SAU #19

SCIENCE CURRICULUM

REVISED 2007

UPDATED 2008

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Forward

Adapted from New Hampshire Department of Education
New Hampshire Framework for Science Literacy (K-12)

The *New Hampshire Framework for Science Literacy (K-12)* was developed to positively impact science education in New Hampshire, as a thoughtful response to the variety of reform efforts currently occurring nationwide. The current revision of the *Frameworks* was the result of countless hours of effort by more than 150 educators, parents, administrators, and informal science educators from across the state. It provides the structure of this SAU #19 science curriculum revision, and its Forward is included below to explain that structure.

The term "literacy" is intended to signal the importance of this body of skills and knowledge for **all citizens**. While the framers of the NH Framework for Science Literacy hope to encourage more students to engage in further study and eventual careers in science and engineering, that is not its primary purpose. Rather, it is to prepare **all students** with the skills and knowledge that they will need to succeed in an increasingly technological world, and to contribute positively and significantly to society as consumers, workers, and citizens.

The standards are organized by domains, which may be utilized in an interdisciplinary or thematic manner. Each domain is organized into "strands" which are indicated by "statements of enduring knowledge". These statements are used to divide the domain into major segments of related content. Each strand is further divided into "stems", smaller content sub-groupings. Unlike the previous science curriculum framework, the revision includes GSE's (Grade Span Expectations) for students in grades K-2, 3-4, 5-6, 7-8, and 9-12. (Each grade span concludes with a list of proficiencies). *The SAU #19 Science Committee has assigned these GSE's into specific grade levels, resulting in local GLE's (Grade **Level** Expectations).* Proficiencies for grades 9-12 are divided into "basic literacy level" and "advanced literacy level". Basic refers to skills for all students. Advanced level refers to proficiencies for students interested in science related career and technical education programs or advanced science coursework.

The standards are written to accommodate a variety of teaching methods and resources, yet they are pointed at specific concepts and skills that students should know and be able to do. In addition to the 3 content domains (Earth Space Science, Life Science, and Physical Science) this revision of the frameworks includes a set of **Science Process Skills** which should help teachers develop solid and meaningful experiences for students. The standards are written to promote the learning of science by doing science. Current cognitive research suggests that students learn best by constructing their own

Forward (continued)

knowledge. It is the intent of this document to increase students' understanding of essential concepts by promoting activities that engage students in doing scientific inquiry and design, using available technological tools, and rationally thinking about both the human-made and the natural world.

To this end, the framework should serve as the foundation for the development of a comprehensive assessment system which incorporates both local and statewide components. At the state level, science proficiency will be assessed at the end of grades 4, 8, and 11 providing information which can be used to promote educational accountability and to improve curriculum and the quality of instruction. *The SAU #19 local curriculum includes additional assessment complement the state effort*.

Systems, patterns, and change are examples of common themes inherent in the investigations made in all disciplines. Most ideas are not isolated, but are found in a context that transcends disciplinary boundaries. Knowledge that is connected and useful expands the understanding of an idea. The understanding of multifaceted problems is enhanced when explored from the perspectives of history, art, mathematics, language arts, and the social sciences. Technology pervades all of the disciplines and is an integral part of the total picture.

Acquiring a common core of knowledge and understanding about science and technology, including a framework of organized conceptual information and skills, will enable students to think through problems. Educators, undertaking the task of curriculum development and revision, are forced to make difficult decisions and identify the most important ideas in science and technology. Educators must concentrate on the quality of understanding rather than the quantity of information learned.

SAU #19 SCIENCE CURRICULUM COMMITTEE MEMBERS

The following people contributed to the development of the SAU #19 Science Curriculum. This multi-stage project, in collaboration with Southern New Hampshire University, was partially supported by a Math Science Partnership grant through the New Hampshire Department of Education.

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The Committee wishes to also cite the work of the previous science curriculum revision committee. Much of that team's Goals 2000 work remains in this revision (see next page for committee names).

SAU #19
SCIENCE CURRICULUM COMMITTEE MEMBERS ~ 2000

The following people contributed to the development of the SAU #19 Science Curriculum. This multi-stage project, completed over the past few years, was funded by a Goals 2000 grant through the New Hampshire Department of Education.

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GUIDING PRINCIPLES

Home, School and Community Partnerships

Parent involvement in school increases student achievement. Given the significant change in family structures and working patterns, the need for creative cooperation between the home and the school has become even greater. Diminished contact by the school with parents and guardians has lead to reduced student accountability at both home and school. We are committed to strengthening the relationship between students and school, and families and school. Recognizing that business and industry are integral parts of our community, we will invite local companies, businesses and corporations to serve as resources and as partners as we seek to redefine our programs for the years ahead.

An Intellectual Focus

The school should focus on helping all students learn to use their minds well. Our belief is that every student can and will learn to read, to write, to compute and to think and that every student will be academically successful. We must establish high standards and appropriate expectations which promote habits of learning that embrace inquiry and critical skills.

Interdisciplinary Learning

All knowledge is interrelated. The development of ideas that make up this interrelationship helps to crystallize understanding and enables problem-solving. There, we will develop interdisciplinary approaches to curriculum and learning.

Lifelong Learning

Our emphasis is an understanding of those concepts, skills, and attitudes that will be important to lifelong learning, rather than simply breadth of content knowledge. This dominant theme means that curriculum decisions should be directed at thorough student mastery and achievement, rather than by an effort merely to cover content

A Community That Reflects Democratic Principles

We are a democratic school community based upon the rights and responsibilities of individuals to make choices, to collaborate, to adopt decisions, and expect justice. Clear expectations for behavior will be established that include explicit consequences and fair judicial procedures. Students learn to become responsible citizens with opportunities to practice decision making within a just and democratic school community.

GUIDING PRINCIPLES (continued)

Personalization and Interdependence

We are a positive, caring place where an individual feels a sense of identity, importance, and connectedness. The culture of our school community reflects trust and confidence, open and honest communication, celebration and humor, caring and empathy where students and staff feel recognized and rewarded.

An Ethic of Growth, Development and Inquiry

We model a community of learners where a spirit of inquiry, risk-taking, and reflection prevails. A commitment of mutual support for learning, experimentation, and self-renewal exists among teachers and is reflected in the classroom.

Student as Learner

Learning is an active experience. Students need to be responsible for their own learning, engaged in purposeful "work" rather than simply receiving services from teachers. The teacher as a facilitator of knowledge will present information appropriate to the learner. Throughout the learning process, the teacher will coach and advise, enabling all students to become successful.

Student as Giver

Service to the school or to the community will be promoted as an experiential opportunity for students to learn about themselves as well as to gain poise and confidence in their dealings with others. Community service will foster a sense of responsibility to the needs of the larger society.

K-12 BROAD GOALS FOR SCIENCE EDUCATION[1]

1. Students will use inquiry strategies to investigate and understand the natural world.

2. Students will demonstrate an understanding of key concepts and principles central to the biological, physical, and earth sciences, and engineering, while recognizing the interrelationship of all the sciences.

3. Students will demonstrate an understanding of the basic laws which govern and explain phenomena observed in the natural world

4. Students will demonstrate an understanding of, and be able to practice, the basic processes which scientists use to obtain and continually revise knowledge about the natural world.

5. Students will perceive that scientific and technological knowledge is the result of the cumulative efforts of people, past and present, who have attempted to explain the world through an objective, peer-tested, rational approach to understanding natural phenomena and occurrences.

6. Students will display a sense of curiosity and wonder about the natural world, and demonstrate an increasing awareness of the interdependence between all living things and the environment.

7. Students will demonstrate their abilities to identify human needs and concerns and to engage in problem-solving processes to define the problem, research and generate solutions, and develop simulations and prototypes to test their ideas before implementation.

8. Students will be able to apply rational, creative-thinking, and investigative skills and use scientific and technical knowledge in their roles as citizens, workers, family members, and consumers in an increasingly technological society.

9. Students will use oral and written communication, mathematical representation, and physical and conceptual models to describe and explain scientific concepts and ideas, and will be able to apply scientific and technical knowledge.

