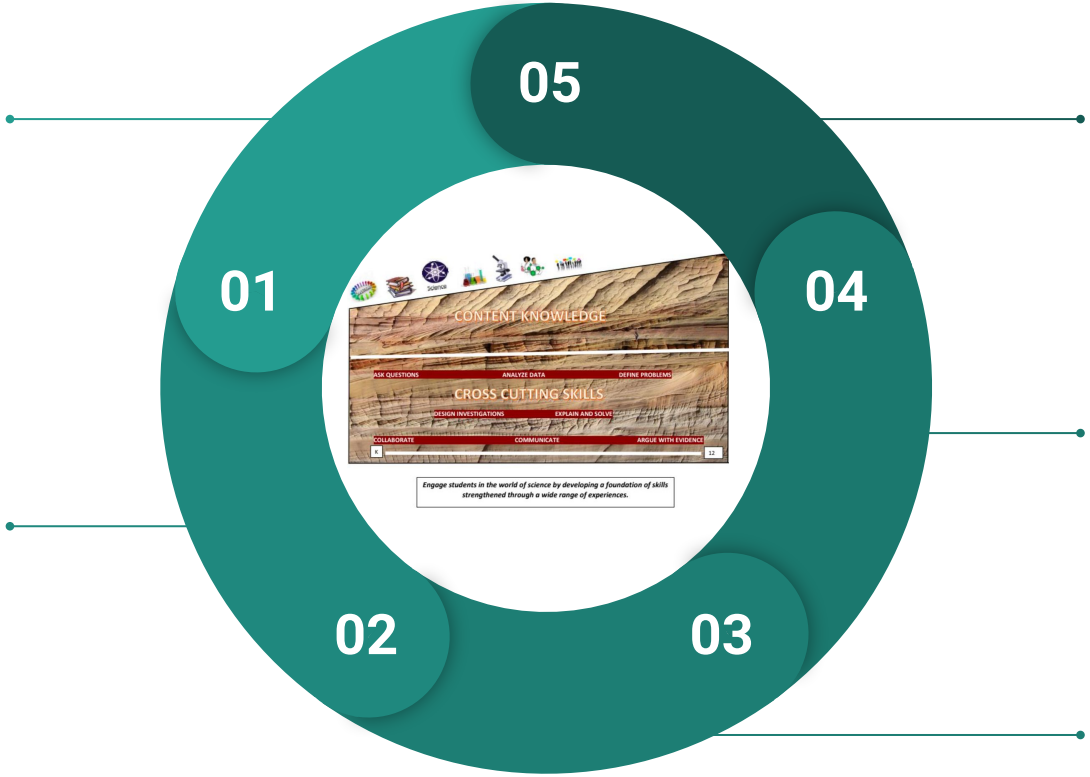
2016 - 2017 Science Program Review



Science Department Mini-Review

Review Depth of IDPR Implementation

Data Review (PSSA, Keystone, Advanced Placement, Course Requests, etc.)



Revised/New Recommendations

Research

Local, State, Country, World Trends (PA Standards)



Recommendation #1:

A) Increase phenomenon/inquiry-based learning activities (in accordance with STEELS Standards) into all K-12 science courses.
B) Add career education and work standard learning activities into all K-12 science courses.
C) Integrate reading in the content area strategies in science classes to support and challenge all students (e.g., structured literacy aligned with word parts, vocabulary, background knowledge, etc).

Pre-STEELS Instruction

Chapter 13: Solutions







Solutions…What do we already know?

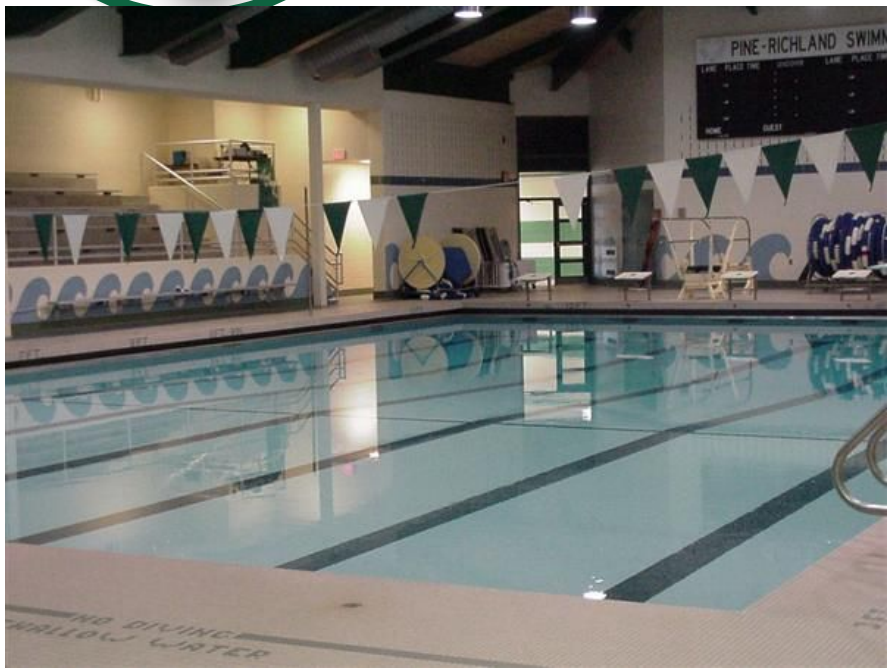
- Define a solution.
- Give at least 3 examples of a solution.
- Are there different types of solutions? Explain.
- How can you make something dissolve faster?
- Do solutions have different properties than their solvents? (Ex. Salt water vs. water)

