LAB-AIDS CORRELATIONS FOR THE MINNESOTA SCIENCE BENCHMARKS

GRADES 6-8

With Assessment Guidelines information

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. 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 programs that support the Minnesota Science Benchmarks. It is not an exhaustive list; other locations may exist that are not listed here.

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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.

MIDDLE SCHOOL

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?

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.

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		

6th GRADE

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
1. The Nature of Science and Engineering Engineers create, develop and manufacture machines, structures, processes and systems that impact society and may make humans more productive.	6.1.2.1.1	Identify a common engineered system and evaluate its impact on the daily life of humans. *For example:* Refrigeration, cell phone or automobile.	IAPS 11, 13, 60 (glass bottle, aluminum can, refrigerator)	**11** AQ1 ET, [IB] A17 **13** Proc RE, GI; [IB] B2-3 **60** AQ3-4
	6.1.2.1.2	Recognize that there is no perfect design and that new technologies have consequences that may increase some risks and decrease others. *For example:* Seat belts and airbags.	IAPS 10, 11, 13	**10** AQ1 AD, Proc DI; [IB] A10-12 **11** AQ1 ET, [IB] A17 **13** Proc RE, GI; [IB] B2-3
	6.1.2.1.3	Describe the trade-offs in using manufactured products in terms of features, performance, durability and cost.	IAPS 10, 13 (byproducts of home cleaners and impact of industrial refrigeration)	**10** AQ1 AD, Proc DI; [IB] A10-12 **13** Proc RE, GI; [IB] B2-3
	6.1.2.1.4	Explain the importance of learning from past failures, in order to inform future designs of similar products or systems. *For example:* Space shuttle or bridge design.	IAPS 23 (circuit board design), 39 (water cycle contaminants)	**23** AQ2-3 **39** AQ7 SI; [IB] C3-4
Engineering design is the process of devising products, processes and systems that address a need,	6.1.2.2.1	Apply and document an engineering design process that includes identifying criteria and constraints, making representations, testing and evaluation, and refining the design as needed to construct a product or system that solves a problem.	IAPS 11 (household cleaner), 13 (soft drink container)	**11** AQ1 ET, [IB] A17 **13** Proc RE, GI; [IB] B2-3

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
capitalize on an opportunity, or solve a specific problem.		*For example:* Investigate how energy changes from one form to another by designing and constructing a simple roller coaster for a marble.	IAPS 74, 76, 77 (measuring mass, speed and effect of mass in collisions)	**74** Proc DI; [IB] E1-2, 5-6 **76** [IB] E2 **77** AQ 1-4, Proc DI
Designed and natural systems exist in the world. These systems consist of components that act within the system and interact with other systems.	6.1.3.1.1	Describe a system in terms of its subsystems and parts, as well as its inputs, processes and outputs.	IAPS 13, 25, 27 (reclaiming metal from a used copper solution)	**13** Proc RE, GI; [IB] B2-3 **25** AQ2-3 **27** AQ2 CS, AQ3 ET
	6.1.3.1.2	Distinguish between open and closed systems. *For example:* Compare mass before and after a chemical reaction that releases a gas in sealed and open plastic bags.	IAPS 25 (compare mass before and after a chemical reaction that releases a gas in sealed and open plastic bags)	**25** AQ2-3
Current and emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work	6.1.3.4.1	Determine and use appropriate safe procedures, tools, measurements, graphs and mathematical analyses to describe and investigate natural and designed systems in a physical science context.	Throughout, Lab safety an integral component (see TG, course essentials), IAPS 8-10, 18, 35, 56, 74…	8 AQ 3 9 AQ 3a-e 10 AQ1 35 AQ 1a-c 56 AQ 74 AQ 1, 3, 4
	6.1.3.4.2	Demonstrate the conversion of units within the International	Throughout, e.g., 8-10, 18,	8 AQ 3