10. Students will know and employ safe practices and techniques in the laboratory, in field work or any other scientific investigation, and when using scientific or technological materials at home or work.

[1] New Hampshire Department of Education. 2006.

PROGRAM GOALS

Earth and Space Science

- The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.

- The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.

- The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.

- The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.

Life Science

- All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

- Energy flows and matter recycles through an ecosystem.

- Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry).

- Humans are similar to other species in many ways, and yet are unique among Earth's life forms.

- Humans are similar to other species in many ways, and yet are unique among Earth's life forms.

Physical Science

- All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).

PROGRAM GOALS (continued)

- Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.

- The motion of an object is affected by force.

- The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.

Science Process Skills

- Scientific Inquiry and Critical Thinking Skills (INQ) include:
  - Making observations and asking questions
  - Designing scientific investigations
  - Conducting scientific investigations
  - Representing and understanding results of investigations
  - Evaluating scientific explanations

- Unifying Concepts of Science are:
  - Systems and Energy (SAE)
  - Patterns of Change (POC) (constancy, change, evolution and equilibrium)
  - Form and Function (FAF)

- Personal, Social, and Technological Perspectives on science include:
  - Collaboration in scientific endeavors
  - Common Environmental Issues, Natural Resources Management and Conservation
  - Science and Technology; Technological Design and Application

- Science Skills for Information, Communication and Media Literacy
  - Information and Media Literacy
  - Communication Skills
  - Critical Thinking and Systems Thinking
  - Problem Identification, Formulation, and Solution
  - Creativity and Intellectual Curiosity
  - Interpersonal and Collaborative Skills
  - Self Direction
  - Accountability and Adaptability
  - Social Responsibility

Depth-of-Knowledge Levels for Four Content Areas

Norman L. Webb

March 28, 2002

Science Levels of Depth-of-Knowledge

Interpreting and assigning depth-of-knowledge levels to objectives both within standards and assessment items is an essential requirement of alignment analysis. Four levels of depth of knowledge are used for this analysis. Because the highest (fourth) DOK level is rare or even absent in most standardized assessments, reviewers usually will be making distinctions among DOK levels 1, 2 and 3. Please note that, in science, "knowledge" can refer both to content knowledge and knowledge of science processes. This meaning of knowledge is consistent with the National Science Education Standards (NSES), which terms "Science as Inquiry" as its first Content Standard.

Level 1. Recall and Reproduction

Level 1 is the recall of information such as a fact, definition, term, or a simple procedure, as well as performing a **simple** science process or procedure. Level 1 only requires students to demonstrate a rote response, use a well-known formula, follow a set procedure (like a recipe), or perform a clearly defined series of steps. A "simple" procedure is well-defined and typically involves only **one-step**. Verbs such as "identify," "recall," "recognize," "use," "calculate," and "measure" generally represent cognitive work at the recall and reproduction level. Simple word problems that can be directly translated into and solved by a formula are considered Level 1. Verbs such as "describe" and "explain" could be classified at different DOK levels, depending on the complexity of what is to be described and explained.

A student answering a Level 1 item either knows the answer or does not: that is, the answer does not need to be "figured out" or "solved." In other words, if the knowledge necessary to answer an item automatically provides the answer to the item, then the item is at Level 1. If the knowledge necessary to answer the item does not automatically provide the answer, the item is at least at Level 2. Some examples that represent but do not constitute all of Level 1 performance are:

- Recall or recognize a fact, term, or property.
- Represent in words or diagrams a scientific concept or relationship.
- Provide or recognize a standard scientific representation for simple phenomenon.
- Perform a routine procedure such as measuring length.

Science Levels of Depth-of-Knowledge (continued)

Level 2. Skills and Concepts

Level 2 includes the engagement of some mental processing beyond recalling or reproducing a response. The content knowledge or process involved is **more complex** than in level 1. Items require students to make some decisions as to how to approach the question or problem. Keywords that generally distinguish a Level 2 item include "classify," "organize," "estimate," "make observations," "collect and display data," and "compare data." These actions imply **more than one step**. For example, to compare data requires first identifying characteristics of the objects or phenomenon and then grouping or ordering the objects. Level 2 activities include making observations and collecting data; classifying, organizing, and comparing data; and organizing and displaying data in tables, graphs, and charts.

Some action verbs, such as "explain," "describe," or "interpret," could be classified at different DOK levels, depending on the complexity of the action. For example, interpreting information from a simple graph, requiring reading information from the graph, is a Level 2. An item that requires interpretation from a complex graph, such as making decisions regarding features of the graph that need to be considered and how information from the graph can be aggregated, is at Level 3. Some examples that represent, but do not constitute all of Level 2 performance, are:

- Specify and explain the relationship between facts, terms, properties, or variables.
- Describe and explain examples and non-examples of science concepts.
- Select a procedure according to specified criteria and perform it.
- Formulate a routine problem given data and conditions.
- Organize, represent and interpret data.

Level 3. Strategic Thinking

Level 3 requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. The cognitive demands at Level 3 are **complex and abstract**. The complexity does not result only from the fact that there could be multiple answers, a possibility for both Levels 1 and 2, but because the multi-step task requires **more demanding reasoning**. In most instances, requiring students to explain their thinking is at Level 3; requiring a very simple explanation or a word or two should be at Level 2. An activity that has more than one possible answer and requires students to justify the response they give would most likely be a Level 3. Experimental designs in Level 3 typically involve more than one dependent variable. Other Level 3 activities include drawing conclusions from observations; citing evidence and developing a

logical argument for concepts; explaining phenomena in terms of concepts; and using concepts to solve non-routine problems. Some examples that represent, but do not constitute all of Level 3 performance, are:

- Identify research questions and design investigations for a scientific problem.
- Solve non-routine problems.
- Develop a scientific model for a complex situation.
- Form conclusions from experimental data.

Level 4. Extended Thinking

Tasks at Level 4 have **high cognitive demands** and are **very complex**. Students are required to make several connections—relate ideas *within* the content area or *among* content areas—and have to select or devise one approach among many alternatives on how the situation can be solved. Many on-demand assessment instruments will not include any assessment activities that could be classified as Level 4. However, standards, goals, and objectives can be stated in such a way as to expect students to perform extended thinking. "Develop generalizations of the results obtained and the strategies used and apply them to new problem situations," is an example of a Grade 8 objective that is a Level 4. Many, but not all, performance assessments and open-ended assessment activities requiring significant thought will be Level 4.

Level 4 requires complex reasoning, experimental design and planning, and **probably will require an extended period of time** either for the science investigation required by an objective, or for carrying out the multiple steps of an assessment item. However, the extended time period is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking. For example, if a student has to take the water temperature from a river each day for a month and then construct a graph, this would be classified as a Level 2 activity. However, if the student conducts a river study that requires taking into consideration a number of variables, this would be a Level 4. Some examples that represent but do not constitute all of a Level 4 performance are:

- Based on provided data from a complex experiment that is novel to the student, deduct the fundamental relationship between several controlled variables.
- Conduct an investigation, from specifying a problem to designing and carrying out an experiment, to analyzing its data and forming conclusions.

Science Process Skills Overview
These science process skills apply throughout the K-12 curriculum standards that follow.