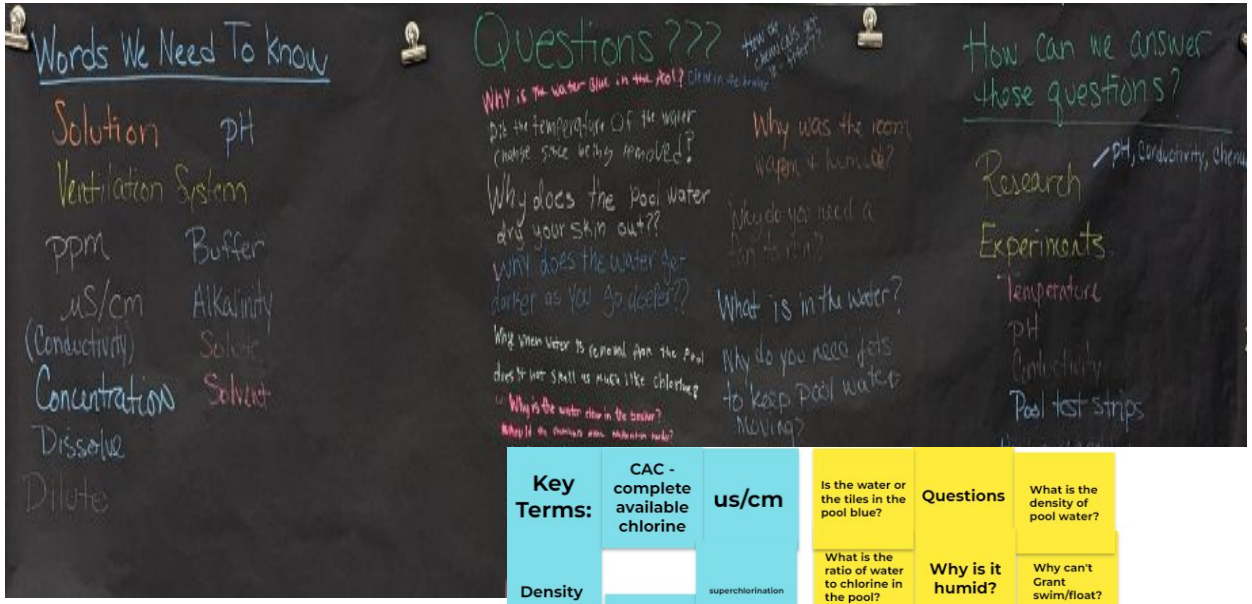
Solutions: Big Ideas

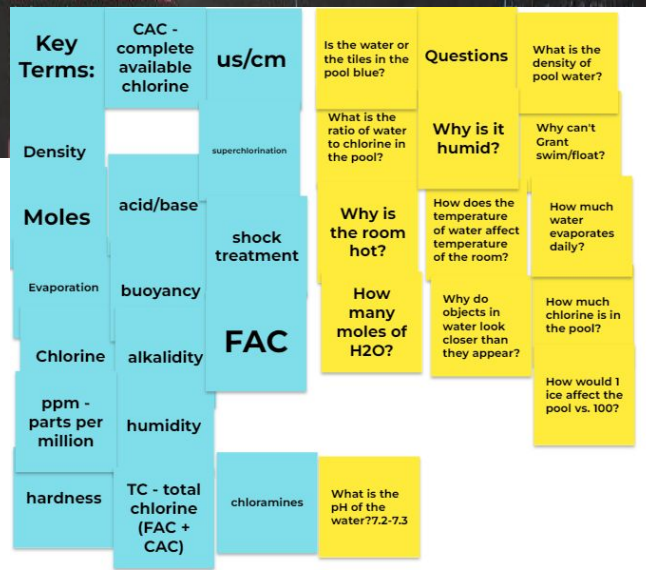
1. Solutions are homogeneous mixtures.
2. Concentration can be expressed in a variety of ways.
3. The solubility of a substance is dependent on the chemical makeup.