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
and interact.		System of Units (SI, or metric) and estimate the magnitude of common objects and quantities using metric units.	19, 25, 35, 37, 56, 74…	9 AQ 3a-e 10 AQ1 35 AQ 1a-c 56 AQ 74 AQ 1, 3, 4
2. Physical Science **Matter** Pure substances can be identified by properties which are independent of the sample of the substance and the properties can be explained by a model of matter that is composed of small particles.	6.2.1.1.1	Explain density, dissolving, compression, diffusion and thermal expansion using the particle model of matter.	IAPS 9, 10 IAPS 37 IALS 40 IAPS 59-60 Thermal expansion not covered*	**9** AQ3 UC, [IB] A10-12 **10** AQ1 AD, Proc DI; [IB] A10-12 **37** AQ2 AD; [IB] C1 **40** AQ1 ET; [IB] C5-7, C19 **59** AQ3-5 **60** AQ3-4
Substances can undergo physical changes which do not change the composition or	6.2.1.2.1	Identify evidence of physical changes, including changing phase or shape, and dissolving in other materials.	IAPS 14, 37	**14** [IB] B4-6 **37** AQ2 AD; [IB] C1
	6.2.1.2.2	Describe how mass is conserved during a physical change in a	IAPS 25	**25** AQ2-3

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
the total mass of the substance in a closed system.		closed system. *For example:* The mass of an ice cube does not change when it melts.		
	6.2.1.2.3	Use the relationship between heat and the motion and arrangement of particles in solids, liquids and gases to explain melting, freezing, condensation and evaporation.	IAPS 58-60	**58** AQ2 UC, [IB] D4-5, D8 **59** AQ3-5 **60** AQ3-4
Force and Motion The motion of an object can be described in terms of speed, direction and change of position.	6.2.2.1.1	Measure and calculate the speed of an object that is traveling in a straight line.	IAPS 74	**74** Proc DI; [IB] E1-2, 5-6
	6.2.2.1.2	For an object traveling in a straight line, graph the object's position as a function of time, and its speed as a function of time. Explain how these graphs describe the object's motion.	IAPS 74, 75	**74** Proc DI; [IB] E1-2, 5-6 **75** AQ2 UC, [IB] E2, 4-6, 7, 14
Forces have magnitude and direction and affect the motion of objects.	6.2.2.2.1	Recognize that when the forces acting on an object are balanced, the object remains at rest or continues to move at a constant speed in a straight line, and that unbalanced forces cause a change in the speed or direction of the motion of an object.	IAPS 79-81	**79** [IB] E10 **80** AQ2; [IB] E2, 3, 11, 20 **81** [IB] E3, 13, 15
	6.2.2.2.2	Identify the forces acting on an object and describe how the sum of the forces affects the motion of the object. *For example:* Forces acting on a book on a table or a car on the	IAPS 79-81	**79** [IB] E10 **80** AQ2; [IB] E2, 3, 11, 20 **81** [IB] E3, 13, 15

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
		road.		
	6.2.2.2.3	Recognize that some forces between objects act when the objects are in direct contact and others, such as magnetic, electrical and gravitational forces can act from a distance.	IAES 95	**95** AQ4 AD; [IB] G10, 12
	6.2.2.2.4	Distinguish between mass and weight.	IAPS 9, 78	**9** AQ3 UC, [IB] A10-12 **78** [IB] E2, 3, 8
Energy Waves involve the transfer of energy without the transfer of matter.	6.2.3.1.1	Describe properties of waves, including speed, wavelength, frequency and amplitude.	LA 211*	
	6.2.3.1.2	Explain how the vibration of particles in air and other materials results in the transfer of energy through sound waves.	LA 211*	
	6.2.3.1.3	Use wave properties of light to explain reflection, refraction and the color spectrum.	LA P104-SO1*	
Energy can be transformed within a system or transferred to other systems or the environment.	6.2.3.2.1	Differentiate between kinetic and potential energy and analyze situations where kinetic energy is converted to potential energy and vice versa.	IAPS 54, 55, 58	**54** Proc DI; [IB] D1 **55** AQ1 UC [IB] D1 **58** AQ2 UC, [IB] D4-5, D8
	6.2.3.2.2	Trace the changes of energy forms, including thermal, electrical, chemical, mechanical or others as energy is used in devices. *For example:* A bicycle, light bulb	IAPS 58	**58** AQ2 UC, [IB] D4-5, D8

