LAB-AIDS/SEPUP ALIGNMENT TO COLORADO SCIENCE STANDARDS AND 21ST CENTURY SKILLS

SCIENCE 6-8

Materials from the Science Education for Public Understanding Program (SEPUP) are developed at the Lawrence Hall of Science, at the University of California, Berkeley, and distributed nationally by LAB-AIDS, Inc., and are the primary instructional resource for the middle grades. SEPUP materials are supported by grants from the National Science Foundation. All other materials developed by LAB-AIDS. This correlation is intended to show selected locations in SEPUP 2nd Edition programs that support the Colorado Science Content Standards, Grade Level Expectations (GLE), and 21st Century Skills. It is not an exhaustive list; other locations may exist that are not listed here.

This document was prepared by Mark Koker, Ph D, Vice President and Chief Academic Officer at LAB-AIDS. For more information about this correlation or for questions about review copies, presentations, or any matters related to sales or service, please visit us on the web at www.lab-aids.com.

Key to SEPUP Core Science Programs:

SEPUP programs are available as full year courses, or separately, as units, each taking 3-9 weeks to complete, as listed below.

Issues and Earth Science, Second Edition (IAES)

Unit Title	**Activity Number**
Studying Soil Scientifically	1-11
Rocks and Minerals	12-23
Erosion and Deposition	24-35
Plate Tectonics	36-49
Weather and Atmosphere	50-70
The Earth in Space	71-84
Exploring Space	85-98

Issues and Life Science, Second Edition (IALS)

Unit Title	**Activity Number**
Experimental Design: Studying People Scientifically	1-10
Body Works	11-29
Cell Biology and Disease	30-53
Genetics	54-71
Ecology	72-88
Evolution	89-101
Bioengineering	102-109

Issues and Physical Science, Second Edition (IAPS)

Unit Title	**Activity Number**
Studying Materials Scientifically	1-11
The Chemistry of Materials	12-29
Water	30-52
Energy	53-72
Force and Motion	73-88
Waves	89-99

Each of the full year programs begins with a "starter" unit sequence on the scientific method in the context of each particular discipline. For example, the Issues and Life Science (IALS) course contains a ten-activity unit called "Experimental Design: Studying People Scientifically," which uses the science behind clinical trials on human subjects, to frame the study of the life sciences. These are listed first in each course.

SEPUP Course/Activity Numbers	*Main Unit Issue*
IAES *Issues and Earth Science*	
Studying Soils Scientifically, 1-11	Why don't plants grow in the school garden?
Rocks and Minerals, 12-23	How do diamonds made in a lab compare to diamonds mined from the earth?
Erosion and Deposition, 24-35	Where should Boomtown construct the new buildings?
Plate Tectonics, 36-49	Which site would you recommend for storing nuclear waste?
Weather and Atmosphere, 50-70	Is the growth of Sunbeam City affecting its weather, atmosphere, and water availability?
The Earth in Space, 71-84	Why are there many different calendars?
Earth and the Solar System, 85-98	What kinds of future space missions should we conduct?
IALS *Issues and Life Science*	
Studying People Scientifically, 1-10	Which proposals have an experimental design worth funding?
Body Works, 11-29	How can you convince people to make choices that reduce their level of heart disease risk?
Cell Biology and Disease, 30-53	How is an emerging disease spread? What can you do to stop it?
Genetics, 54-71	What are the ethical issues involved in using genetic information?
Ecology, 72-88	What are the trade-offs of introducing a species into a new environment?
Evolution, 89-101	What are the trade-offs in deciding whether to save an endangered species or to re-create an extinct one?
Bioengineering, 102-108	How are new solutions to problems in life science developed?
IAPS *Issues and Physical Science*	
Studying Materials Scientifically, 1-11	How should unidentified materials be handled?
The Chemistry of Materials, 12-29	When you buy a new product, do you think about what materials it is made of? What will happen to it when you no longer have a use for it?
Water, 30 - 52	What does your community do to make its water safe to drink? Whose responsibility is it?
Energy, 53-72	Can you help a family decide what energy improvements they should invest in?
Force and Motion, 73-88	Should noncommercial vehicles be more alike?
Waves, 89-99	Are there situations in which some waves are harmful to your health?

SEPUP Support for Engineering Design

The Next Generation Science Standards (NGSS) note that science and engineering are somewhat parallel practices and have many similar elements. Scientists ask questions, make observations, and collect and analyze data, in an attempt to make sense of the natural world. Similarly, engineers create, test, and redesign as they respond with solutions to human needs. And just as we use scaffolds in teaching of scientific inquiry to improve student learning and practice, so do we use scaffolds in teaching about engineering for our students. The NGSS emphasize three major phases of the engineering design process.

- DESIGN: Creates design, prototype or plan, noting constraints of proposed use
- TEST: Tests design, prototype or plan, collecting qualitative or quantitative data
- REDESIGN: Evaluates prototype, design or plan, suggests further changes as needed

In addition, the NGSS emphasize the role of design in solving human problems, and of designers in developing criteria for solutions, evaluating solutions, and determining the tradeoffs involved in a design or solution.

The table below shows SEPUP activities that support major elements of engineering design. Some support the initial stages of design, criteria development, and evaluation that precede the full design cycle by suggesting or evaluating scientific or technological solutions to real-world problems. Others involve students in one or all steps of the design cycle as they build, test, and/or redesign prototypes.

Engineering and Design Practices in SEPUP

Course activity with description	**Students suggest or evaluate a solution**	**Students engage in the engineering process**		
		Design	Test	Re-design
IAES11: Recommend a soil improvement plan	X			
IAES 32: Design a coastal breakwater		X	X	X
IAES 35: Recommend a site plan for housing development		X		
IAES 49: Evaluate sites for nuclear waste disposal	X			
IAES 67: Design/build wind vane/ anemometer		X	X	X
IAES 98: Recommend a space	X			

mission				
IALS 48: Design an improved hand-washing procedure		X	X	X
IALS 88: Suggest a plan for preventing zebra mussel spread	X			
IALS 104: Design artificial heart valve		X		
IALS 105: Design an artificial bone		X	X	X
IALS 107: Design an energy bar		X	X	X
IALS 108: Design a prosthetic limb		X	X	X
IAPS 12: Recommend a material for a drink container	X			
IAPS 13: Construct a product life cycle for a drink container	X			
IAPS 29: Evaluate options to recommend a “green” computer	X			
IAPS 60: Design an ice preservation chamber		X	X	X
IAPS 63: Improve a calorimeter design			X	X
IAPS 69: Design a better solar collector		X	X	X
IAPS 70: Design a warm & cool home		X		
IAPS 72: Recommend an energy-improvement plan for a home	X	X	X	X
IAPS 73: Evaluate vehicle safety features		X		
IAPS 85: Design a crash test dummy		X		

Key to SEPUP Assessment System:

SEPUP materials include research-based assessment system developed by SEPUP and the Berkeley Evaluation and Assessment Research Group (BEAR) in the University of California Graduate School of Education. Forming the core of the SEPUP Assessment System are the **assessment variables** (content and process skills to be assessed), **assessment questions or tasks** used to gather evidence and **scoring guides** for interpreting students' responses (correspond to assessment variables).