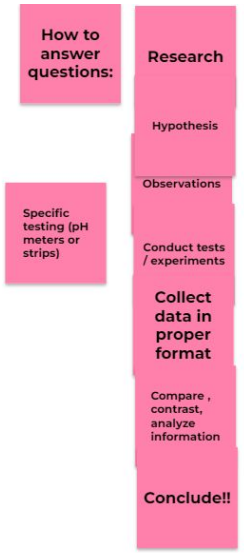
Teacher driven presentation of ideas to students.

Post-STEELS Instruction









Student driven exploration of ideas guided by the teacher.

Pre-STEELS "Procedural" Labs

Students were given procedures to explore how different variables affect solubility.

Procedure:

Part I: What effect does temperature have on the ability of granular sodium chloride to dissolve in water?
Note: Our variable is temperature. You must be certain to control all other variables. Ex. Be sure to stir all three test tubes at the same rate.

1. Set up a ring stand and burner. Use your graduated cylinder to measure exactly 150.0 ml of water and pour it into a 250 ml beaker. Heat the water to 70℃.
2. Use your graduated cylinder to fill a second beaker with 150.0 ml of water. Leave this beaker at room temperature.
3. Use your graduated cylinder to add 75 ml of water to a beaker. Add ice to the beaker until the level of liquid matches the level in the room temperature beaker.
4. Obtain three 1.000 gram samples of granular sodium chloride.
5. Use your graduated cylinder to place 20.0 ml of water into each of three test tubes. Place the test tubes into the three beakers.
6. Record the temperatures of the beakers in your data table.
7. Add the samples of sodium chloride to the three test tubes and press start on your timer.
8. Stir the samples gently and record the amount of time that it takes for the samples to completely dissolve. Record times in your data table.
9. Record the final volume of the solution in each of the test tubes and record the volumes in your data table.
10. Clean and rinse all of the test tubes. Leave the beakers of water containing the hot water and the ice water for the next part of the lab.

Part II: How does particle size affect solubility?
Note: Our variable is particle size. Be sure to keep all other variables constant.

1. Obtain 1.000 gram samples of each type of sodium chloride.
2. Use your graduated cylinder to fill each test tube with 20.0 ml of water.
3. Add the sodium chloride samples to the test tube and start your timer.
4. Gently stir each sample at the same rate.
5. Record the amount of time necessary to completely dissolve the sodium chloride in your data table.
6. Clean and rinse all the test tubes and the stir rods.

Part III: How does agitation affect solubility?
Note: movement of solute particles is our variable. Try to keep all other variables constant.

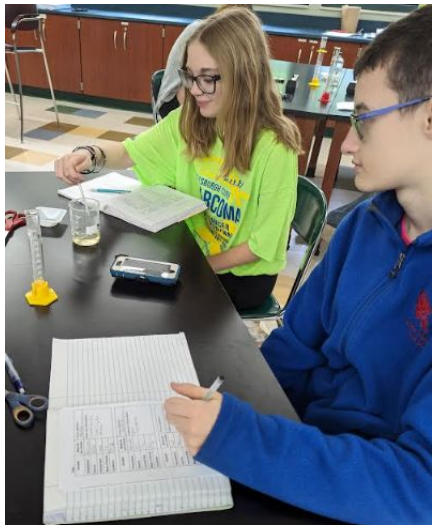
1. Obtain two 1.000 gram samples of sodium chloride powder.
2. Fill two test tubes with 20.0 ml of water.
3. Place the sodium chloride into the test tubes and start your timer.
4. Gently stir the first test tube. Leave the second test tube stationary.
5. Record the amount of time necessary to completely dissolve each tube in the data table.
6. Clean and rinse the test tubes and stir rod.

Post-STEELS Guided Inquiry Labs

Choose a different combination of variables for each trial. Record the variables you use, your time to dissolve AND make observations about what happens during each trial. Use as many data sheets as necessary.

Variable	Options		
Temperature	Hot Water	Room Temp	Ice Water
Volume	50 ml	100 ml	250 ml
Particle Size	Fine	Granules	Cubes
Mass of Solute	3.5 g	7 g	10.5 g
Container	Beaker	Beaker + Stir Rod	Bottle with cap

Student design, run, and analyze procedures. They communicate with their group and determine how to alter their procedures in order to meet the goals.







Recommendation #2*:

A) Modify unit-based curriculum to include STEELS standards.
B) Determine an approach to address the earth and space science standards at the secondary level.