Strand (Enduring Knowledge Statements)	Stem (rows) in GSEs	Page K-4	Page 5-8	Page 9-12
SPS1– Scientific Inquiry and Critical Thinking Skills	1. Making observations and asking questions	**14**	**22**	**32**
	2. Designing scientific investigations	**14**	**23**	**32**
	3. Conducting scientific investigations	**14**	**23**	**33**
	4. Representing and Understanding results of Investigations	**15**	**23**	**33**
	5. Evaluating Scientific Investigations	**15**	**24**	**33**
	NECAP Science Assessment Targets for Inquiry (INQ) *May subject of performance component*	**15**	**24**	**33**
SPS2– Unifying Concepts of Science (including NECAP Science Assessment Targets by Big Idea)	1. Nature of Science (NOS)	**16**	**25**	**34**
	2. Systems and Energy (SAE)	**16**	**26**	**35**
	3. Models and Scale (MAS)	**17**	**27**	**35**
	4. Patterns of Change (POC)	**17**	**28**	**36**
	5. Form and Function (FAF)	**17**	**28**	**37**
SPS3– Personal, Social, and Technological Perspectives	1. Collaboration in Scientific Endeavors	**18**	**29**	**38**
	2. Environment, Natural Resources, and Conservation	**18**	**29**	**38**
	3. Science, Technology, and Design	**19**	**30**	**39**
SPS4– Science Skills for Information, Communication and Media Literacy	1. Information and Media Literacy	**20**	**31**	**40**
	2. Communication Skills	**20**	**31**	**40**
	3. Critical Thinking and Systems Thinking	**20**	**31**	**40**
	4. Problem Identification, Formulation, and Solution	**20**	**31**	**40**
	5. Creativity and Intellectual Curiosity	**20**	**31**	**41**
	6. Interpersonal and Collaborative Skills	**21**	**31**	**41**
	7. Self Direction	**21**	**31**	**41**
	8. Accountability and Adaptability	**21**	**31**	**41**
	9. Social Responsibility	**21**	**31**	**41**

Science Process Skills		
SPS1– Scientific Inquiry and Critical Thinking Skills (INQ)		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
1. MAKING OBSERVATIONS AND ASKING QUESTIONS	S:SPS1:2:1.1 Make observations and explore materials using all of their senses (one sense at a time). S:SPS1:2:1.2 Record observations using language, concrete objects, and symbolic representations. S:SPS1:2:1.3 Ask questions about objects, organisms and events in their immediate environment. S:SPS1:2:1.4 Ask questions that lead to exploration and investigation as a result of working with materials and objects. S:SPS1:2:1.5 Sort and classify object materials and events based on one or more attributes; and explain the methods used for sorting.	S:SPS1:4:1.1 Extend the senses using simple tools. S:SPS1:4:1.2 Make and record observations for a given purpose. S:SPS1:4:1.3 Differentiate between observations and inferences. S:SPS1:4:1.4 Record observations using standard units of measurement. S:SPS1:4:1.5 Classify according to several attributes and describe or show the method for classification. S:SPS1:4:1.6 Compare methods of classifying based on the goal. S:SPS1:4:1.7 Ask questions about objects, organisms and events in their local environment. S:SPS1:4:1.8 Pose questions to investigate and practical problems to solve.
2. DESIGNING SCIENTIFIC INVESTIGATIONS	S:SPS1:2:2.1 Select tools and procedures, in a purposeful way, to explore objects and materials. S:SPS1:2:2.2 Suggest a plan and describe a sequence of events for conducting an exploration. S:SPS1:2:2.3 Predict how changing one part of an exploration will affect the outcome.	S:SPS1:4:2.1 Plan a step-by-step process to solve a practical problem or to carry out a “fair test” of a simple scientific question. S:SPS1:4:2.2 Select an activity and justify it as an effective means of collecting appropriate data.
3. CONDUCTING SCIENTIFIC INVESTIGATIONS	S:SPS1:2:3.1 Follow their own plan for conducting an investigation. S:SPS1:2:3.2 Follow a simple step-by-step procedure.	S:SPS1:4:3.1 Follow a set of procedures. S:SPS1:4:3.2 Plan and test ideas through guided experiments. S:SPS1:4:3.3 Identify and use appropriate tools.

Science Process Skills		
SPS1– Scientific Inquiry and Critical Thinking Skills (INQ)		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
4. REPRESENTING AND UNDERSTANDING RESULTS OF INVESTIGATIONS	S:SPS1:2:4.1 Represent and interpret information and observations in many ways (such as in tally, pictographs, bar graphs, tables). S:SPS1:2:4.2 Identify and describe patterns and relationships in observed objects and events.	S:SPS1:4:4.1 Compile and display data in a variety of formats. S:SPS1:4:4.2 Select an appropriate format to represent data or observations. S:SPS1:4:4.3 Identify and suggest possible explanations for patterns. S:SPS1:4:4.4 Analyze data and identify discrepancies.
5. EVALUATING SCIENTIFIC EXPLANATIONS	*None at this level.*	S:SPS1:4:5.1 Cite evidence or data to support conclusions. S:SPS1:4:5.2 Determine if an observation or measurement supports a given scientific explanation. S:SPS1:4:5.3 Draw a conclusion to answer an initial question, based on the evidence collected.
NECAP ASSESSMENT TARGETS FOR INQUIRY *MAY BE SUBJECT OF PERFORMANCE COMPONENT*		NECAP ASSESSMENT TARGETS S:ESS1:4:2.4 S:ESS1:4:5.2 S:ESS1:4:6.4 S:LS1:4:1.2 S:PS1:4:2.5 S:PS2:4:3.8 S:PS3:4:2.1 S:PS3:4:1.5 (For actual text: please see GSE's for Earth Space, Life, and Physical Science.)

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
1. NATURE OF SCIENCE (NOS)	S:SPS2:2:1.1 Recognize that information can be obtained merely by careful observation, but sometimes even more data can be collected by conducting scientific investigations. S:SPS2:2:1.2 Discover that when a scientific investigation is done the way it was done before, we expect to get a very similar result. S:SPS2:2:1.3 Explain that sometimes people aren't sure what will happen because they don't know all the factors that may have an effect on the outcome.	S:SPS2:4:1.1 Recognize that sometimes scientists have different explanations for the same set of observations which usually lead them to make more observations to resolve the differences. S:SPS2:4:1.2 Realize that results of similar scientific investigations seldom turn out exactly the same, but if the differences are large it's important to try to figure out why. S:SPS2:4:1.3 Know when comparisons might not be fair because some conditions are not kept the same. S:SPS2:4:1.4 Explain that scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments; and that investigations can focus on physical, biological, and social questions. S:SPS2:4:1.5 Realize that scientists' explanations about what happens in the world come partly from what they observe, and partly from what they think.
2. SYSTEMS AND ENERGY (SAE)	S:SPS2:2:2.1 Show how most things are made of parts. S:SPS2:2:2.2 Observe that when parts are put together, they can do things that they couldn't do by themselves. S:SPS2:2:2.3 Explain that something may not work if some of its parts are missing.	S:SPS2:4:2.1 Demonstrate that if something consists of many parts, the parts usually influence one another. S:SPS2:4:2.2 Provide examples that demonstrate that something may not work well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected.

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
3. MODELS AND SCALE (MAS)	S:SPS2:2:3.1 Describe how a model of something is different from the real thing but can be used to learn something about the real thing. S:SPS2:2:3.2 Explain how one way to describe something is to say how it is like something else. S:SPS2:2:3.3 Provide examples to explain that things in nature and things people make have very different sizes, weights, ages and speeds.	S:SPS2:4:3.1 Know that seeing how a model works after changes are made to it may suggest how the real thing would work if the same changes were done to it. S:SPS2:4:3.2 Use geometric figures, number sequences, graphs, diagrams, and pictures as scientific models. S:SPS2:4:3.3 Recognize that most everything has limits on how big or small it can be.
4. PATTERNS OF CHANGE (POC)	S:SPS2:2:4.1 Discover that things change in some ways and stay the same in some ways. S:SPS2:2:4.2 Understand that people can keep track of some things by seeing where they come from and where they go. S:SPS2:2:4.3 Observe that things can change in different ways, such as in size, weight, color and movement.	S:SPS2:4:4.1 Observe that some small changes can be detected by taking measurements. S:SPS2:4:4.2 Understand that some changes are so slow or so fast that they are hard to see. S:SPS2:4:4.3 Demonstrate that some features of things may stay the same even when other features change (e.g., some patterns look the same when they are shifted over, turned, reflected, or seen from different directions).
5. FORM AND FUNCTION (FAF)	S:SPS2:2:5.1 Identify shape and use of objects. S:SPS2:2:5.2 Draw an object and the object in use.	S:SPS2:4:5.1 Discover the relationship between shape and use. S:SPS2:4:5.2 Explore methods, designs and problems of transporting liquids.