The nine assessment variables are:

Designing Investigations (DI)
Organizing Data (OD)
Analyzing Data (AD)
Understanding Concepts (UC)
Recognizing Evidence (RE)
Evidence and Trade-offs (ET)
Communication Skills (CS)
Organizing Scientific Ideas (SI)
Group Interaction (GI)

Types of assessment:

Quick Checks (✓) present opportunities for informal formative assessment and may be used prior to instruction to find out what students know or think. They may also be used to help teachers track students' knowledge of key information or progress in understanding a concept.

Some embedded questions and tasks and all item bank questions are all suitable for summative assessment. Analysis questions are included at the end of each activity.

Citations included in the correlation document are as follows:

IAES 40, 41, 42	40 Q1, 3, 4
IALS 2, 3, 37	41 Q3 UC; [IB] D2
IAPS 1, 2, 3	42 [IB] D4, 6, 8-10, 16

IAES 40, 41, 42 **40 Q1, 3, 4**
41 Q3 UC; [IB] D2
42 [IB] D4, 6, 8-10, 16

means that the standard or benchmark may be assessed using Issues and Earth Science (IAES) Activity 40 Analysis Questions 1, 3 and 4, IAES Activity 41 Analysis Question 3 using the Understanding Concepts scoring guide and Item Bank Questions D2, 4, 6, 8-10, and 16 from Unit D Plate Tectonics.

For more information on program assessment and using SEPUP rubrics, consult the Teacher's Guide, TR part III Assessment section.

PHYSICAL SCIENCE

1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
a. Predict and evaluate the movement of an object by examining the forces applied to it b. Use mathematical expressions to describe the movement of an object c. Develop and design a scientific investigation to collect and analyze speed and acceleration data to determine the net forces acting on a moving object	• IAPS 74, 76, 78 • IAPS 74, 76, 78, 83 • IAPS 74, 80, 81	**74** Proc DI; [IB] E1-2, 5-6 **76** [IB] E2 **78** [IB] E2, 3, 8 **80** AQ2; [IB] E2, 3, 11, 20 **81** [IB] E3, 13, 15

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• What relationships exists among force, mass, speed, and acceleration? • What evidence indicates a force has acted on a system? Is it possible for a force to act on a system without having an effect?	• How can you measure the speed of a moving cart? • How can you use graphs to describe motion? • Does vehicle speed and mass affect the forces in a collision?
Relevance and Application:	

• Engineers take forces into account when designing moving objects such as car tires, roller coasters, and rockets. • Vehicles and their propulsion systems are designed by analyzing the forces that act on the vehicle. For example, the designs of propellers and jet engines are based on the aerodynamics of airplanes.	• Motor vehicles must be designed for safety with regard to braking distance, rollover-type accidents, and survivability in accidents (IAPS 82, 83, 85, 86)
Nature of Science:	
• Recognize that our current understanding of forces has developed over centuries of studies by many scientists, and that we will continue to refine our understanding of forces through continued scientific investigations and advances in data collection. • Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases to answer scientific questions about motion and acceleration.	• Newton's Laws of Motion were developed over many years and applications of this science are important in understanding motor vehicle safety (IAPS 87, 88) • What kinds of government controls are appropriate to reduce the risk of injury in motor vehicle accidents (IAPS 87, 88)

2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
a. Gather, analyze, and interpret data to describe the different forms of energy and energy transfer b. Develop a research-based analysis of different forms of energy and energy transfer c. Use research-based models to describe energy transfer mechanisms, and predict amounts of energy transferred	• IAPS 54, 55, 56, 58 • IAPS 55, 61, 62, 63 • IAPS 56, 58, 62, 67	**54** Proc DI; [IB] D1 **55** AQ1 UC [IB] D1 **56** AQ3 **58** AQ2 UC, [IB] D4-5, D8 **61** [IB] D10 **62** [IB] D6, D19, D20 **63** AQ6 AD; [IB] D20-21 **67** AQ5 AD, [IB] D-14

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• Which forms of energy can be directly observed, and which forms of energy must be inferred? • What evidence supports the existence of potential and kinetic energy?	• What happens to energy when hot and cold water are mixed? (IAPS 61) • How can kinetic energy be transformed into another type? (IAPS 54) • What kinds of metals/materials make the best battery? (IAPS 65)
Relevance and Application:	

• Photos and measurements of accident investigation provide evidence of energy transfers during such events. • Kinetic energy often is turned into heat such as when brakes are applied to a vehicle or when space vehicles re-enter Earth's atmosphere. • Energy transfers convert electricity to light, heat, or kinetic energy in motors. • There are ways of producing electricity using both nonrenewable resources such as such as coal or natural gas and renewable sources such as hydroelectricity or solar, wind, and nuclear power.	• There are advantages and disadvantages of different sources of energy used to produce electricity in the United States. (IAPS 64) • How is energy transformed in an electrical circuit? (IAPS 66) • How can you use solar cells to produce the most energy possible? (IAPS 68) • What does it take to reduce energy use in a home? (IAPS 53)
Nature of Science:	
• Share experimental data, and respectfully discuss conflicting results. • Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others. • Use tools to gather, view, analyze, and report results for scientific investigations designed to answer questions about energy transformations.	• How many calories are in peanuts, pecans and walnuts, and how does this compare with the nutrition information on food labels? (IAPS 63) • How can the use of compact fluorescent bulbs reduce energy use and how can this be quantified and compared? (IAPS 67)

3. Distinguish between physical and chemical changes, noting that mass is conserved during any change (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
1. Identify the distinguishing characteristics between a chemical and a physical change 2. Gather, analyze, and interpret data on physical and chemical changes 3. Gather, analyze, and interpret data that show mass is conserved in a given chemical or physical change 4. Identify evidence that suggests that matter is always conserved in physical and chemical changes e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate physical and chemical changes	• IAPS 14 • IAPS 14, 18, 19, 25 • IAPS 25 • IAPS 25, 27 • IAPS 28, 29, www.sepuplhs.org	**14** [IB] B4-6 **18** AQ3 AD, [IB] B19-21 **19** [IB] B12-14 **25** Q2-3 **27** AQ2 CS, AQ3 ET **28** AQ3 ET **29** AQ1 ET; [IB] B22-23