*Spring of 2025 Curriculum Board Approval

Science Technology Engineering, Environmental Literacy, Sustainability (STEELS)

2024 - 2025 Curriculum Adjustments

Grades 6–8

3.1.6-8.H Life Science: Structure, Function, and Information Processing

Students who demonstrate understanding can *gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.*

Clarifying Statement: N/A

Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.

Science and Engineering Practices (SEP)	Disciplinary Core Ideas (DCI)	Crosscutting Concepts (CCC)
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods. • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.	**LS1.D: Information Processing** • Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural systems.

Skills

Content

Connections

Pennsylvania Context: N/A

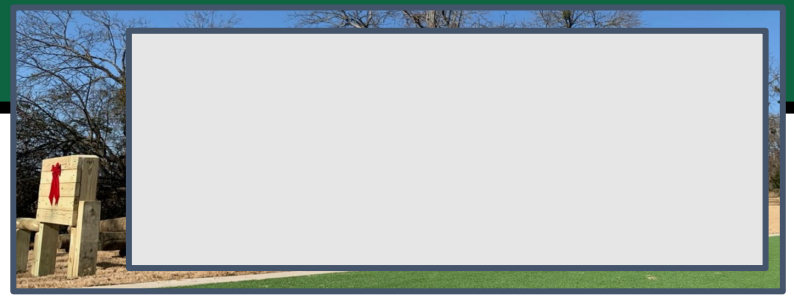
PA Career Ready Skills: Explain to others one's own strengths, needs, and preferences specific to a context.

Connections to Other Standards Content and Practices

Connections to Other Content Areas

Standard Source	Possible Connections to Other Standard(s) or Practice(s)
Agriculture (AFNR)	CS.02.02.01.a: Identify and summarize the components within AFNR systems (e.g., Animal Systems: health, nutrition, genetics, etc.; Natural Resources Systems: soil, water, etc.).
Science, Environmental Literacy and Sustainability (NAAEE)	5-8 Strand 1.C. Collecting information: Learners locate and collect quantitative and qualitative information about the environment and environmental topics, using a range of methods and sources. They explain why they used selected information collection methods.
PA Core Standards: ELA	CC.3.6.6-8.G: Gather relevant information from multiple print and digital resources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of other while avoiding plagiarism and following a standard format for citation.

STEELS Timeline





2024 - 2025

- Classroom Diagnostic Tools (CDTs) Aligned to New Standards
- PSSA Will Begin Field Testing Items Aligned to New Standards
  - (2023 - 2024) Grade 4 Students Took the PSSA Science Assessment
  - (2024 - 2025) Grade 5 Students Will Take the Field Test Science Assessment
- Biology Keystone Will Begin Field Testing Items Aligned to New Standards



2025 - 2026

- PSSA and Biology Keystone Will Be Operational Assessing the New Standards



Recommendation #3*:

Revise course pathway options and sequencing of resources considering the following:

A) Expand anatomy pathways options (e.g., academic to AP; consideration of zoology);

B) Adjust high school science pathway recommendations based on mathematical readiness;

C) Identify non-traditional science courses to integrate into the Program of Studies (e.g., forensics, theoretical physics);

D) Modify Earth and the Environment course/pathways options;

E) Explore College in High School dual enrollment options;

F) Audit the Amplify Units to ensure that they are the correct units, properly sequenced by grade, for STEELS standards mastery.

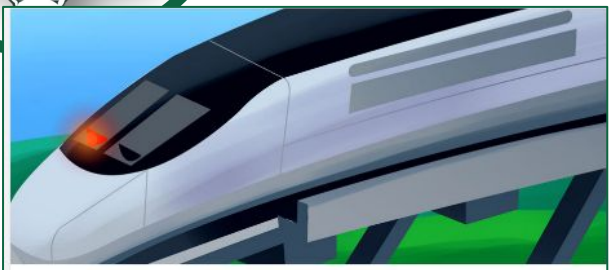
*TBD Program of Studies & Curriculum Board Approval

Pine-Richland High School Current Pathways Chart

Science Pathways

Freshman	Sophomore	Junior	Senior
Course	Course	Course	Course
Honors Biology	Honors Chemistry with Lab AP Anatomy (College Board Pending)	Honors Physics with Lab or AP Biology with Lab or AP Chemistry with Lab or AP Environmental Science	AP Biology with Lab or AP Chemistry with Lab or AP Physics C - *Mechanics* or AP Environmental Science
Academic Biology	Academic Chemistry with Lab	Academic Physics with Lab	Additional Senior Courses
Biology	Chemistry with Lab	Physical Science or Academic Physics with Lab	Academic Physics with Lab or Additional Senior Courses
Earth & the Environment	Biology	Chemistry with Lab	Physical Science or Additional Senior Courses
Additional Science Courses	**Sophomore**	**Junior**	**Senior**
	Comparative Anatomy & Physiology Honors Human Anatomy & Physiology Environmental Science Additional Academic Course Electives	Comparative Anatomy & Physiology Honors Human Anatomy & Physiology Environmental Science Organic Chemistry Astronomy	Comparative Anatomy & Physiology Honors Human Anatomy & Physiology Environmental Science Organic Chemistry Astronomy

Amplify Lesson Example Grade 3 [Rec#3F]



Balancing Forces

How is it possible for a train to float?