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
		or automobile.		
	6.2.3.2.3	Describe how heat energy is transferred in conduction, convection and radiation.	IAPS 56, 58 IAES 46	**56** AQ3 **58** AQ2 UC, [IB] D4-5, D8 **46** [IB] D16

7th GRADE

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
1. Nature of science and engineering Science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	7.1.1.1.1	Understand that prior expectations can create bias when conducting scientific investigations. *For example:* Students often continue to think that air is not matter, even though they have contrary evidence from investigations.	Throughout, see for example, TR-67 'Working with student ideas'; and all 'Talking it Over' type activities, e.g. IALS 10, 34, 52, 67…	**10** Act UC, AQ 3 ET, [IB] A18-20 **34** AQ4 ET **52** AQ4 UC **67** AQ2 UC, AQ3, ET, [IB] D20
	7.1.1.1.2	Understand that when similar investigations give different results, the challenge is to judge whether the differences are significant, and if further studies are required. *For example:* Use mean and range to analyze the reliability of experimental results.	IALS 8, 14, 27, 95-96	**8** [IB] A11-16 **14** [IB] B16 **27** [IB] B32 **95** [IB] F18-21 **96** AQ2 DCI
Scientific inquiry uses multiple interrelated processes to investigate questions and propose explanations about the natural world.	7.1.1.2.1	Generate and refine a variety of scientific questions and match them with appropriate methods of investigation, such as field studies, controlled experiments, reviews of existing work, and development of models.	Throughout, e.g., IALS 80, 83, 88 (field studies), 17, 74, 82 (controlled experiments), 21, 41 (models), 37, 94 (reviews)	**80** [IB] E2-3, E7-10, E15, E16, E25 **83** AQ3 DCI **88** AQ3 ET, [IB] E28-32 **17** [IB] B1, B8, B21 **21** [IB] B19 **41 A**Q1-2 **82** [IB] E5, E13-14, E17

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
				37 Act UC, [IB] C14 **94** AQ3 UC, [IB] F16, F26
	7.1.1.2.2	Plan and conduct a controlled experiment to test a hypothesis about a relationship between two variables, ensuring that one variable is systematically manipulated, the other is measured and recorded, and any other variables are kept the same (controlled). *For example:* The effect of various factors on the production of carbon dioxide by plants.	Throughout, e.g., IALS 8, 14, 17, 27…	**8** [IB] A11-16 **14** [IB] B16 **17** [IB] B1, B8, B21 **27** [IB] B32
	7.1.1.2.3	Generate a scientific conclusion from an investigation, clearly distinguishing between results (evidence) and conclusions (explanation).	Throughout, e.g., IALS 8, 14, 17, 27…	**8** [IB] A11-16 **14** [IB] B16 **17** [IB] B1, B8, B21 **27** [IB] B32
	7.1.1.2.4	Evaluate explanations proposed by others by examining and comparing evidence, identifying faulty reasoning, and suggesting alternative explanations.	Throughout, e.g., IALS 2, 10, 37, 77…	**2** AQ2b ET, AQ4 UC, AQ5 ET **10** Act UC, AQ 3 ET, [IB] A18-20 **37** Act UC, [IB] C14 **77** AQ4 DCI, AQ7 DCI
Current and	7.1.3.4.1	Use maps, satellite images and	Throughout,	**53** AQ2-3 ET

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.		other data sets to describe patterns and make predictions about natural systems in a life science context. *For example:* Use online data sets to compare wildlife populations or water quality in regions of Minnesota.	e.g., IALS 53, 62, 73, 77, 86, 88…	**62** AQ4a UC **73** [IB] E1, E12, E24 **77** AQ4 DCI, AQ7 DCI **86** AQ1 CM **88** AQ3 ET, [IB] E28-32
	7.1.3.4.2	Determine and use appropriate safety procedures, tools, measurements, graphs and mathematical analyses to describe and investigate natural and designed systems in a life science context.	Safety (TR-21-23), IALS 14, 30, 54 (tools), IALS 30, 54, 77 (uses graphs) IALS 17, 19, 77 (calculates statistics)	**14** [IB] B16 **17** [IB] B1, B8, B21 **19** [IB] B14 **30** AQ 1a DCI, [IB] C1, C30-31 **54** Act DCI, [IB] D2 **77** AQ4 DCI, AQ7 DCI
2. Physical Science Matter The idea that matter is made up of atoms and molecules provides the basis for	7.2.1.1.1	Recognize that all substances are composed of one or more of approximately one hundred elements and that the periodic table organizes the elements into groups with similar properties.	IAPS 15, 16	**15** AQ5 UC [IB] B7-11 **16** [IB] B7-11
	7.2.1.1.2	Describe the differences between elements and compounds in terms of atoms and molecules.	IAPS 15, 16	**15** AQ5 UC [IB] B7-11 **16** [IB] B7-11
	7.2.1.1.3	Recognize that a chemical equation describes a reaction where pure substances change to produce one	IAPS 14, 17	**14** [IB] B4-6 **17** AQ6 UC