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• What evidence can indicate whether a change is physical or chemical? • Is it easier to observe the conservation of mass in physical or chemical changes? Why? • What would happen if mass were not conserved?	• How do the properties of materials determine their uses? (IAPS 14) • How are reactants and products changed by a chemical reaction? (19) • How does the total mass of reactants compare to the mass of products in a chemical reaction? (IAPS 25)

Relevance and Application:	
• The freezing, thawing, and vaporization of Earth's water provide examples of physical changes. • An understanding of chemical changes have resulted in the design various products such as refrigerants in air conditioners and refrigerators. • Physical and chemical changes are involved in the collection and refinement of natural resources such as using arsenic in gold mining. • Living systems conserve mass when waste products from some organisms are nutrients for others.	• What is the environmental impact of manufacturing computers? (IAPS 22) • How is a circuit board produced? (IAPS 23) • When waste is incinerated, what happens to potentially toxic heavy metals? (IAPS 28)
Nature of Science:	
• Evaluate the reproducibility of an experiment, and critically examine conflicts in experimental results. • Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.	• Which "green" computers should a school district purchase? (IAPS 29) • What is the best material for making a drink container? (IAPS 12)

4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Compare and contrast different types of waves • Describe for various waves the amplitude, frequency, wavelength, and speed • Describe the relationship between pitch and frequency in sound • Develop and design a scientific investigation regarding absorption, reflection, and refraction of light	IAPS 91, 93, 96 IAPS 90-91, 96 IAPS 90 IAPS 95, 97	**91** AQ1; **96** AQ3 **90** AQ3; **96** AQ4 **95** AQ2; **97** AQ1

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• What are some different ways to describe waves?	• Many types of energy, such as sound and light, travel in the form of a wave (211) • How does colored light change the 'color' of objects? (P130) • What are shadows? How are they made?
Relevance and Application:	

• Different vibrations create waves with different characteristics. For example, a vibrating low-pitch guitar string feels different to the touch than a high-pitch guitar string. • Dealing with different types of waves presents design challenges. For example, higher frequency waves have shorter wavelengths, which affect ships, buildings, and antenna design. • Energy from different types of waves can affect the environment. For example, natural waves cause different beach erosion and boat wakes • There are many applications of light and lasers such as using fiber optics in high speed communication and lasers in surgery. • Living organisms collect and use light and sound waves – such as for hearing and vision – to gather information about their surroundings.	• All waves have certain characteristics such as wavelength, frequency and amplitude (211) • The different sounds that we perceive are related to the wavelength, frequency, and amplitude of the sound waves that reach our ears (211) • The different colors that we perceive are related to the wavelength, frequency, and amplitude of the light waves that reach our eye (211)
Nature of Science:	
• Evaluate models used to explain and predict wave phenomena that cannot be directly measured. • Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere. For example, the speed of light in a vacuum is constant across space and time. • Select and use technology tools to gather, view, analyze, and report results for scientific investigations about the characteristics and properties of waves.	• Students' exploration of waves continues through investigating vibrations and the production of sound waves. Using an elasticized string allows students to create and observe different pitch notes and relate the sounds produced to the frequency of the vibrations.

1. Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities (7)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Identify properties of substances in a mixture that could be used to separate those substances from each other • Develop and design a scientific investigation to separate the components of a mixture	• IAPS 3 • IAPS 3	**3** Proc DI; [IB] A16

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• Which properties are the most useful in trying to separate mixtures of substances? • How much difference must there be among the properties of substances for the properties to be useful in separating the substances?	• How can you separate the substances in a mixture? (IAPS 3)
Relevance and Application:	
• Materials are sorted based on their properties in a variety of applications. For example, water filtration systems rely on the solubility, density, and physical sizes of substances and recycling facilities use the properties of materials to separate substances in single-stream recycling systems. • Mining and oil refining processes use properties to separate	• A mixture of hazardous wastes must be separated into its component parts, which then must be identified, before the waste can be safely and legally disposed.

materials. • The kidneys use properties to filter wastes from the blood.	
Nature of Science:	
• Ask testable questions and make a falsifiable hypothesis about using properties in perform separations, and design a method to find an answer. • Evaluate and critique experimental procedures designed to separate mixtures. • Share experimental data, and respectfully discuss inconsistent results. • Describe several ways in which scientists would study mixtures, and suggest ways that this has contributed to our understanding of materials.	• Work together with classmates to design a plan to separate the substances in a mixture, and then test the component solids and liquids that make up the mixture (IAPS 3-7).

2. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
a. Identify evidence that suggests there is a fundamental building block of matter b. Use the particle model of matter to illustrate characteristics of different substances c. Develop an evidence based scientific explanation of the atomic model as the foundation for all chemistry d. Find and evaluate appropriate information from reference books, journals, magazines, online references, and databases to compare and contrast historical explanations for the nature of matter	• IAPS 16, 17 • IAPS 16, 17 • IAPS 16, 17, 18 • IAPS 16, www.sepuplhs.org	**16** [IB] B7-11 **17** AQ6 UC **18** AQ3 AD, [IB] B19-21

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• In the world of science what makes something a building block?	What are elements, and how do they relate to compounds? (IAPS 16) In what way were the Greek philosophers right—and

	wrong--about elements? (IAPS 16)
Relevance and Application:	
• Living things consist of the same matter as the rest of the universe.	• How are compounds different from the elements that form them? (IAPS 16)
Nature of Science:	
• Work in groups using the writing process to effectively communicate an understanding of the particle model of matter. • Use technology to share research findings about historical explanations for the nature of matter and to publish information to various audiences. • Create models that explain the particle theory of matter. • Recognize and describe the ethical traditions of science: value peer review, truthful reporting of methods and outcomes, making work public, and sharing a lens of professional skepticism when reviewing others work.	• How do atoms combine to form molecules? (IAPS 17) • How are the molecular models good—and bad—representations of actual molecules? (IAPS 17)

3. Atoms may stick together in well-defined molecules or be packed together in large arrays. Different arrangements of atoms into groups compose all substances. (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Explain the similarities and differences between elements and compounds • Identify evidence suggesting that atoms form into molecules with different properties than their components • Find and evaluate information from a variety of resources about molecules	• IAPS 16, 17 • IAPS 16, 17 • www.sepuplhs.org	**16** [IB] B7-11 **17** AQ6 UC

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• Why do substances behave differently? For example, why does water pour rapidly while syrup pours slowly?	• How are compounds different from the elements forming them?
Relevance and Application:	
• Different arrangements of atoms provide different properties. • Very small devices consist of large numbers of arranged groups of atoms that perform a specific function.	• Carbon dioxide gas contributes to global warming, but liquid, cooled carbon dioxide is an effective dry cleaning solvent, replacing toxic substances like PERC in related applications. (IAPS 15, 16, 17)
Nature of Science:	