Why does the train rise and change from floating to falling?

Vocab: force, gravity, electromagnet, pole, repel, etc.

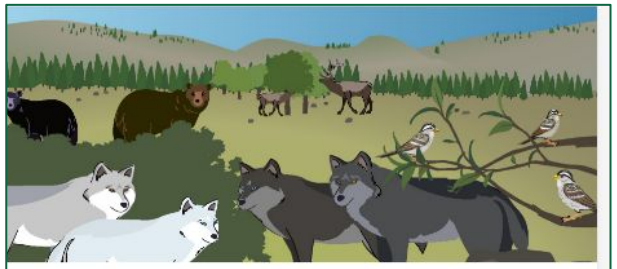


Weather and Climate

Where do different weather patterns happen repeatedly?

Which island's weather will continue to be best for orangutans?

Vocab: data, graph, evidence, evaluate, measure, precipitation, range, seasons, climate, pattern, etc.



Inheritance and Traits

Why are wolves different even though they're all from the same species?

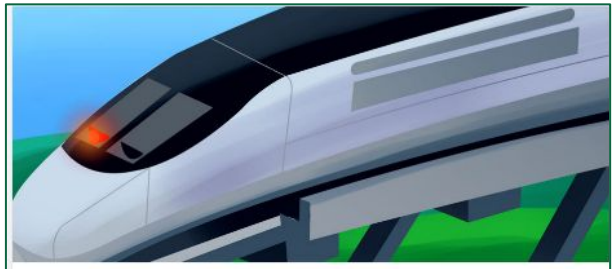
How can scientists investigate questions about traits?

Vocab: environment, genes, inherit, offspring, species, trait, variation, organism, etc.

Amplify Lesson Example Grade 3 [Rec#3F]

Audit of 3rd Grade Science against STEELS Standards showed the need for Inheritance of Traits to be Mastered Prior to PSSA.

3.1 Life Science								
3.1	Students who demonstrate understanding can:							
Strand	**Kindergarten**	**1**	**2**	**3**	**4**	**5**	**6–8**	**9–12**
Inheritance of Traits	Intentionally Blank	3.1.1.C Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	Intentionally Blank	3.1.3.C Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.	Intentionally Blank	Intentionally Blank	3.1.6-8.M Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.	3.1.9-12.P Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.