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
understanding the properties of matter.		or more pure substances whose properties are different from the original substance(s).		
4. Life Science Tissues, organs and organ systems are composed of cells and function to serve the needs of all cells for food, air and waste removal.	7.4.1.1.1	Recognize that all cells do not look alike and that specialized cells in multicellular organisms are organized into tissues and organs that perform specialized functions. *For example*: Nerve cells and skin cells do not look the same because they are part of different organs and have different functions.	IALS 36, 42, 43	**36** AQ8 UC **42 A**Q2-4 **43** IB] C24
	7.4.1.1.2	Describe how the organs in the respiratory, circulatory, digestive, nervous, skin and urinary systems interact to serve the needs of vertebrate organisms.	IALS 12, 13-17	**12** [IB] B12, B15 **13** [IB] B3, B7 **17** [IB] B1, B8, B21
All living organisms are composed of one or more cells which carry on the many functions needed to sustain life.	7.4.1.2.1	Recognize that cells carry out life functions, and that these functions are carried out in a similar way in all organisms, including animals, plants, fungi, bacteria and protists.	IALS 38, 43	**38 A**Q1-6 **43** AQ2 CM, AQ5 UC, [IB] C 12, C21-22
	7.4.1.2.2	Recognize that cells repeatedly divide to make more cells for growth and repair.	IALS 42	**41 A**Q1-2
	7.4.1.2.3	Use the presence of the cell wall and chloroplasts to distinguish between plant and animal cells. *For example:* Compare microscopic views of plant cells and animal cells.	IALS 38, 82	**38 A**Q1-6 **82** [IB] E5, E13-14, E17
Natural systems include a	7.4.2.1.1	Identify a variety of populations and communities in an ecosystem	IALS 73, 79	**73** [IB] E1,

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
variety of organisms that interact with one another in several ways.		and describe the relationships among the populations and communities in a stable ecosystem.		E12, E24 **79** AQ1 UC, [IB] E2-3, E7-11, E16, E35
	7.4.2.1.2	Compare and contrast the roles of organisms with the following relationships: predator/prey, parasite/host, and producer/consumer/decomposer.	IALS 79, 80	**79** AQ1 UC, [IB] E2-3, E7-11, E16, E35 **80** [IB] E2-3, E7-10, E15, E16, E25
	7.4.2.1.3	Explain how the number of populations an ecosystem can support depends on the biotic resources available as well as abiotic factors such as amount of light and water, temperature range and soil composition.	IALS 72, 83, 84, 88	**72** AQ5 UC, [IB] E2, 3, E5, E13-14 **83** AQ3 DCI **84** [IB] E19-20, E26-27, E34 **88** AQ3 ET, [IB] E28-32
The flow of energy and the recycling of matter are essential to a stable ecosystem.	7.4.2.2.1	Recognize that producers use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.	IALS 81, 82	**81** AQ5 UC, [IB] E2, 3, E5, E13-14 **82** [IB] E5, E13-14, E17
	7.4.2.2.2	Describe the roles and relationships among producers, consumers and decomposers in changing energy from one form to another in a food web within an ecosystem.	IALS 79, 80	**79** AQ1 UC, [IB] E2-3, E7-11, E16, E35 **80** [IB] E2-3, E7-10, E15, E16, E25
	7.4.2.2.3	Explain that the total amount of	IALS 79, 80	**79** AQ1 UC,