• Use models and/or electronic media to show and understand how molecules are made of atoms. • Investigate how our current understanding of matter has developed through centuries of scientific investigations.	• How do atoms combine to form molecules? (IAPS 17) • How are the molecular models good—and bad—representations of actual molecules? (IAPS 17)

3. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Explain how the arrangement and motion of particles in a substance such as water determine its state • Distinguish between changes in temperature and changes of state using the particle model of matter	• IAPS 20, 21, 35 • IAPS 35, 36	**20** Q3-5 **21** Q1-3 **35** AQ1 AD **36** AQ8 UC

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• What determines whether matter is in the form of a solid, liquid, or gas? • What is the kinetic molecular theory, and how does temperature affect the behavior of particles in a gas?	• How can physical properties identify substances? (IAPS 35, 36)
Relevance and Application:	
• Solids, liquids, and gasses all have unique properties that make them useful in different situations. For example, solids are useful building materials.	Properties of liquids include appearance, smell, density, melting point and boiling point (IAPS 35).
Nature of Science:	

• Use models and technology tools to help visualize what is happening at the molecular level during phase changes. • Understand and apply the difference between scientific laws, theories and hypotheses. • Work in groups using the writing process to communicate an understanding how the particle model of matter explains various states of matter.	• Use characteristic properties of water and alchol – and skills such as observing and measuring – to tell the difference between water and alcohol samples (IAPS 35).

4. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density. (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Explain that the mass of an object does not change, but its weight changes based on the gravitational forces acting upon it • Predict how changes in acceleration due to gravity will affect the mass and weight of an object • Predict how mass, weight, and volume affect density • Measure mass and volume, and use these quantities to calculate density • Use tools to gather, view, analyze, and report results for scientific investigations about the relationships among mass, weight, volume, and density	• IAPS 8, 9, 10 (all)	**8** AQ6 UC; [IB] A9 **9** AQ3 UC, [IB] A10-12 **10** AQ1 AD, Proc DI; [IB] A10-12

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	

• Which of the following is the best recommendation for a person trying to lose weight and why?
  o Reduce the number of calories he or she eats.
  o Exercise more.
	• How do you measure the volume of an irregular solid object? (IAPS 8)
	• How can you use density to identify solids? (IAPS 10)
	• How would you measure the volume of an irregular

○ Go to the Moon. • If weight and mass are not the same thing, why might people use the words interchangeably? • Describe a situation in which mass would be the most useful information to know about an object? Do the same for weight, volume, and density.	object?
Relevance and Application:	
• Mass, weight, and gravitational forces are critical for space travel, future visits to outer space, and possibly the colonization of places like the Moon or Mars.	• Intrinsic properties can be used to identify substances. (IAPS 8, 9, 10)
Nature of Science:	
• Calculate the density of a sample, predict its ability to float or sink in a liquid of known density, design and perform the experiment, and justify discrepancies in the experimental outcome. • Ask testable questions and make a falsifiable hypothesis about density and design an inquiry based method to find an answer.	• How can you design an experiment to use the mass and volume of an unknown object to calculate its density? (IAPS 9, 10)

LIFE SCIENCE

1. Human activities can deliberately or inadvertently alter ecosystems and their resiliency (8).

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Develop, communicate, and justify an evidence-based scientific example of how humans can alter ecosystems • Analyze and interpret data about human impact on local ecosystems • Recognize and infer bias in print and digital resources while researching an environmental issue • Use technology resources such as online encyclopedias, online databases, and credible websites to locate, organize, analyze, evaluate, and synthesize information about human impact on local ecosystems • Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate an environmental issue	• IALS 72, 73, 85 • IALS 72, 77 • IALS 73, 88 • IALS 73, 88, www.sepuplhs.org • IALS 73, 88, www.sepuplhs.org	**72** [IB] F17 **73** AQ1 UC **77** [IB] F10-12 **85** [IB] G1 **88** AQ2 UC, [IB] G3, G13, G17

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• Do humans have a unique responsibility to the ecosystems	• What are the tradeoffs in introducing a new species to the

in which they live? • How can a young person be a steward of an ecosystem?	environment? (IALS 72) • What, if anything, should be done to control introduced species? (IALS 73)
Relevance and Application:	
• Human activities such as cutting down forests and polluting water or covering deserts with fields of solar panels are constantly changing various cycles and habitats in the natural world. • There are laws that preserve and protect wilderness areas such as national parks and other natural areas but such laws also limit the utilization of the natural resources in those areas.	• How might the introduction of a competing species, such as zebra mussels, affect a population of native clams? (IALS 84)
Nature of Science:	
• Critically evaluate scientific claims in popular media and peer generated explanations regarding interactions in ecosystems, and determine if the evidence presented is appropriate and sufficient to support the claims.	• What do you observe when you conduct a field study? (IALS 86) • What are the tradeoffs of trying to control introduced species? (IALS 87)

2. Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation (8).

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Develop, communicate, and justify an evidence-based scientific explanation for how genetic information is passed to the next generation • Use direct and indirect observations, evidence, and data to support claims about genetic reproduction and traits of individuals • Gather, analyze, and interpret data on transmitting genetic information • Use models and diagrams to predict the phenotype and genotype of offspring based on the genotype of the parents • Use computer simulations to model and predict phenotype and genotype of offspring based on the genotype of the parents	• IALS 55, 59 • IALS 54 • IALS 55, 58, 59, 61, 63 • IALS 65, 66 • IALS 59, 62 (www.sepuplhs.org)	**54** Act DCI, [IB] D2 **55** AQ2 UC **59** AQ5 UC, [IB] D2 **61** [IB] D5, D12-16 **62** AQ4a UC **63** [IB] D1, D2-5, D8-11, D18, D22-24 **65** AQ8 UC **66** [IB] D7, D21, D25

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP

Inquiry Questions:	
• How are traits passed from one generation to the next? • What traits can be passed to the next generation and what traits cannot? • How can patterns in the inheritance of traits be used to predict how frequently they appear in offspring?	• How are simple inherited traits passed from parents to their offspring and the next generation? (IALS 58) • How can Punnett squares help predict patterns of inheritance? (IALS 61)
Relevance and Application:	
• There are benefits and risks to genetic engineering such as cloning, genetically modifying organisms, and replacing genes for therapy. • Genome sequencing has many potential applications to the field of medicine.	• Would you want to find out if you had a genetic disease? (IALS 56) • How can DNA fingerprinting help identify missing persons? (IALS 70)
Nature of Science:	
• Understand the interconnected nature of math and science by utilizing math in the prediction of future generations. • Recognize that current understanding of genetics has developed over time and become more sophisticated as new technologies have lead to new evidence. • Critically evaluate models used to represent deoxyribonucleic acid (DNA) and genes; identify strengths and weaknesses of these models for representing complex natural phenomena.	• Who was Gregor Mendel, and how did he discover the basis of heredity? (IALS 60) • What are the ethical issues involved in using genetic information? (IALS 71)

1. Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment (7)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Develop, communicate, and justify an evidence-based explanation for why a given organism with specific traits will or will not survive to have offspring in a given environment	• IALS 95, 96, 97	**89** AQ4 ET, [IB] F1-4, F29 **95** [IB] F18-21 **96** AQ2 DCI **97** AQ2 CM, [IB] F15, F22-25, F27-28, F30-31 **99** AQ2 UC, [IB] 434-36
• Analyze and interpret data about specific adaptations to provide evidence and develop claims about differential survival and reproductive success	• IALS 89, 98, 99	
• Use information and communication technology tools to gather information from credible sources, analyze findings, and draw conclusions to create and justify an evidence-based scientific explanation	• IALS 99 (www.sepuplhs.org); 100	
• Use computer simulations to model differential survival and reproductive success associated with specific traits in a given environment	• IALS 99 (www.sepuplhs.org); 100	

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	

• What is the relationship between an organism's traits and its potential for survival and reproduction? • How is the use of the word "adaptation" different in everyday usage than in biology?	• Should we save endangered species? (IALS 89) • What role do mutations play in natural selection? (IALS 97)
Relevance and Application:	
• Bacteria have evolved to survive in the presence of the environmental pressure of antibiotics – giving rise to antibiotic resistance. • Species that can live with humans –such as rats and pigeons – are more common around towns and cities.	• What can you learn about evolution by comparing the fossil record of fish, mammals, and reptiles? (IALS 98) • How does natural selection explain the extinction of the dodo and the success of the common pigeon? (IALS 101)
Nature of Science:	
• Create and use sound experimental designs to collect data around survival and genetic traits. • Describe several ways in which scientists would study genetics, and suggest ways that this has contributed to our understanding of survival and populations.	• How do factors such as the environment and the presence of predators affect the process of natural selection? (IALS 95)

2. The human body is composed of atoms, molecules, cells, tissues, organs, and organ systems that have specific functions and interactions (7).

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Develop and design a scientific investigation about human body systems • Develop, communicate, and justify an evidence-based scientific explanation regarding the functions and interactions of the human body • Gather, analyze, and interpret data and models on the functions and interactions of the human body	• IALS 12, 13, 14, 15, 16, 17, 18, 23 • IALS 12, 13, 14, 15, 16, 17, 18. 23 • IALS 12, 13, 14, 15, 16, 17, 18, 23	**12** [IB] B12, B15 **13** [IB] B3, B7 **14** [IB] B16 **15** AQ3 UC, [IB] B2, B5, B25-28 **17** [IB] B1, B8, B21 **18** [IB] B9, B17-18, B29 **23** AQ3 UC, [IB] B23 **31** [IB] C8

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How does each body system contribute to supporting the life of the organism? • How do organs and organ systems in the human body interact to perform specific functions? •	• What do you know about the organs and systems of the human body? (12) • How does your liver help your body stay in balance? (13)
Relevance and Application:	
• There are technologies such as magnetic resonance imaging (MRI), computed tomography (CT) scans, and chemical lab tests that are related to the diagnosis and treatment of the human body's diseases	• What is the range of human diseases? (31)

Nature of Science:	
• Critically evaluate models, and identify the strengths and weaknesses of the model in representing our understanding of the human body •	• How can you design a prototype of an artificial bone that is strong, yet light and flexible? (105) • How can you design a heart valve prototype out of common materials? (104)

3. Cells are the smallest unit of life that can function independently and perform all the necessary functions of life. (7)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Gather, analyze, and interpret data and models on the different types of cells, their structures, components and functions • Develop, communicate, and justify an evidence-based scientific explanation regarding cell structures, components, and their specific functions • Compare and contrast the basic structures and functions of plant cells, animal cells, and single-celled organisms • Employ tools to gather, view, analyze, and report results for the scientific investigations of cells	• IALS 42, 82 • IALS 39, 42, • IALS 38, 42, 82 • IALS 35, 36, 38, 43	**35** [IB] C10, C33, C34 **36** AQ3 CM, [IB] C24 **37** Act UC, [IB] C14 **38** Q1-6 **39** AQ2 DCI, [IB] C6 **42** [IB] D3, D7, D16-10, C23 **43** AQ2 CM, AQ5 UC, [IB] C 12, C21-22 **44** Act GI, [IB] C2, C35 **49** AQ4 ET, [IB] D26 **50** Q1-3 **82** [IB] E5, E13-14, E17

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How is the basic structure of a cell related to its function? • How are the components – or organelles – of a cell related to the cell's function? • How are various cells unique, and what do they have in common with other cells?	• How are the cells of plants different from the cells of animals? How do plant cell structures relate to their functions as producers? (82) • What are some parts of the cell? What do they do? (42)

	• How are microbes classified? (44)
Relevance and Application:	
• Stem cells are undifferentiated cells that have potential use in medicine. • Cancer is caused by a cell that isn't functioning correctly. • Cells can be cultured to benefit humanity.	• How do vaccines prevent disease? (49) • How was the first antibiotic discovered? (50)
Nature of Science:	
• Recognize that our current understanding of cells has developed over centuries of studies by many scientists, and that through continued scientific investigations and advances in data collection, we will continue to refine our understanding of cells.	• How did the germ theory of disease develop? (37)

4. Photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms. (7)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Gather, analyze, and interpret data regarding the basic functions of photosynthesis and cellular respiration • Use direct and indirect evidence to describe the relationship between photosynthesis and cellular respiration within plants – and between plants and animals • Use computer simulations to model the relationship between photosynthesis and cellular respiration within plants – and between plants and animals	• IALS 17, 18, 81, 82 • IALS 17, 18, 81, 82 • Visit www.sepuplhs.org	**17** [IB] B1, B8, B21 **18** [IB] B9, B17-18, B29 **79** AQ1 UC, [IB] E2-3, E7-11, E16, E35 **81** AQ5 UC, [IB] E2, 3, E5, E13-14 **82** [IB] E5, E13-14, E17

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• What is the relationship between photosynthesis and cellular respiration? • What energy transformations occur in both the processes of photosynthesis and cellular respiration?	• How do scientists study the role of light in photosynthesis? (81) • How do the cells of producers differ from those of consumers? (81)
Relevance and Application:	