Balancing Forces

22 Lessons

Kids grasp this quickly



Weather and Climate

22 Lessons

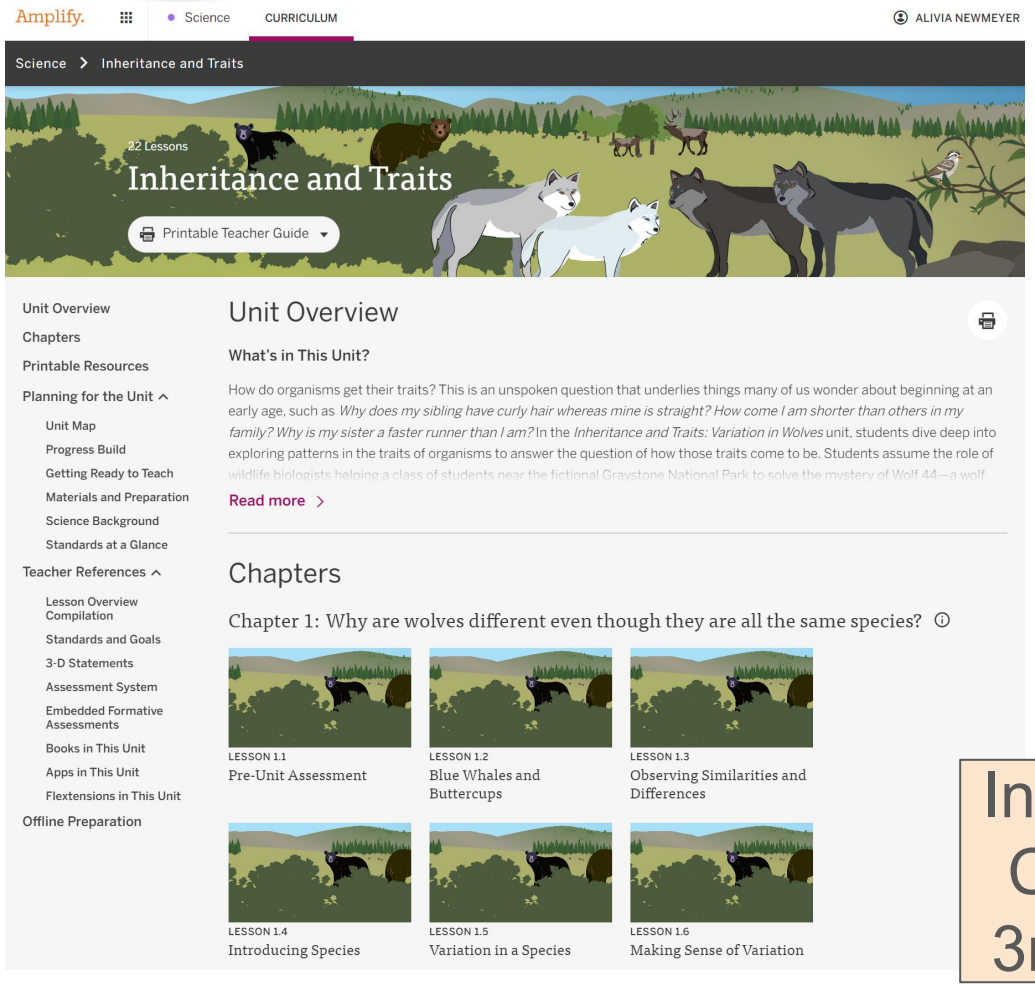


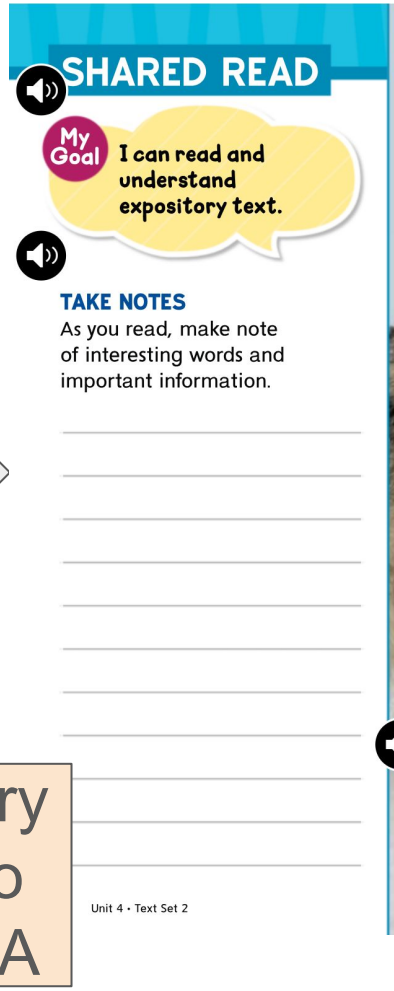
Inheritance and Traits

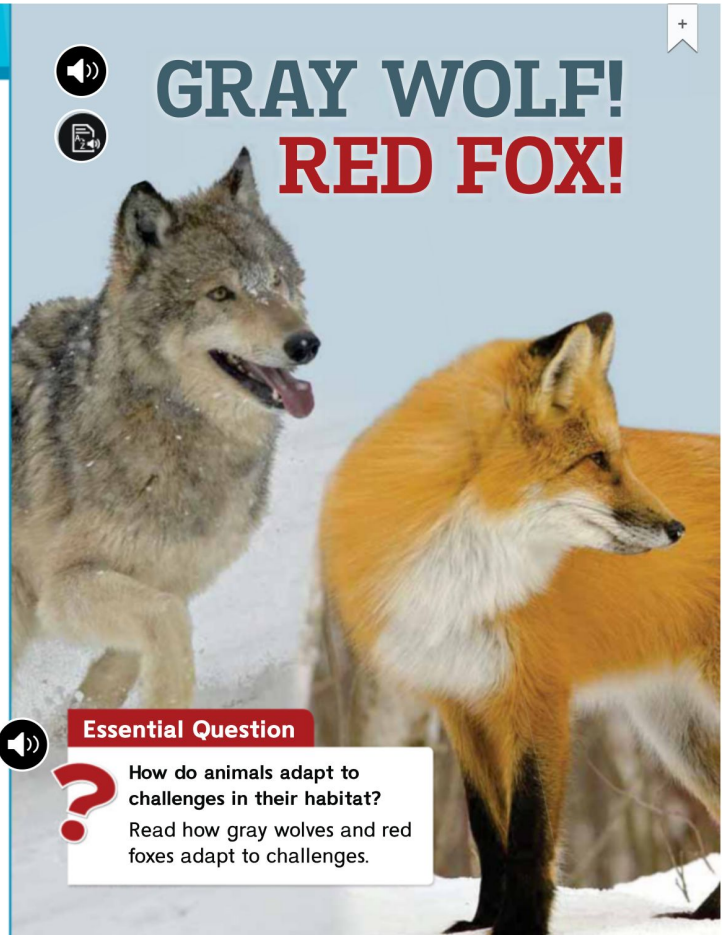
22 Lessons

Needs more Emphasis

Amplify Lesson Example Grade 3 [Rec#3F]







Interdisciplinary Connection to 3rd Grade ELA



Recommendation #4*:

A) Identify physical space modifications needed to support the phenomenon/inquiry-based learning activities (e.g., high school physics classrooms; lab resources). Include those recommendations in the capital funding plan.