Science Process Skills		
SPS3– Personal, Social, and Technological Perspectives		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
1. COLLABORATION IN SCIENTIFIC ENDEAVORS	S:SPS3:2:1.1 Work with a partner to accomplish a specific task. S:SPS3:2:1.2 Take turns. S:SPS3:2:1.3 Ask questions of others about their work.	S:SPS3:4:1.1 Be able to complete an assigned task when given a specific role in a group. S:SPS3:4:1.2 Communicate ideas to others. S:SPS3:4:1.3 Give specific feedback about work of others.
2. COMMON ENVIRONMENTAL ISSUES, NATURAL RESOURCES MANAGEMENT AND CONSERVATION	S:SPS3:2:2.1 Use observation skills to describe the area around their homes and school.	S:SPS3:4:2.1 Demonstrate a basic conservation action such as recycling or a schoolyard habitat project. S:SPS3:4:2.2 Develop questions based upon their observations about the natural world and design a simple investigation. S:SPS3:4:2.3 Develop questions that help them learn about the environment; and design and conduct simple investigations. S:SPS3:4:2.4 Locate and collect information about the environment and environmental and natural resources topics. S:SPS3:4:2.5 Use reliable information to answer questions. S:SPS3:4:2.6 Organize information to search for relationships and patterns concerning the environment and environmental topics. S:SPS3:4:2.7 Identify and investigate issues in their local environments and communities.

Science Process Skills		
SPS3– Personal, Social, and Technological Perspectives		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
3. SCIENCE AND TECHNOLOGY, TECHNOLOGICAL DESIGN AND APPLICATION	S:SPS3:2:3.1 Demonstrate that all tools have a special purpose (e.g., to measure, to help in observations, to make things or to make things better). S:SPS3:2:3.2 Provide examples that highlight the importance of the planning phase of any project. S:SPS3:2:3.3 Identify multiple ways to solve a design problem. S:SPS3:2:3.4 Describe how most things are made up of multiple parts and explain that things may not work if some parts are missing. S:SPS3:2:3.5 Provide examples of how people throughout history have used legends and stories to explain how the world works.	S:SPS3:4:3.1 Describe the design process as a logical progression for transforming ideas into reality. S:SPS3:4:3.2 Describe how people have designed and used tools throughout history; and provide examples of how many of these tools, while improved, are still in use today. S:SPS3:4:3.3 Provide examples illustrating that throughout history, people of all ages and from all walks of life have made significant contributions to the fields of science and technology.

Science Process Skills		
SPS4– Science Skills for Information, Communication and Media Literacy (from *ICT Literacy Map for Science*, www.21stcenturyskills.org)		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
1. INFORMATION AND MEDIA LITERACY	S:SPS4:2:1.1 Have experience with a variety of media sources. S:SPS4:2:1.2 Use tools. S:SPS4:2:1.3 Use age-appropriate sources such as newspapers, books and websites.	S:SPS4:4:1.1 Access information from a variety of media sources (e.g., Internet, CD-ROM programs, print resources). S:SPS4:4:1.2 Use appropriate tools to measure and graph data. S:SPS4:4:1.3 Analyze and compare data from a variety of age-appropriate sources such as newspapers and websites.
2. COMMUNICATION SKILLS	S:SPS4:2:2.1 Communicate ideas and observations through a variety of tools and formats (e.g., oral, journal, drawing, projects, multimedia).	S:SPS4:4:2.1 Use a variety of tools and formats (oral presentations, journals, and multimedia presentations) to summarize and communicate the results of observations.
3. CRITICAL THINKING AND SYSTEMS THINKING	S:SPS4:2:3.1 Make observations and tell ideas about real-life issues. S:SPS4:2:3.2 Use pictures or other means to organize ideas. S:SPS4:2:3.3 Make a graph to represent data.	S:SPS4:4:3.1 Apply a variety of age-appropriate strategies to address real-life issues (e.g., identify factors that affect plants in a particular habitat). S:SPS4:4:3.2 Build a concept map (or other graphic organizer) to understand a complex problem. S:SPS4:4:3.3 Organize observations and data into tables, charts and graphs.
4. PROBLEM IDENTIFICATION, FORMULATION, AND SOLUTION	S:SPS4:2:4.1 Ask questions and take part in investigations. S:SPS4:2:4.2 Compile observations (one to one relationship) by making or using simple pictographs, tally charts or simple graphs. S:SPS4:2:4.3 Look for evidence to support ideas.	S:SPS4:4:4.1 Ask questions and plan investigations to find answers. S:SPS4:4:4.2 Compile data gathered through observations to record and present results using tally charts, tables and graphs. S:SPS4:4:4.3 Use evidence to construct explanations.
5. CREATIVITY AND INTELLECTUAL CURIOSITY	S:SPS4:2:5.1 Use computer software and various technologies as appropriate to display and communicate information and ideas.	S:SPS4:4:5.1 Use a variety of equipment and software packages to enter, process, display, and/or communicate information in different forms using text, tables, pictures, and sound (e.g., brainstorming software, collaboration software, telecommunications, presentation software, digital cameras, projectors).

Science Process Skills		
SPS4– Science Skills for Information, Communication and Media Literacy (from *ICT Literacy Map for Science,* www.21stcenturyskills.org)		
	By the end of Grade 2, all students will…	**By the end of Grade 4, all students will apply skills from previous grades and…**
6. INTERPERSONAL AND COLLABORATIVE SKILLS	S:SPS4:2:6.1 Plan and carry out simple activities with a group.	S:SPS4:4:6.1 Plan and conduct a scientific investigation in group settings. S:SPS4:4:6.2 Engage in group decision making activities. S:SPS4:4:6.3 Role-play different points of view on an issue.
7. SELF DIRECTION	S:SPS4:2:7.1 Keep a visual or written journal.	S:SPS4:4:7.1 Keep a journal record of observations, recognizing patterns, summarizing findings, and reflecting on the observations.
8. ACCOUNTABILITY AND ADAPTABILITY	S:SPS4:2:8.1 Take part in sharing information with another classroom or school as a group.	S:SPS4:4:8.1 Establish ongoing communication with students from other communities or countries to share and compare data.
9. SOCIAL RESPONSIBILITY	S:SPS4:2:9.1 Collaborate, as a group, with another classroom or school.	S:SPS4:4:9.1 Collaborate with other learners by letter, phone, or online.

Science Process Skills		
SPS1– Scientific Inquiry and Critical Thinking Skills (INQ)		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
1. MAKING OBSERVATIONS AND ASKING QUESTIONS	S:SPS1:6:1.1 Make observations and record measurements using a variety of tools and instruments. S:SPS1:6:1.2 Plan observations based on a given purpose. S:SPS1:6:1.3 Identify and investigate similarities and differences among observations and sets of observations. S:SPS1:6:1.4 Use appropriate units and precision of metric measurement when recording data. S:SPS1:6:1.5 Use a classification key, such as a dichotomous key, to identify and distinguish among members of a group or set. S:SPS1:6:1.6 Construct a simple classification key. S:SPS1:6:1.7 Compare methods of classification for a specific purpose. S:SPS1:6:1.8 Ask questions about relationships between and among observations. S:SPS1:6:1.9 Determine which observations will be helpful to a given investigation. S:SPS1:6:1.10 Distinguish between those questions that can be answered by science and those that cannot.	S:SPS1:8:1.1 Use appropriate tools to accurately collect and record both qualitative and quantitative data gathered through observations (e.g., temperature probes, electronic balances, spring scales, microscopes, stop watches). S:SPS1:8:1.2 Determine the degree of accuracy that can be obtained using a given instrument. S:SPS1:8:1.3 Investigate similarities and differences noted when making observations. S:SPS1:8:1.4 Construct and use a dichotomous key to classify a given set of objects or organisms. S:SPS1:8:1.5 Evaluate methods of classification for a specific purpose. S:SPS1:8:1.6 Rephrase questions so that they can be tested or investigated using scientific methodologies. S:SPS1:8:1.7 Ask questions about relationships between and among observable variables.