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
		matter in an ecosystem remains the same as it is transferred between organisms and their physical environment, even though its form and location change. *For example:* Construct a food web to trace the flow of matter in an ecosystem.		[IB] E2-3, E7-11, E16, E35 **80** [IB] E2-3, E7-10, E15, E16, E25
Reproduction is a characteristic of all organisms and is essential for the continuation of a species. Hereditary information is contained in genes which are inherited through asexual or sexual reproduction.	7.4.3.1.1	Recognize that cells contain genes and that each gene carries a single unit of information that either alone, or with other genes, determines the inherited traits of an organism.	IALS 63, 64	**63** [IB] D1, D2-5, D8-11, D18, D22-24 **64** AQ 1 DCI, AQ6
	7.4.3.1.2	Recognize that in asexually reproducing organisms all the genes come from a single parent, and that in sexually reproducing organisms about half of the genes come from each parent.	IALS 57, 63	**57 A**Q1-2 **63** [IB] D1, D2-5, D8-11, D18, D22-24
	7.4.3.1.3	Distinguish between characteristics of organisms that are inherited and those acquired through environmental influences.	IALS 54, 64	**54** Act DCI, [IB] D2 **64** AQ 1 DCI, AQ 6
Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring.	7.4.3.2.1	Explain how the fossil record documents the appearance, diversification and extinction of many life forms.	IALS 89, 92, 97, 98	**89** AQ4 ET, [IB] F1-4, F29 **92** [IB] F6-7, F17 **97** AQ2 CM, [IB] F15, F22-25, F27-28, F30-31 **98** [IB] F32-33

			SEPUP	
Descriptor	Code	Benchmark	Location	Assessment
	7.4.3.2.2	Use internal and external anatomical structures to compare and infer relationships between living organisms as well as those in the fossil record.	IALS 96, 98, 100	**96** AQ2 DCI **98** [IB] F32-33 **100** AQ 1-4
	7.4.3.2.3	Recognize that variation exists in every population and describe how a variation can help or hinder an organism's ability to survive.	IALS 94, 100	**94** AQ3 UC, [IB] F16, F26 **100** AQ 1-4
	7.4.3.2.4	Recognize that extinction is a common event and it can occur when the environment changes and a population's ability to adapt is insufficient to allow its survival.	IALS 89, 101	**89** AQ4 ET, [IB] F1-4, F29 **101** AQ 1-5
Human activity can change living organisms and ecosystems.	7.4.4.1.1	Describe examples where selective breeding has resulted in new varieties of cultivated plants and particular traits in domesticated animals.	IALS 59, 60, 65	**59** AQ5 UC, [IB] D2 **60** AQ1 DCI [IB] D2 **65** AQ8 UC
	7.4.4.1.2	Describe ways that human activities can change the populations and communities in an ecosystem.	IALS 72, 77, 87	**72** AQ5 UC, [IB] E2, 3, E5, E13-14 **77** AQ4 DCI, AQ7 DCI **87** AQ1 ET
Human beings are constantly interacting with other	7.4.4.2.1	Explain how viruses, bacteria, fungi and parasites may infect the human body and interfere with normal body functions.	IALS 31, 34, 37	**31** [IB] C8 **34** AQ4 ET **37** Act UC,

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Descriptor	Code	Benchmark	Location	Assessment
organisms that cause disease.				[IB] C14
	7.4.4.2.2	Recognize that a microorganism can cause specific diseases and that there are a variety of medicines available that can be used to combat a given microorganism.	IALS 34, 37	**34** AQ4 ET **37** Act UC, [IB] C14
	7.4.4.2.3	Recognize that vaccines induce the body to build immunity to a disease without actually causing the disease itself.	IALS 31, 37	**31** [IB] C8 **37** Act UC, [IB] C14
	7.4.4.2.4	Recognize that the human immune system protects against microscopic organisms and foreign substances that enter from outside the body and against some cancer cells that arise from within.	IALS 31, 34, 37	**31** [IB] C8 **34** AQ4 ET **37** Act UC, [IB] C14