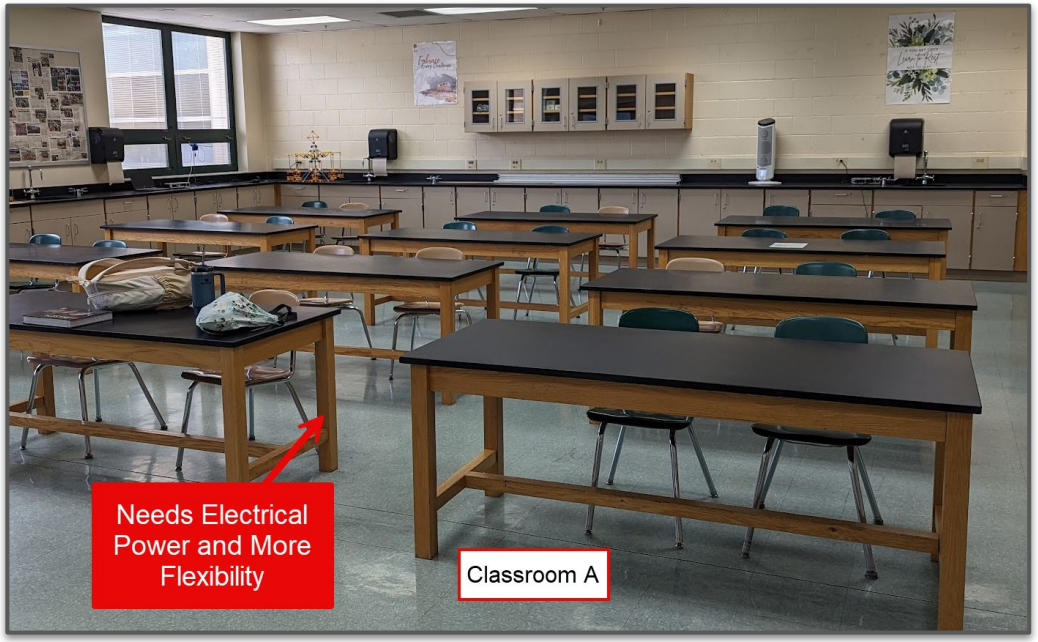
*TBD Short- & Long-Term Budget Development Process

Physical Space/Inquiry Learning

- **Flexible Classroom Designs**
  - STEM classrooms are most effective when designed for a multitude of activities, like team-based projects and hands-on learning.
- **Mobility**
  - A crucial part of flexible classroom design is mobility. Tables, desks, chairs, and whiteboards should be on wheels so that students are encouraged to make the space their own.
- **Tech-Savvy and Power**
  - Technology is a crucial part of every STEM program, and it should be accessible for all students.
- **Organized**
  - STEM classes are packed with fun gadgets and equipment, but clutter can quickly negate the flexible design. Different types of classes being taught in the same room calls for maximum organization.
- **Collaborative**
  - STEM classrooms encourage active learning, which is the practice of engaging students through projects and activities instead of passive listening from lectures.
- **Sustainable**
  - Well-designed STEM classrooms encourage problem solving, critical thinking, innovation, and collaboration skills, which are necessary to address the environmental challenges of today.

https://www.americanmodular.com/your-guide-to-effective-stem-classroom-design/

Current Classroom Designs (Physics)





Pine-Richland High School Physics Classrooms Built in 1993
(2) Classroom As
(2) Classroom Bs

Classroom Designs Options (Physics)









Recommendation #5:

A) Modify assessments (e.g., common, unit, benchmark) to align with STEELS standards.