Science Process Skills		
SPS1– Scientific Inquiry and Critical Thinking Skills (INQ)		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
2. DESIGNING SCIENTIFIC INVESTIGATIONS	S:SPS1:6:2.1 Design and record a simple step-by-step procedure to follow in order to carry out a fair test of a scientific question. S:SPS1:6:2.2 Identify and utilize appropriate tools/technology for collecting data in designing investigations. S:SPS1:6:2.3 Incorporate components of good experimental design, such as controls and multiple trials, into investigations.	S:SPS1:8:2.1 Identify the manipulated, responding and controlled variables in an experiment. S:SPS1:8:2.2 Design a controlled experiment, identifying and controlling the major variables. S:SPS1:8:2.3 Identify flaws or omissions in the design of simple experiments.
3. CONDUCTING SCIENTIFIC INVESTIGATIONS	S:SPS1:6:3.1 Carry out simple student or teacher-developed procedures or experiments. S:SPS1:6:3.2 Use appropriate tools to collect and record data. S:SPS1:6:3.3 Follow the teacher's instructions in performing experiments, following all appropriate safety rules and procedures.	S:SPS1:8:3.1 Use appropriate laboratory techniques to carry out student- or teacher-developed procedures or experiments. S:SPS1:8:3.2 Use appropriate tools to gather data as part of an investigation (e.g., ruler, meter stick, thermometer, spring scale, graduated cylinder, calipers, balance, probes, microscopes). S:SPS1:8:3.3 Follow the teacher's instructions in performing experiments, following all appropriate safety rules and procedures.
4. REPRESENTING AND UNDERSTANDING RESULTS OF INVESTIGATIONS	S:SPS1:6:4.1 Use appropriate tools to organize, represent, analyze and explain data. S:SPS1:6:4.2 Make and record observations using a pre-determined format. S:SPS1:6:4.3 Compare and display data in a variety of student or computer generated formats (such as diagrams, flow charts, tables, bar graphs, line graphs, scatter plots, and histograms). S:SPS1:6:4.4 Identify patterns and relationships in data and formulate basic explanations. S:SPS1:6:4.5 Draw appropriate conclusions based on data collected.	S:SPS1:8:4.1 Use appropriate tools (including computer hardware and software) to collect, organize, represent, analyze and explain data. S:SPS1:8:4.2 Identify sources of error in experiments. S:SPS1:8:4.3 Draw appropriate conclusions regarding the scientific question under investigation, based on the data collected.

Science Process Skills		
SPS1– Scientific Inquiry and Critical Thinking Skills (INQ)		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
5. EVALUATING SCIENTIFIC EXPLANATIONS	S:SPS1:6:5.1 Determine if the results of an experiment support or fail to support the scientific idea tested. S:SPS1:6:5.2 Explain how a hypothesis is a direct extension of a scientific idea and therefore makes that idea "testable."	S:SPS1:8:5.1 Determine if the results of an experiment support or refute the scientific idea tested. S:SPS1:8:5.2 Evaluate whether the information and data collected allows an evaluation of the scientific idea under investigation. S:SPS1:8:5.3 Determine what additional information would be helpful in answering the scientific question.
NECAP ASSESSMENT TARGETS FOR INQUIRY *MAY BE SUBJECT OF PERFORMANCE COMPONENT*		NECAP ASSESSMENT TARGETS S:ESS1:8:2.2 S:ESS1:8:6.4 S:LS1:8:2.5 S:LS2:8:1.3 S:LS4:8:2.4 S:LS1:8:3.7 S:LS4:8:3.4 S:PS1:8:2.4 S:PS1:8:2.5 S:PS1:8:1.6 S:PS2:8:3.6 S:PS3:8:1.3 (For actual text: please see GSE's for Earth Space, Life, and Physical Science.)

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
1. NATURE OF SCIENCE (NOS)	S:SPS2:6:1.1 Explain that scientists do not pay much attention to claims about how something works unless they are backed up with evidence that can be confirmed with a logical argument. S:SPS2:6:1.2 Describe how results of similar and repeated investigations may vary and suggest possible explanations for variations. S:SPS2:6:1.3 Explain that sometimes similar investigations get different results because of unexpected differences in the things being investigated, the methods used, or the circumstances in which the investigation is carried out, and sometimes just because of uncertainties of observations. S:SPS2:6:1.4 Realize that if more than one variable changes at the same time in an experiment, the outcome of the experiment may not be clearly attributable to any one of the variables.	S:SPS2:8:1.1 Describe how scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence. S:SPS2:8:1.2 Realize that when similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, and this often requires more investigations. S:SPS2:8:1.3 Realize that knowledge, based on science, is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way. S:SPS2:8:1.4 Provide examples that show how some scientific knowledge is very old and yet is still applicable today. S:SPS2:8:1.5 Recognize that some matters cannot be examined usefully in a scientific way, such as those matters that by their nature cannot be tested objectively and those that are essentially matters of morality. S:SPS2:8:1.6 Give examples of how science can sometimes be used to inform ethical decisions by identifying the likely consequences of particular actions but cannot be used to establish that some action is either moral or immoral.

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
2. SYSTEMS AND ENERGY (SAE)	S:SPS2:6:2.1 Recognize that thinking about things as systems means looking for how every part relates to others. S:SPS2:6:2.2 Discover that collections of pieces (e.g., powders, marbles, sugar cubes or wooden blocks) may have properties that the individual pieces do not. S:SPS2:6:2.3 Estimate or predict the effect that making a change in one part of the system will have on other parts, and on the system as a whole. S:SPS2:6:2.4 Compare a variety of forms of energy, including heat, light, sound, mechanical, electrical, and chemical energy. S:SPS2:6:2.5 Demonstrate how energy can be transformed from one form to another (e.g., from electrical energy to heat, light or mechanical energy).	S:SPS2:8:2.1 Understand that any system is usually connected to other systems, both internally and externally; thus a system may be thought of as containing subsystems and as being a subsystem of a larger system. S:SPS2:8:2.2 Analyze how the output of one part of a system, which can include materials, energy or information, can become the input to other parts. S:SPS2:8:2.3 Realize that as the complexity of any system increases, gaining an understanding of it depends increasingly on summaries (such as averages and ranges) and on descriptions of typical examples of that system. S:SPS2:8:2.4 Explain that when energy is transformed or converted from one type to another, there is no net loss of energy. S:SPS2:8:2.5 Describe how objects and substances can store energy (e.g., a battery, food, gasoline).

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
3. MODELS AND SCALE (MAS)	S:SPS2:6:3.1 Understand that models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly; or that are too vast to be changed deliberately; or that are potentially dangerous. S:SPS2:6:3.2 Analyze how finding out the biggest and smallest values of something are often as revealing as knowing what the usual value is.	S:SPS2:8:3.1 Demonstrate how mathematical models can be displayed on a computer and then modified to see what happens. S:SPS2:8:3.2 Know that different models can be used to represent the same thing; what kind of model is used and how complex it should be depends on its purpose; and the usefulness of a model is one of the instances in which intuition and creativity come into play in science, mathematics and engineering. S:SPS2:8:3.3 Discover how properties of systems that depend on volume, such as capacity and weight change, change out of proportion to properties that depend on area, such as strength or surface processes. S:SPS2:8:3.4 Recognize that as the complexity of any system increases, gaining an understanding increasingly depends on summaries (such as averages and ranges) and on descriptions of typical examples of that system.