• Plants are essential for human health and the health and survival of Earth's ecosystems. • The energy in food comes from Sunlight via photosynthesis and is the basis for most ecosystems on earth. • Fossil fuels come from the photosynthesis of organisms that lived millions of years ago.	• How do plant cell structures relate to their function as producers? (81) • What are the energy relationships among organisms in an ecosystem? (79)
Nature of Science:	
• Ask a testable question and make a falsifiable hypothesis about photosynthesis or respiration and design an inquiry based method to find an answer. • Design an experiment to observe photosynthesis or respiration, and clearly define controls and variables. • Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.	• How do scientists study the role of light in photosynthesis? (81) • How much carbon dioxide is in your exhaled breath? (17)

5. Multiple lines of evidence show the evolution of organisms over geologic time. (7)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Interpret and analyze data from the fossil record to support a claim that organisms and environments have evolved over time • Analyze and critique the evidence regarding the causes and effects of a mass extinction event • Analyze and interpret data that show human evolution • Use technology to share research findings about the evidence regarding the causes and effects of a mass extinction event	• IALS 90, 91 • IALS 89 • N/C • IALS 89, 97, 98	**89** AQ4 ET, [IB] F1-4, F29 **90** AQ3 CM, [IB] F5 **91** AQ4 UC, [IB] F12-14 **97** AQ2 CM, [IB] F15, F22-25, F27-28, F30-31 **98** [IB] F32-33

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• What might life on Earth have been like in the distant past, and what evidence is there for this? • How does the evidence about the way life has evolved on Earth from long ago tell us about Earth today?	• What can fossils tell you about organisms that lived in the past? (90) • How can fossil footprints be used to study the behavior of animals that were alive millions of years ago?
Relevance and Application:	

• There is growing concern over the current extinction of organisms around the world – and the consequences of these extinctions.	• It is estimated that 99.9% of all species that have ever lived on Earth are now extinct. (89)
Nature of Science:	
• Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists. • Cite various scientific arguments regarding the causes and effects of mass extinctions.	• What can you learn about evolution by comparing the fossil records of fish, mammals, and reptiles? (98)

1. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species. (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Interpret and analyze data about changes in environmental conditions – such as climate change – and populations that support a claim describing why a specific population might be increasing or decreasing	• IALS 72, 77 • IALS 73	**72** AQ5 UC, [IB] E2, 3, E5, E13-14 **73** [IB] E1, E12, E24 **77** AQ4 DCI, AQ7 DCI **79** AQ1 UC, [IB] E2-3, E7-11, E16, E35 **84** [IB] E19-20, E26-27, E34 **85** AQ1 UC, [IB] E21-23 **87** AQ1 ET
• Develop, communicate, and justify an evidence-based explanation about how ecosystems interact with and impact the global environment	• IALS 72, 77, 79, 84, 87	
• Model equilibrium in an ecosystem, including basic inputs and outputs, to predict how a change to that ecosystem such as climate change might impact the organisms, populations, and species within it such as the removal of a top predator or introduction of a new species	• IALS 72, 77, 79, 84, 87 and www.sepuplhs.org	
• Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate how environmental conditions affect the survival of organisms		

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How do ecosystem changes affect biodiversity? • How does biodiversity contribute to an ecosystem's equilibrium?	• What are the tradeoffs of introducing a new species into a new environment? (72)
Relevance and Application:	
• The development and application of technologies intended to aid some populations and ecosystems.	• What is carrying capacity? How can technology affect this? (85)
Nature of Science:	
• Ask testable questions and make a falsifiable hypothesis about how environmental conditions affect organisms, populations, or entire species and design a method to find the answer. • Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others. • Use models and technology tools to show what might happen to individuals, populations, and species as environmental conditions change.	• What is carrying capacity? Can you identify the maximum and minimum number of organisms in an environment? (85) • How do scientists study the size of a population and predict future population changes? (77) • Do you and your classmates agree about what to do regarding the Nile Perch problem in Lake Victoria? (72)

2. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem. (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Develop, communicate, and justify an evidence-based explanation about why there generally are more producers than consumers in an ecosystem	• IALS 79, 80, 81	**79** AQ1 UC, [IB] E2-3, E7-11, E16, E35 **80** [IB] E2-3, E7-10, E15, E16, E25 **81** AQ5 UC, [IB] E2, 3, E5, E13-14 **88** AQ3 ET, [IB] E28-32
• Design a food web diagram to show the flow of energy through an ecosystem	• IALS 79, 80, 81	
• Compare and contrast the flow of energy with the cycling of matter in ecosystems	• IALS 79, 80, 81	

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How do different ecosystems cycle matter differently? • What "jobs" do organisms do to facilitate the flow of energy and cycling of matter?	• What are the energy relationships among organisms in an ecosystem? (79) • What 'jobs' do decomposers do? Where do you find them? (80)
Relevance and Application:	
• Humans use an understanding of the cycling of matter and energy to help mitigate environmental problems. For example, they treat waste water and clean up oil spills.	• What can be done to remove invasive species, such as zebra mussels and hydrilla, from a lake? (88)

Nature of Science:	
• Scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere – that energy follows the same rules in an ecosystem as it does in physic's experiments. • Generate solutions to help mitigate environmental problems based on an understanding of the cycling of matter and energy. • Create and evaluate models that show how interactions create a flow of energy and a cycling of matter in an ecosystem.	• How do scientists study the size of a population and predict future population changes? (77) • What can be done to remove invasive species, such as zebra mussels and hydrilla, from a lake? How do scientists and society decide what, if anything, must be done? (88)

EARTH SCIENCE

Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the sun, and can be predicted and described through complex models. (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Differentiate between basic and severe weather conditions, and develop an appropriate action plan for personal safety and the safety of others • Observe and gather data for various weather conditions and compare to historical data for that date and location • Use models to develop and communicate a weather prediction	• IAES 51, 52 • IAES 69, 70	**51** Proc OD **52** Q1-3 **53** [IB] E2, E7 **69** Proc CS; [IB] E14 **70** AQ3 ET, [IB] E16

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• Why does weather vary from day to day? • What are the strengths and limitations of different types of weather models? • What are the variables that make predicting weather challenging? • How do weather patterns relate to climate?	• How does daily weather data differ from monthly data? (51) • How are weather disasters different from everyday weather? (52) • How does weather differ from climate? How do climates vary? (53)

Relevance and Application:	
• Weather stations, buoys, satellites, radar, and computer modeling are examples of technology used to help forecast weather. • Weather prediction is based on the interaction of many variables. • Weather prediction can save lives, protect property, and conserve resources.	• Meteorologists collect data about the weather using a variety of technologies. (69)
Nature of Science:	
• Evaluate of the accuracy of various tools used in forecasting weather. • Use the historical context and impact of early weather research and consider the potential implications for current weather studies on science and our society.	• How can you tell if a weather disaster is likely where you live? A great deal depends on the history of extreme weather and accuracy of the forecast. (52)

2. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location. (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Develop, communicate and justify an evidence-based scientific explanation to account for Earth's different climates • Research and evaluate direct and indirect evidence to explain how climates vary from one location to another on Earth • Examine, evaluate, and question information from a variety of sources and media to investigate how climates vary from one location to another on Earth	• IAES 53, 55, 56, 57, 58 • IAES 53, 55, 56, 57, 58 • IAES 53, 55, 56, 57, 58	**53** [IB] E2, E7 **55** Proc DI **56** Proc GI **57** [IB] E10 **58** [IB] E6

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How does the climate in one area compare and contrast with another area? • Why are there different climates on Earth? • How has Earth's climate changed over time? • What evidence supports and/or contradicts human influence on climate change? • What is the difference between weather and climate?	• How does weather differ from climate? (53) • How do climates vary? (53) • How do oceans affect climate? (57)

Relevance and Application:	
• Data tables, charts, and graphs allow people to compare and contrast various climates around the globe. • Computer models help people understand past, present, and future climates.	• What is the difference between polar, tropical, highland, mild, and dry climates? (53) • What is the avearge annual rainfalls for different parts of the world? (53)
Nature of Science:	
• Ask testable questions and make a falsifiable hypothesis about earth's climate and use an inquiry based approach to find an answer. • Describe various techniques that scientists use to study climate, and suggest ways that each technique can be used to better understand various climates and changes in climate.	• How do ocean temperatures vary over the surface of the earth?

3. The solar system is comprised of various objects that orbit the Sun and are classified based on their characteristics. (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Construct a scale model of the solar system, and use it to explain the motion of objects in the system such a planets, Sun, Moons, asteroids, comets, and dwarf planets • Describe methods and equipment used to explore the solar system and beyond • Design an investigation that involves direct observation of objects in the sky, and analyze and explain results • Research, critique, and communicate scientific theories that explain how the solar system was formed • Use computer data sets and simulations to explore objects in the solar system • Recognize that mathematical models are used to predict orbital paths and events	• IAES 89, 90, 91 • IAES 87, 93 • IAES 86 • IAES 92 • IAES 88, 89 (www.sepuplhs.org) • IAES 87	**86** Q3 **87** [IB] G8, G15 **88** AQ2 UC, [IB] G3, G13, G17 **89** Proc RE; [IB] G6, G14 **90** [IB] G9, 16, 18 **91** AQ4 UC **92** [IB] G2, G11

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	

• How are the various bodies in the solar system similar and different? • How does investigating characteristics of the various bodies in the solar system provide clues to Earth's origin and evolution? • Why do objects such as satellites, Moons and planets stay in orbit? • How is the life cycle of a star such as the Sun similar to the cycle of life on Earth?	• What types of objects are found in space? (88) • What feature makes each planet unique? (89) • How far away are other planets in the solar system? (90) • How big are the planets? (91) • How is the Sun different from other objects in the solar system? (92)
Relevance and Application:	
• Various technological methods and equipment such as telescopes are used to investigate far-away objects in the solar system and beyond. • By representing galaxies and solar systems, planetariums allow people to simulate the experience of outer space.	• How can you get a picture of a surface you can't see? (93) • How has the telescope helped astronomers see space objects? (87)
Nature of Science:	
• Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere – that planets follow the same rules about forces as other objects. • Recognize that our current understanding of the solar system has developed over centuries of studies by many scientists, and that through continued scientific investigations and advances in data collection, we will continue to refine our understanding of the solar system.	• How has the telescope helped astronomers see space objects? How has it changed over time? (87) • How can you study objects millions of light-years away from earth? (93)

4. The relative positions and motions of Earth, Moon, and Sun can be used to explain observable effects such as seasons, eclipses, and Moon phases. (8)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP

• Develop, communicate, and justify an evidence-based explanation using relative positions of Earth, Moon, and Sun to explain the following natural phenomenon:
  o Tides
  o Eclipses of the Sun and Moon
  o Different shapes of the Moon as viewed from Earth
• Analyze and interpret data to explain why we have seasons
• Use models to explain the relative motions of Earth, Moon, and Sun over time
	• IAES 74, 75, 76, 77, 78
	
	• IAES 76, 77
	
	• IAES 78, 79, 81
		74 [IB] F1-2
		75 AQ1-5
		76 AQ4 AD
		77 [IB] F10-12
		78 AQ2 UC
		79 [IB] F10-12, F14-16
		80 [IB] F4-9
		81 AQ5 UC; [IB] F5, F8
		97 AQ1 RE
		98 AQ2 ET, CS; [IB] G16, G20

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• Why do we observe changes in the relative positions of Earth, Moon, and Sun from Earth over time? • How do the relative positions of Earth, Moon and Sun affect natural phenomenon on Earth?	• What causes the yearly cycle of the seasons on earth? (76) • How do the rotation and revolution of the earth explain the lenth of a year and the seasons? (78) • What causes the lunar cycle we observe from earth?

	(80)
Relevance and Application:	
• Different tools are used to help understand motion in the solar system. • Space missions can be planned because we understand planetary motion.	• What kinds of future space mission should we fund? (97, 98
Nature of Science:	
• Explore the global consequences of the interrelationships among science, technology and human activity. • Evaluate visual and print media for scientific evidence, bias, and conjecture related to the historical ideas about relative positions of the Earth, Moon and Sun.	• What types of space exploration should NASA fund? (97) • When did some of the great advances in space exploration occur? (85)

1. Major geologic events such as earthquakes, volcanic eruptions, mid-ocean ridges, and mountain formation are associated with plate boundaries and attributed to plate motions. (7)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Gather, analyze, and communicate data that explains Earth's plates, plate motions, and the results of plate motions • Identify, interpret, and explain models of plates motions on Earth • Use maps to locate likely geologic "hot spots", using evidence of earthquakes and volcanic activity • Use web-based or other technology tools to show connections and patterns in data about tectonic plate boundaries and earthquakes, volcanic eruptions, and mountain formation	• IAES 41, 42 44, 47, 48 • IAES 41, 42 44, 47, 48 • IAES 44 • IAES 47, 48	**41** AQ3 UC; [IB] D2 **42** [IB] D4, 6, 8-10, 16 **44** [IB] D7, D16 **45** [IB] D3, D11-12, D16 **47** [IB] D16 **48** AQ4 UC; [IB] D14, D16