8th GRADE

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Descriptor	Code	Benchmark	Location	Assessment
1. The Nature of Science and Engineering Science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.	8.1.1.1.1	Evaluate the reasoning in arguments in which fact and opinion are intermingled or when conclusions do not follow logically from the evidence given. *For example:* Evaluate the use of pH in advertising products related to body care or gardening.	IAES 2 (evidence vs opinion), 17 (analyze dispute over mineral types), 49 (comparing site risks)	**2** AQ3 RE **17** [IB] B 9, 10 **49** AQ2 ET
Scientific inquiry uses multiple interrelated processes to investigate questions and propose explanations about the natural world.	8.1.1.2.1	Use logical reasoning and imagination to develop descriptions, explanations, predictions and models based on evidence.	Throughout, e.g., IAES 3, 10, 16, 67, 93	**3** [IB] A2 **10** Proc GI **16** AQ3 RE; [IB] B7-10 **67** Proc DI **93** [IB] G5
Men and women throughout the history of all cultures, including Minnesota American Indian tribes and	8.1.3.2.1	Describe examples of important contributions to the advancement of science, engineering and technology made by individuals representing different groups and cultures at different times in history.	IAES 41 (Continental drift), IALS 37 (History of germ theory of disease), 108 (Technoloy and the life	**41** AQ3 UC; [IB] D2 **37** Act UC, [IB] C14 108 AQ 1-4

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Descriptor	Code	Benchmark	Location	Assessment
communities, have been involved in engineering design and scientific inquiry.			sciences)	
Science and engineering operate in the context of society and both influence and are influenced by this context.	8.1.3.3.1	Explain how scientific laws and engineering principles, as well as economic, political, social, and ethical expectations, must be taken into account in designing engineering solutions or conducting scientific investigations.	IAES 23 (manufactured minerals), 30 (challenges of the Mississippi delta), 36-49 (Yucca Mountain)	**23** AQ3 ET **30** [IB] C2, C10 **36** AQ2 ET **49** AQ2 ET
	8.1.3.3.2	Understand that scientific knowledge is always changing as new technologies and information enhance observations and analysis of data. *For example:* Analyze how new telescopes have provided new information about the universe.	IAES 42 (Theory of Continental Drift), 87 (Telescope technology and new information about the universe)	**42** [IB] D4, 6, 8-10, 16 **87** [IB] G8, G15
	8.1.3.3.3	Provide examples of how advances in technology have impacted the ways in which people live, work and interact.	IAES 23, 30, 36, 98	**23** AQ3 ET **30** [IB] C2, C10 **36** AQ2 ET **98** AQ2 ET, CS; [IB] G16, G20
Current and emerging technologies	8.1.3.4.1	Use maps, satellite images and other data sets to describe patterns and make predictions	IAES 25 (topo maps), 40-41 (continental	**25** [IB] C4-6 **40** Q1, 3, 4

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Descriptor	Code	Benchmark	Location	Assessment
have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.		about local and global systems in Earth science contexts. *For example:* Use data or satellite images to identify locations of earthquakes and volcanoes, ocean surface temperatures, or weather patterns.	drift), 51-52, 69 (weather maps)	**41** AQ3 UC; [IB] D2 **69** Proc CS; [IB] E14
	8.1.3.4.2	Determine and use appropriate safety procedures, tools, measurements, graphs and mathematical analyses to describe and investigate natural and designed systems in Earth and physical science contexts.	Safety (TR 21-23), IAES 3, 30, 54, 77 (graphs), 17, 19, 77 (calculates statistics), 14, 30, 54 (uses tools to measure)	**3** [IB] A2 **30** [IB] C2, C10 **54** AQ2 **77** [IB] F10-12 **17** [IB] B 9, 10 **19** AQ1, 4, 5 **14** AQ5 RE **54** AQ2
2. Physical Science **Matter** Pure substances can be identified by properties which are independent of the sample of	8.2.1.1.1	Distinguish between a mixture and a pure substance and use physical properties including color, solubility, density, melting point and boiling point to separate mixtures and identify pure substances.	IAPS 3, 5, 6, 7	**3** Proc DI; [IB] A16 **4** [IB] A-15 **5** Proc GI **6** AQ1 AD [IB] A3, A4 **7** AQ 1 AD, AQ1 UC, [IB] A5, A7, A8
	8.2.1.1.2	Use physical properties to distinguish between metals and	IAPS 15, 16	**15** AQ5 UC [IB] B7-11