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
4. PATTERNS OF CHANGE (POC)	S:SPS2:6:4.1 Understand that things change in steady, repetitive, or irregular ways, or sometimes in more than one way at the same time; often the best way to tell which kinds of change are happening is to make a table or graph of measurements. S:SPS2:6:4.2 Discover how a system may stay the same because nothing is happening or because things are happening that exactly balance each other out.	S:SPS2:8:4.1 Analyze how physical and biological systems tend to change until they become stable and then stay that way unless their surroundings change. S:SPS2:8:4.2 Recognize how many systems contain feedback mechanisms that serve to keep changes within specified limits. S:SPS2:8:4.3 Realize that symbolic equations can be used to summarize how the quantity of something changes over time or in response to other changes. S:SPS2:8:4.4 Explain how symmetry (or the lack of it) may determine properties of many objects, from molecules and crystals to organisms and designed structures. S:SPS2:8:4.5 Realize that cycles, such as the seasons or body temperature, can be described by their cycle length or frequency, what their highest and lowest values are, and when those values occur; different cycles range from many thousand years down to less than a billionth of a second.
5. FORM AND FUNCTION (FAF)	S:SPS2:6:5.1 Describe the structure and function of organs. S:SPS2:6:5.2 Diagram and label the structure of the primary components of representative organs in plants and animals. S:SPS2:6:5.3 Investigate the relationship between various landforms and wind currents.	S:SPS2:8:5.1 Describe the relationship between structure and function of organ systems in plants and animals. S:SPS2:8:5.2 Describe the structure and function of various organ systems (i.e., digestion, respiration, circulation, nervous, protection and support) and how these systems contribute to homeostasis of the organism. S:SPS2:8:5.3 Compare the structure and function of organ systems in one organism to the structure and function in another organism.

Science Process Skills		
SPS3– Personal, Social, and Technological Perspectives		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
1. COLLABORATION IN SCIENTIFIC ENDEAVORS	S:SPS3:6:1.1 Work effectively within a cooperative group setting, accepting and executing assigned roles and responsibilities. S:SPS3:6:1.2 Work collectively within a group toward a common goal. S:SPS3:6:1.3 Demonstrate respect of one another's abilities and contributions to the group.	S:SPS3:8:1.1 Work effectively within a cooperative group setting, accepting and executing assigned roles and responsibilities. S:SPS3:8:1.2 Work collectively within a group toward a common goal. S:SPS3:8:1.3 Demonstrate respect of one another's abilities and contributions to the group. S:SPS3:8:1.4 Demonstrate an understanding of the ethics involved in scientific inquiry.
2. COMMON ENVIRONMENTAL ISSUES, NATURAL RESOURCES MANAGEMENT AND CONSERVATION	S:SPS3:6:2.1 Develop, focus and explain questions about the environment and do environmental investigations. S:SPS3:6:2.2 Design environmental investigations to answer particular questions. S:SPS3:6:2.3 Explore evidence that human-caused changes have consequences for the immediate environment as well as for other places and future times. S:SPS3:6:2.4 Explore how humans shape and control the environment while creating knowledge and developing new technologies. S:SPS3:6:2.5 Investigate environmental and resource management issues at scales that range from local to national to global.	S:SPS3:8:2.1 Locate and collect reliable information about the environment and environmental topics using a variety of methods and sources. S:SPS3:8:2.2 Judge the weaknesses and strengths of the information they are using. S:SPS3:8:2.3 Explore the uses and limitations of models. S:SPS3:8:2.4 Synthesize observations and findings into coherent explanations about natural resources and the environment.

Science Process Skills		
SPS3– Personal, Social, and Technological Perspectives		
	By the end of Grade 6, all students will apply skills from previous grades and…	**By the end of Grade 8, all students will apply skills from previous grades and…**
3. SCIENCE AND TECHNOLOGY, TECHNOLOGICAL DESIGN AND APPLICATION	S:SPS3:6:3.1 Identify problems/issues that can be addressed by design technology. S:SPS3:6:3.2 Identify and describe the procedure for designing a product, including identifying a need, researching, brainstorming, selecting, developing a prototype, testing and evaluating. S:SPS3:6:3.3 Evaluate technological designs using established criteria.	S:SPS3:8:3.1 Design a product or solution to a problem. S:SPS3:8:3.2 Build a product that has been designed in class. S:SPS3:8:3.3 Evaluate student-designed products according to established criteria and recommend improvements or modifications.

Science Process Skills	
SPS4– Science Skills for Information, Communication and Media Literacy (from *ICT Literacy Map for Science,* www.21stcenturyskills.org)	
	By the end of Grade 8, all students will apply skills from previous grades and…
1. INFORMATION AND MEDIA LITERACY	S:SPS4:8:1.1 Use a variety of information access tools to locate, gather, and organize potential sources of scientific information to answer questions. S:SPS4:8:1.2 Collect real-time observations and data, synthesizing and building upon existing information (e.g., online databases, NOAA, EPA, USGS) to solve problems. S:SPS4:8:1.3 Use appropriate tools to analyze and synthesize information (e.g., diagrams, flow charts, frequency tables, bar graphs, line graphs, stem-and-leaf plots) to draw conclusions and implications based on investigations of an issue or question.
2. COMMUNICATION SKILLS	S:SPS4:8:2.1 Use a wide range of tools and a variety of oral, written, and graphic formats to share information and results from observations and investigations.
3. CRITICAL THINKING AND SYSTEMS THINKING	S:SPS4:8:3.1 Execute steps of scientific inquiry to engage in the problem-solving and decision making processes. S:SPS4:8:3.2 Apply new and unusual applications of existing knowledge to new and different situations. S:SPS4:8:3.3 Make sketches, graphs, and diagrams to explain ideas and to demonstrate the interconnections between systems.
4. PROBLEM IDENTIFICATION, FORMULATION, AND SOLUTION	S:SPS4:8:4.1 Formulate a scientific question about phenomena, a problem, or an issue and using a broad range of tools and techniques; and plan and conduct an inquiry to address the question. S:SPS4:8:4.2 Use evidence collected from observations or other sources and use them to create models and explanations.
5. CREATIVITY AND INTELLECTUAL CURIOSITY	S:SPS4:8:5.1 Use a variety of media tools to make oral and written presentations, which include written notes and descriptions, drawings, photos, and charts to communicate the procedures and results of an investigation.
6. INTERPERSONAL AND COLLABORATIVE SKILLS	S:SPS4:8:6.1 Work in diverse pairs/teams to answer questions, solve problems and make decisions. S:SPS4:8:6.2 Plan and develop team science projects. S:SPS4:8:6.3 Articulate understanding of content through personal interaction and sharing with peers.
7. SELF DIRECTION	S:SPS4:8:7.1 Keep a journal of observations and investigations, and periodically evaluate entries to assess progress toward achieving the understanding of key ideas.
8. ACCOUNTABILITY AND ADAPTABILITY	S:SPS4:8:8.1 Develop and execute a plan to collect and record accurate and complete data from various sources to solve a problem or answer a question; and gather and critically analyze data from a variety of sources. S:SPS4:8:8.2 Participate in science competitions, where students are responsible for creating a product or participating in an event.
9. SOCIAL RESPONSIBILITY	S:SPS4:8:9.1 Collaborate with a network of learners by phone, video, virtual classroom platform. S:SPS4:8:9.2 Participate in simulation or role-playing activities in which students grapple with the ethics of complex issues.

Science Process Skills		
SPS1– Scientific Inquiry and Critical Thinking Skills (INQ)		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
1. MAKING OBSERVATIONS AND ASKING QUESTIONS	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.	S:SPS1:12:1.1 Define and delimit problems to facilitate investigation. S:SPS1:12:1.2 Make and record measurements to the correct number of significant figures based on the precision of the instrument used. S:SPS1:12:1.3 Make measurements and observations about a variety of events and phenomena, including those that occur during very small and very large time frames. S:SPS1:12:1.4 Ask questions about relationships between and among observable variables as well as theoretical entities. S:SPS1:12:1.5 Use, evaluate and apply complex classification schemes based on an understanding of scientific concepts, laws and principles. S:SPS1:12:1.6 Describe and apply classification systems and nomenclatures used in the sciences.
2. DESIGNING SCIENTIFIC INVESTIGATIONS	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.	S:SPS1:12:2.1 Identify the theoretical basis of an investigation and develop a prediction and a hypothesis that are consistent with the theoretical basis. S:SPS1:12:2.2 Evaluate and select appropriate instruments for collecting data and evidence in an investigation. S:SPS1:12:2.3 Develop appropriate sampling procedures for a given investigation.