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How can major geologic events be attributed to plate movement? • What evidence supports the theory of plate tectonics? • What are the effects of plate movement along plate boundaries?	• How can you use earthquakes and volcano data to map the earth's plates? (44) • What happens when the earth's plates move apart over time? What happens when they collide or slide past one another? (47, 48)

Relevance and Application:	
• Computer models and simulations help us understand and make informed decisions about major geologic events. • Building codes and emergency plans often reflect natural threats in an area.	• How can a seismograph be used to measure earthquakes? (43)
Nature of Science:	
• Construct a model to demonstrate how plate movement results in geologic events. • Trace the development of a scientific theory using the theory of plate tectonics. • Describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others.	• Students use earthquake simulations to study plate movement. (47, 48) • How did continental drift lead to the theory of plate tectonics? (42)

2. Geologic time, history, and changing life forms are indicated by fossils and successive sedimentation, folding, faulting, and uplifting of layers of sedimentary rock. (7)|

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Describe the geologic time scale and why it is used • Identify and describe the impact of major geologic events on life on Earth • Identify and describe major events in Earth's geologic history • Use direct and indirect evidence to determine the sequence of events in geologic time	• IAES 39 • IAES 39 • IAES 39, 40 • IAES 39	**38** AQ5 UC; [IB] D1, D15 **39** [IB] D5, D13 **40** Q1, 3, 4

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How can we interpret data from layers of rock? • What is geologic time?	• When did particular events in Earth's history occur? (39)
Relevance and Application:	
• Knowledge of Earth's structure such as knowing where to mine for gold or drill for oil helps humans locate and extract resources. • Dating fossils absolutely and relatively helps assemble the story of the evolution of life on Earth.	• How does a knowledge of fossil distribution help explain the movement of Earth's major plates? (40) • What is beneath the Earth's surface? (38)
Nature of Science:	

• Ask testable questions and make falsifiable hypotheses on the history of the earth and design a method to find an answer. • Describe how scientists study fossils, and suggest ways that understanding fossil evidence contributed to our knowledge about life on Earth over geologic time.	• Describe what has happened to the land on the surface of the earth. (40) • Use computer simulations to study movements of the major lithospheric plates on the surface of the Earth (40)

1. Complex interrelationships exist between Earth's structure and natural processes that over time are both constructive and destructive. (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Gather, analyze, and communicate an evidence-based explanation for the complex interaction between Earth's constructive and destructive forces • Gather, analyze and communicate evidence form text and other sources that explains the formation of Earth's surface features • Use or create a computer simulation for Earth's changing crust	• IAES 37, 38, 41, 42, 44, 45, 47, 48 • IAES 42, 44, 45, 47, 48 • IAES 48	**37** Q1, 3 **38** AQ5 UC; [IB] D1, D15 **41** AQ3 UC; [IB] D2 **40** Q1, 3, 4 **42** [IB] D4, 6, 8-10, 16 **44** [IB] D7, D16 **45** [IB] D3, D11-12, D16 **47** [IB] D16 **48** AQ4 UC; [IB] D14, D16

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How do forces inside Earth and on the surface build, destroy, and change Earth's crust? • How does Earth's surface change over time?	• What happens as the earth's plates collide or slide past each other? (48) • What is the evidence that the continents have moved? (41, 42)
Relevance and Application:	

• There are costs and benefits to building in areas that are prone to constructive and destructive forces such as earthquakes and landslides. • Harbors, glaciers, and geysers change over time based on geologic and natural events.	• How do volcanic eruptions vary? (37) • How can a seismograph measure earthquakes? (43)
Nature of Science:	
• Practice the collaborative inquiry process that scientists use to identify local evidence of Earth's constructive and destructive processes. • Create and compare models that show how natural processes affect Earth's structures.	• What happens when the earth's plates move apart over time? What happens when they collide or slide past one another? (47, 48)

2. Water on Earth is distributed and circulated through oceans, glaciers, rivers, ground water, and the atmosphere. (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Gather and analyze data from a variety of print resources and investigations to account for local and world-wide water circulation and distribution patterns	• IAES 59, 60, 61, 62	**59** Q1-3 **60** [IB] E3, E8-9 **61** Q1-3 **62** AQ4 SI; [IB] E3, 9, 11, 15
• Use evidence to model how water is transferred throughout the earth	• IAES 59, 60, 61, 62	
• Identify problems, and propose solutions related to water quality, circulation, and distribution – both locally and worldwide	• IAES 59, 60, 61, 62	
• Identify the various causes and effects of water pollution in local and world water distributions	• IAES 62	
• Describe where water goes after it is used in houses or buildings	• IAES 59, 60, 61, 62	

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• How is water cycled on Earth? • How does the lack or abundance of water impact human civilizations and populations? • How do your daily decisions impact the quality of water in the water cycle?	• How does water move from place to place on Earth? (62) • Can you describe the water cycle? (62)
Relevance and Application:	

• Home water quality and consumption affects for health and conservation policies. • Water systems affect local, regional, and world population development. • Water-use irrigation patterns in Colorado affect economic development in the state.	• How does groundwater become polluted? (61) • How well do different liquids dissolve in water? (59)
Nature of Science:	
• Ask testable questions and make falsifiable hypotheses research about water distribution. • Create and evaluate models; identifying the strengths and weaknesses of the model in representing water circulation and distribution.	• Create and test a model for to show how water can be 'stored' in the ground, as groundwater. (61) • Where does <u>your</u> drinking water come from? (61)

3. Earth's natural resources provide the foundation for human society's physical needs. Many natural resources are nonrenewable on human timescales, while others can be renewed or recycled. (6)

Evidence Outcomes	Where taught in SEPUP	Where Assessed in SEPUP
• Research and evaluate data and information to learn about the types and availability of various natural resources, and use this knowledge to make evidence-based decisions • Identify and evaluate types and availability of renewable and nonrenewable resources • Use direct and indirect evidence to determine the types of resources and their applications used in communities • Research and critically evaluate data and information about the advantages and disadvantages of using fossil fuels and alternative energy sources	• IAES 12 • IAES 12	**12** Q3-4

21st Century Skills and Readiness Competencies	Related Content/Where Developed in SEPUP
Inquiry Questions:	
• What resources are found and used in our community? • How can natural resources be identified and classified? • How can we make responsible choices about the resources we use on a daily basis?	• What do natural resources look like? (12) • What are differences in how the class ranked various natural resources in terms of importance. (12)

Relevance and Application:	
• Natural resources come from a variety of locations and have to be mined or harvested, depending on the type. • A resource can be used in a variety of ways, depending on the product being made. For example plastics, textiles, medications, and fertilizers are produced from petroleum. • Resources in Colorado directly affect the state economy and society by providing employment and sources of revenue.	• Which is more important, coal or wood? (12)
Nature of Science:	
• Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others.	