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Descriptor	Code	Benchmark	Location	Assessment
the substance and the properties can be explained by a model of matter that is composed of small particles.		non-metals.		**16** [IB] B7-11
Substances can undergo physical and chemical changes which may change the properties of the substance but do not change the total mass in a closed system.	8.2.1.2.1	Identify evidence of chemical changes, including color change, generation of a gas, solid formation and temperature change.	IAPS 14, 18	**14** [IB] B4-6 **18** AQ3 AD, [IB] B19-21
	8.2.1.2.2	Distinguish between chemical and physical changes in matter.	IAPS 14, 18, 19	**14** [IB] B4-6 **18** AQ3 AD, [IB] B19-21 **19** [IB] B12-14
	8.2.1.2.3	Use the particle model of matter to explain how mass is conserved during physical and chemical changes in a closed system.	IAPS 25	**25** AQ2-3
	8.2.1.2.4	Recognize that acids are compounds whose properties include a sour taste, characteristic color changes with litmus and other acid/base indicators, and the tendency to react with bases to produce a salt and water.	IAPS 46-47, 50	**46** Proc OD, GI; [IB] C9 **47** [IB] C10-12 **50** AQ5 UC, [IB] C23
3. Earth & Space Science The movement of tectonic plates results	8.2.3.1.1	Explain how seismic waves transfer energy through the layers of the Earth and across its surface.	IAES 43-44	**43** Proc GI **44** [IB] D7, D16
	8.3.1.1.1	Recognize that the Earth is composed of layers, and describe the properties of the layers,	IAES 38	**38** AQ5 UC; [IB] D1, D15

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Descriptor	Code	Benchmark	Location	Assessment
from interactions among the lithosphere, mantle and core.		including the lithosphere, mantle and core.		
	8.3.1.1.2	Correlate the distribution of ocean trenches, mid-ocean ridges and mountain ranges to volcanic and seismic activity.	IAES 45, 57	**45** [IB] D3, D11-12, D16 **57** [IB] E10
Landforms are the result of the combination of constructive and destructive processes.	8.3.1.1.3	Recognize that major geological events, such as earthquakes, volcanic eruptions and mountain building, result from the slow movement of tectonic plates.	IAES 44, 45, 47	**44** [IB] D7, D16 **45** [IB] D3, D11-12, D16 **47** [IB] D16
	8.3.1.2.1	Explain how landforms result from the processes of crustal deformation, volcanic eruptions, weathering, erosion and deposition of sediment.	IAES 28, 29, 45, 47	**28** Proc GI; [IB] C2, C7 **29** AQ2 UC; [IB] C1, C3 **45** [IB] D3, D11-12, D16 **47** [IB] D16
	8.3.1.2.2	Explain the role of weathering, erosion and glacial activity in shaping Minnesota's current landscape.	IAES 28, 29 and local activities	**28** Proc GI; [IB] C2, C7 **29** AQ2 UC; [IB] C1, C3
Rocks and rock formations indicate evidence of the materials and conditions that	8.3.1.3.1	Interpret successive layers of sedimentary rocks and their fossils to infer relative ages of rock sequences, past geologic events, changes in environmental conditions, and the appearance and extinction of life forms.	IALS 93	**93** AQ4 UC, [IB] F8-11