Science Process Skills		
SPS1– Scientific Inquiry and Critical Thinking Skills (INQ)		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
3. CONDUCTING SCIENTIFIC INVESTIGATIONS	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.	S:SPS1:12:3.1 Carry out procedures controlling major variables and adapting or extending procedures where required. S:SPS1:12:3.2 Implement appropriate sampling procedures. S:SPS1:12:3.3 Identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledges the degree of uncertainty.
4. REPRESENTING AND UNDERSTANDING RESULTS OF INVESTIGATIONS	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.	S:SPS1:12:4.1 Interpret patterns and trends in data, and infer or calculate linear and non-linear relationships among variables. S:SPS1:12:4.2 Compare theoretical and empirical values and account for discrepancies. S:SPS1:12:4.3 Evaluate the relevance, reliability and adequacy of data and data collection methods.
5. EVALUATING SCIENTIFIC EXPLANATIONS	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.	S:SPS1:12:5.1 Explain how two different scientific explanations for the same phenomenon can be evaluated using the predictive value of the explanations. S:SPS1:12:5.2 Apply and assess alternative theoretical models.
NECAP ASSESSMENT TARGETS FOR INQUIRY *MAY BE SUBJECT OF PERFORMANCE COMPONENT*	NECAP ASSESSMENT TARGETS S:ESS1:11:4.1 S:ESS1:11:3.2 S:LS1:11:2.8 S:LS2:11:1.5 S:LS3:11:3.9 S:LS3:11:2.6 S:LS4:11:2.6 S:PS1:11:2.6 S:PS2:11:3.10 S:PS3:11:1.8 (For actual text: please see GSE's for Earth Space, Life, and Physical Science.)	

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
1. NATURE OF SCIENCE (NOS)	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.	S:SPS2:12:1.1 Recognize that there are different traditions in science about what is investigated and how; but they all have in common certain beliefs about the value of evidence, logic and good arguments. S:SPS2:12:1.2 Understand that no matter how well one theory fits observations, a new theory might fit them better, or might fit a wider range of observations. S:SPS2:12:1.3 Explain how in the short run, new ideas that do not mesh well with mainstream ideas in science often encounter vigorous criticism. S:SPS2:12:1.4 Know that from time to time, major shifts occur in the scientific view of how the world works; more often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge (change and continuity are persistent features of science). S:SPS2:12:1.5 Recognize that evidence for the value of testing, revising and discarding theories is given by the improving ability of scientists to offer reliable explanations and make accurate predictions.

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
2. SYSTEMS AND ENERGY (SAE)	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.	S:SPS2:12:2.1 Use evidence and logic to explain that as the number of parts in a system grows in size, the number of possible interactions increases much more rapidly, roughly with the square of the number of parts. S:SPS2:12:2.2 Know that understanding how things work and designing solutions to problems of almost any kind can be facilitated by systems analysis; in defining a system, it is important to specify its boundaries and subsystems, indicate its relation to other systems, and identify what its input and output are expected to be.
3. MODELS AND SCALE (MAS)	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.	S:SPS2:12:3.1 Recognize that computers have greatly improved the power and use of mathematical models by performing computations that are very long, very complicated, or repetitive; therefore, computers can show the consequences of applying complex rules or of changing the rules. The graphic capabilities of computers make them useful in the design and testing of devices and structures and in the simulation of complicated processes.

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
4. PATTERNS OF CHANGE (POC)	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.	S:SPS2:12:4.1 Give examples of how in many physical, biological and social systems, changes in one direction tend to produce opposing (but somewhat delayed) influences, leading to repetitive cycles of behavior. S:SPS2:12:4.2 Realize that most systems above the molecular level involve so many parts and forces and are so sensitive to tiny differences in conditions that their precise behavior is unpredictable, even if all the rules for change are known. Predictable or not, the precise future of a system is not completely determined by its present state and circumstances but also on the fundamentally uncertain outcomes of events on the atomic scale.

Science Process Skills		
SPS2– Unifying Concepts of Science		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
5. FORM AND FUNCTION (FAF)	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules. S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.	*Same as Grade 11*

Science Process Skills		
SPS3– Personal, Social, and Technological Perspectives		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
1. COLLABORATION IN SCIENTIFIC ENDEAVORS	S:SPS3:11:1.1 Collaborate with existing research efforts. S:SPS3:11:1.2 Identify global researchers in a field of interest.	*Same as grade 11*
2. COMMON ENVIRONMENTAL ISSUES, NATURAL RESOURCES MANAGEMENT AND CONSERVATION	S:SPS3:11:2.1 Develop, modify, clarify and explain questions that guide environmental investigations of various types. S:SPS3:11:2.2 Design investigations to answer particular questions about the environment. S:SPS3:11:2.3 Locate and collect reliable information for environmental investigations of many types. S:SPS3:11:2.4 Apply basic logic and reasoning skills to evaluate completeness and reliability in a variety of information sources. S:SPS3:11:2.5 Organize and display information in ways appropriate to different types of environmental investigations and purposes. S:SPS3:11:2.6 Create, use and evaluate models to understand environmental phenomena. S:SPS3:11:2.7 Use to evidence and logic in developing proposed explanations that address their initial questions and hypotheses. S:SPS3:11:2.8 Analyze global, social, cultural, political, economic and environmental linkages. S:SPS3:11:2.9 Evaluate presentations of environmental issues for accuracy.	*Same as grade 11*

Science Process Skills		
SPS3– Personal, Social, and Technological Perspectives		
	By the end of Grade 11, all students will apply skills from previous grades and…	**By the end of Grade 12, advanced students will apply skills from previous grades and…**
3. SCIENCE AND TECHNOLOGY, TECHNOLOGICAL DESIGN AND APPLICATION	S:SPS3:11:3.1 Analyze environmental issues such as water quality, air quality, hazardous waste, and depletion of natural resources. S:SPS3:11:3.2 Evaluate status of a local community system (transportation, water, communication, food resources or electrical) in partnership with local officials. S:SPS3:11:3.3 Analyze technical writing, graphs, charts, and diagrams.	*Same as grade 11*

Science Process Skills	
SPS4– Science Skills for Information, Communication and Media Literacy (from *ICT Literacy Map for Science,* www.21stcenturyskills.org)	
	By the end of Grade 11, all students will apply skills from previous grades and…
1. INFORMATION AND MEDIA LITERACY	S:SPS4:12:1.1 Select and analyze information from various sources (including electronic resources, print resources, community resources) and personally collected data to answer questions being investigated. S:SPS4:12:1.2 Collect and use qualitative and quantitative data and information, seek evidence and sources of information to identify flaws such as errors and bias, and explain how the evidence supports or refutes an initial hypothesis. S:SPS4:12:1.3 Analyze data and information gathered to clarify problems or issues identifying costs and benefits from a social, cultural, and/or environmental perspective; predict the consequences of action or inaction; and propose possible solutions.
2. COMMUNICATION SKILLS	S:SPS4:12:2.1 Select and use appropriate scientific vocabulary to orally share and communicate scientific ideas, plans, results, and conclusions resulting from investigations. S:SPS4:12:2.2 Create written reports and journals to share and communicate scientific ideas, plans, results, and conclusions resulting from observations and investigations. S:SPS4:12:2.3 Create a multimedia presentation incorporating numeric symbolic and/or graphic modes of representation to share scientific ideas, plans, results, and conclusions.
3. CRITICAL THINKING AND SYSTEMS THINKING	S:SPS4:12:3.1 Pursue scientific inquiry such as observation, measurement, hypothesis formation and analysis, and value "habits of mind" such as persistence, accuracy, and collaboration. S:SPS4:12:3.2 Generate solutions to scientific questions and challenges through developing, modeling and revising investigations. S:SPS4:12:3.3 Apply scientific knowledge and skills to make reasoned decisions about the use of science and scientific innovations.
4. PROBLEM IDENTIFICATION, FORMULATION, AND SOLUTION	S:SPS4:12:4.1 Formulate scientific questions about an issue and define experimental procedures for finding answers. S:SPS4:12:4.2 Plan and conduct practical tests to solve problems or answer a question, collect and analyze data using appropriate instruments and techniques safely and accurately. S:SPS4:12:4.3 Develop models and explanations to fit evidence obtained through investigations.