Modify Assessments for STEELS Alignment

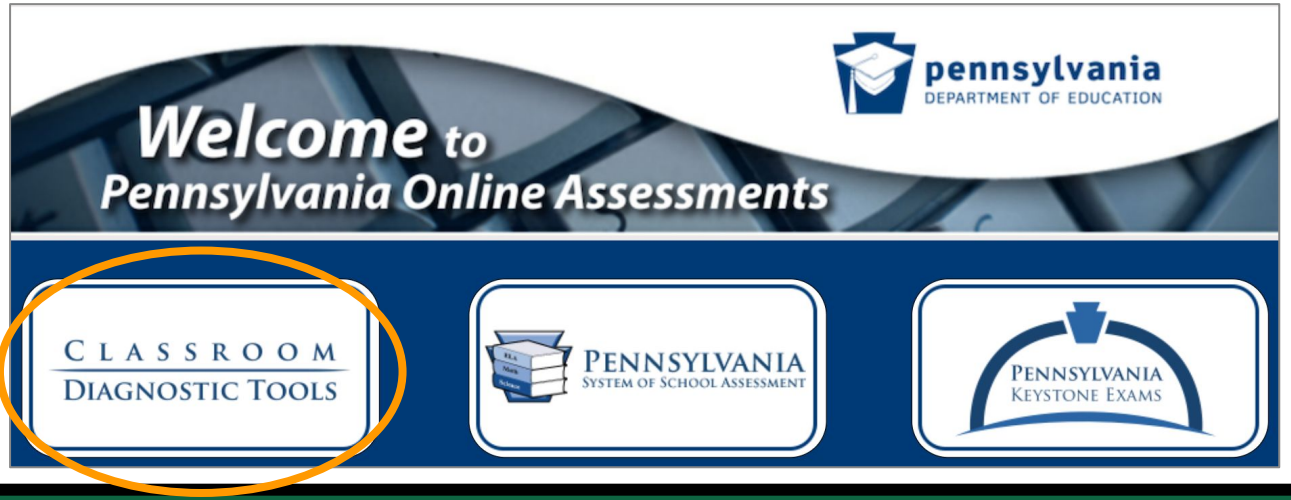
- PDE will release a new version of the Classroom Diagnostic Tools (CDT) benchmarking assessment in 2024 - 2025, which will mirror the new STEELS-based PSSA and Keystone exams.
- By 2025 - 2026, the expectation will be for students to be learning and assessed according to the STEELS standards. The PSSA will shift to Grade 5 (as opposed to grade 4) officially in the spring of 2026.



Assessment tasks will integrate:

1. disciplinary core ideas (DCIs)
2. science & engineering practices (SEPs)
3. crosscutting concepts (CCs)

Application and transfer to the real world is a goal of this assessment approach.



Performance Phenomenon after Shifts

PSSA MATH

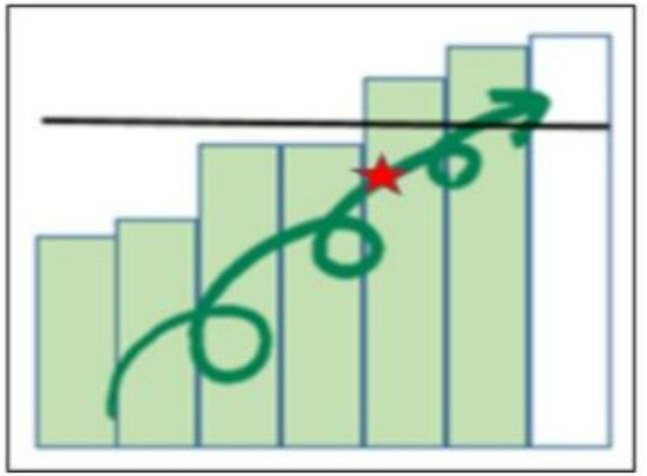
Note: The Spring of 2017 was the third assessment based upon the new PA Core standards introduced in 2015, allowing us to identify trends for the first time. The results of the 2010-2014 former Math PSSA are reflected for context only, not comparison.

GRADE 5 Performance Level Percentages over Time

	PR 2010 Percent	PR 2011 Percent	PR 2012 Percent	PR 2013 Percent	PR 2014 Percent
ADV	57.1	57.3	61.6	64.4	60.8
PROF	25.2	28.5	24.0	27.0	24.4
ADV/PRO	**82.5**	**85.8**	**85.6**	**91.4**	**85.2**
BASIC	13.0	11.0	11.5	8.3	8.9
BEL BAS	4.5	3.3	2.9	0.3	5.8
# TESTED	331	337	375	348	360

	PR 2015 Percent	PR 2016 Percent	PR 2017 Percent
ADV	32.1	46.4	39.3
PROF	40.3	29.8	36.7
ADV/PRO	**72.4**	**76.2**	**76**
BASIC	17.6	17.3	16.9
BEL BAS	9.9	6.5	7
# TESTED	353	336	313
		Mean Score	1080





- New Standards
- New Assessment
- New Level of Rigor
- New Grade Level
- Cycles of Learning & Adjustments Occur to Drive Improvement of Results over Time

PINE-RICHLAND SCHOOL DISTRICT

Discussion/Reflections