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Descriptor	Code	Benchmark	Location	Assessment
produced them.	8.3.1.3.2	Classify and identify rocks and minerals using characteristics including, but not limited to, density, hardness and streak for minerals; and texture and composition for rocks.	IAES 16, 17	**16** AQ3 RE; [IB] B7-10 **17** [IB] B 9, 10
	8.3.1.3.3	Relate rock composition and texture to physical conditions at the time of formation of igneous, sedimentary and metamorphic rock.	IAES 17, 20, 22	**17** [IB] B 9, 10 **20** Proc GI; [IB] B6 **22** AQ7 UC; [IB] B4-6, B11
The sun is the principal external energy source for the Earth.	8.3.2.1.1	Explain how the combination of the Earth's tilted axis and revolution around the sun causes the progression of seasons.	IAES 77, 78	**77** [IB] F10-12 **78** AQ2 UC
	8.3.2.1.2	Recognize that oceans have a major effect on global climate because water in the oceans holds a large amount of heat.	IAES 57, 58	**57** [IB] E10 **58** AQ1-3, [IB] E6
	8.3.2.1.3	Explain how heating of the Earth's surface and atmosphere by the sun drives convection within the atmosphere and hydrosphere producing winds, ocean currents and the water cycle, as well as influencing global climate.	IAES 55, 57, 58, 68	**55** Proc DI **57** [IB] E10 **58** AQ1-3, [IB] E6 **68** AQ2
Patterns of atmospheric movement influence global climate and	8.3.2.2.1	Describe how the composition and structure of the Earth's atmosphere affects energy absorption, climate, and the distribution of particulates and	IAES 64-66	**64** AQ 2-4, [IB] E5 **65** AQ1-3 **66** AQ2 UC;

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Descriptor	Code	Benchmark	Location	Assessment
local weather.		gases. *For example:* Certain gases contribute to the greenhouse effect.		[IB] E12-13
	8.3.2.2.2	Analyze changes in wind direction, temperature, humidity and air pressure and relate them to fronts and pressure systems.	IAES 67, 69	**67** Proc DI **69** Proc CS; [IB] E14
	8.3.2.2.3	Relate global weather patterns to patterns in regional and local weather.	IAES 51, 52, 69	**51** Proc OD **52** AQ1-3 **69** Proc CS; [IB] E14
Water, which covers the majority of the Earth's surface, circulates through the crust, oceans and atmosphere in what is known as the water cycle.	8.3.2.3.1	Describe the location, composition and use of major water reservoirs on the Earth, and the transfer of water among them.	IAES 60, 61	**60** [IB] E3, E8-9 **61** AQ1-3
	8.3.2.3.2	Describe how the water cycle distributes materials and purifies water. *For example:* Dissolved gases in rain can change the chemical composition of substances on Earth. *Another example:* Waterborne disease.	IAES 62	**62** AQ4 SI; [IB] E3, 9, 11, 15
The Earth is the third planet from the sun in a system that includes the moon, the sun, seven other planets and their moons, and smaller	8.3.3.1.1	Recognize that the sun is a medium-sized star, one of billions of stars in the Milky Way galaxy, and the closest star to Earth.	IAES 90, 92	**90** [IB] G9, 16, 18 **92** AQ 1-4, [IB] G2, G11
	8.3.3.1.2	Describe how gravity and inertia keep most objects in the solar system in regular and predictable motion.	IAES 95, 96	**95** AQ4 AD; [IB] G10, 12 **96** [IB] G 4, 7, 19

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Descriptor	Code	Benchmark	Location	Assessment
objects.	8.3.3.1.3	Recognize that gravitational force exists between any two objects and describe how the masses of the objects and distance between them affect the force.	IAES 95, 96	**95** AQ4 AD; [IB] G10, 12 **96** [IB] G 4, 7, 19
	8.3.3.1.4	Compare and contrast the sizes, locations, and compositions of the planets and moons in our solar system.	IAES 89-91	**89** Proc RE; [IB] G6, G14 **90** [IB] G9, 16, 18 **91** AQ4 UC
	8.3.3.1.5	Use the predictable motions of the Earth around its own axis and around the sun, and of the moon around the Earth, to explain day length, the phases of the moon, and eclipses.	IAES 78-80	**78** AQ2 UC **79** [IB] F10-12, F14-16 **80** [IB] F4-9
In order to maintain and improve their existence, humans interact with and influence Earth systems.	8.3.4.1.1	Describe how mineral and fossil fuel resources have formed over millions of years, and explain why these resources are finite and non-renewable over human time frames.	IAES 12	**12** Q3-4
	8.3.4.1.2	Recognize that land and water use practices can affect natural processes and that natural processes interfere and interact with human systems. *For example:* Levees change the natural flooding process of a river. *Another example:* Agricultural runoff influences natural systems far from the source.	IAES 30, 61	**30** [IB] C2, C10 **61** AQ1-3