Science Process Skills	
SPS4– Science Skills for Information, Communication and Media Literacy (from *ICT Literacy Map for Science,* www.21stcenturyskills.org)	
	By the end of Grade 11, all students will apply skills from previous grades and…
5. CREATIVITY AND INTELLECTUAL CURIOSITY	S:SPS4:12:5.1 Prepare multimedia presentations to share results of investigations, demonstrating a clear sense of audience and purpose. S:SPS4:12:5.2 Use electronic networks to share information. S:SPS4:12:5.3 Model solutions to a range of problems in science and technology using computer simulation software.
6. INTERPERSONAL AND COLLABORATIVE SKILLS	S:SPS4:12:6.1 Create a culminating team project that demonstrates content knowledge and conceptual understanding and shows connections between science content and real-world settings. S:SPS4:12:6.2 Collect, synthesize, and report information from a variety of points of view.
7. SELF DIRECTION	S:SPS4:12:7.1 Use key ideas of science to document and explain through an investigation the relationship between science and concepts. S:SPS4:12:7.2 Self-assess progress toward a predetermined outcome and decide what needs to be done to meet the goal.
8. ACCOUNTABILITY AND ADAPTABILITY	S:SPS4:12:8.1 Identify the reputable and appropriate communities of learners to whom research findings should be reported, compare data, and adapt as needed. S:SPS4:12:8.2 Use science learned to create a personal action plan on a community issue.
9. SOCIAL RESPONSIBILITY	S:SPS4:12:9.1 Collaborate with interested learners using appropriate web resources and publication media such as journals (print and electronic).

K-8 Grade Level Expectations for Earth/Space, Life and Physical Sciences
(K-12 science process skills are integrated throughout all domains.)

	Earth/Space	Life	Physical
Kindergarten		Behavior/Health	Energy/Gravity
Grade 1	Earth • Weather/Climate • Water Cycle Astronomy • Earth, Moon Sun systems • Motion of planets, moons, stars • Stars & Galaxies	Diversity of Life • Characteristics of living things • Biological classification Lifes Continuity/Change • Reproduction/growth and development • Health	Energy/Force Motion Unifying Themes • Scales
Grade 2	Earth • Rocks/Minerals • Structure of solid earth • Solar Energy	Lifes Continuity/Change • Bio evolution • Natural/artificial selection Biological structure/function • Human body systems • Health (disease) • Senses Ecology • Flow of energy thru ecosystems • Habitats/local environment	Matter • Properties of Matter • Physical properties & change Energy, Force, Motion (push/pull) • Sound • Heat (temperature) Implications of science Technology • Materials • Manufacturing Science • Technology
Grade 3	Earth • Astronomy • Weather/climate	Structures/Characteristics of plants & animals • Reproduction • Sort/classify • Basic needs • Behavior • Health/nutrition • Human structure (body parts) • Technology – medicine	Gravity • Gravitational pull as it relates to Earth
Grade 4 NH FOCUS	Earth • Materials • Rocks/minerals/soils	Structures/Characteristics of plants & animals • Sort/classify • Basic needs • Energy transfer • Interdependence • Change over time • Health	Matter Energy Magnets Electricity
Grade 5	Ecology • Renewable/nonrenewable Resources ~ conservation recycling Geology • Landforms • Fossils – life forms • Rock cycle Earth, Moon, sun • Planets • Constellations	Life systems (human body systems) Health – social issues/disease Cells Systems Animals/plants Ecosystems (transfer of energy) Adaptations Survival Change over time Behavior	Not at this grade level

K-8 Grade Level Expectations for Earth/Space, Life and Physical Sciences (K-12 science process skills are integrated throughout all domains.)			
	Earth/Space	**Life**	**Physical**
Grade 6	Weather • Water cycle	Not at this grade level	Matter Energy • Heat • Light • Sound • Transfer of energy Force Motion (push/pull)
Grade 7	Not at this grade level	5 Kingdoms – classification • Environment • Cells • Tissues • Organs • Systems (relationship) Behavior • Reproduction o Sexual o Asexual • Genetics – traits • Environmental stimuli • Disease – natural selection Environmental Science • Change in condition • Competition • Abiotic/biotic • Energy flow • Recycling through respiration and photosynthesis	Volume Mass Durable goods Conservation of energy
Grade 8	Geology Composition • Layers Fossils Plate tectonics Change • Earthquakes, etc. Rock Cycle Meteorology • Water cycle • Climate impact o Ocean temp. o Composition of atmosphere o Volcanoes, etc.	Portfolio review of grade seven tri-state assessment targets in preparation for NECAP test	Force/Motion • Gravitational force • Gravity affecting motion • Newton's law (object in motion stays in motion) Chemistry • Energy/transfer of energy • Atoms/molecules • Mixture /element/compound • States of matter • Chemical reactions – rates • Chemical/physical properties of water

The following pages chart K-8 grade level expectations (GLE's) in each of the three domains of science.

TERMINOLOGY & EXPLANATION OF THE NUMBERING SYSTEM

Domain of Science: Earth Science (ESS), Life Science (LS), Physical Science (PS), or Science Process Skills (SPS)

Strands--Enduring Knowledge Statements: Strands are the same for each grade level although not all will be seen in each grade.

Proficiency Standards: These are what students should know and be able to do. The number just indicates the order listed and does *not* indicate a specific sequence.

Domain/ Unifying Theme	Strand/Big Idea	Proficiency Standard	CTS Resource	Unit Resources
Earth Space Science	***EARTH*** ***ESS1 The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes***	ESS1 1.1 Identify and describe the processes of the water cycle and explain their effects on climatic patterns. ESS1 1.2 Identify and describe the impact certain factors have on the Earth's climate, including changes in the oceans' temperature, changes in the composition of the atmosphere, and geological shifts due to events, such as volcanic eruptions and glacial movements. ESS1 2.1 Describe the layers of the Earth, including the core, mantle, lithosphere, hydrosphere, and atmosphere. **ESS1 2.2 Use geological evidence provided to support the idea that Earth's crust/lithosphere is composed of plates that move. [ESS1 (5-8) INQ+POC –1]** ESS1 4.1 Describe how catastrophic changes that have taken place on the Earth's surface can be revealed by satellite images. ESS1 5.1 Explain that the Earth's crust is divided into plates which move at extremely slow rates in response to movements in the mantle.	P. 175 P. 182 P. 183 P. 184 P. 188 P. 189 P. 190	

Tri-State Assessment Targets: Proficiencies which are **bold** are the "assessment targets" for the Tri-State Assessment. These were written to guide the writing of MANY of the test questions so are intentionally broad. Students should have experiences in all proficiencies over the entire grade span to be prepared for the state-wide assessment. Included with each Assessment Target is one or more codes which align to the Science Process Skills and Unifying Concepts assessed on the state-wide test (Scientific Inquiry and Critical Thinking Skills INQ; Systems and Energy SAE; Patterns of Change POC; Form and Function FAF). Also included is a number corresponding to the depth of knowledge (DOK) which the state-wide test assesses the proficiency (see Webb for descriptors of each level in Appendix A)

Curriculum Topic Study Resource: Reference to *Science Curriculum Topic Study* (Page Keeley. 2005. NSTA Press) which aligns adult content knowledge, grade level concepts and specific ideas, instructional implications, research on student learning, and coherency and articulation with tri-state standards.

Unit Resources: References to specific parts, pages, units, etc., of local print materials (text and common supplements) lab kits, audiovisuals or other assured learning experiences that align to the proficiency standards.

Grade K ~ Life Science	
Strand/Big Idea: LS4 – Humans are similar to other species in many ways, and yet are unique among Earth's life forms.	
Stem	GLE's (Grade Level Expectations)
BEHAVIOR	S:LS4:2:1.2 Recognize that humans learn from each other in many different ways, such as listening and speaking, watching and imitating. S:LS4:2:1.4 Recognize that some of the things humans can do, such as playing games, reading, and writing, must be learned.
DISEASE	S:LS4:2:2.1 Recognize that proper nutrition, exercise and rest are all important factors in maintaining good health. S:LS4:2:2.2 Recognize that humans can spread germs that cause disease. S:LS4:2.2.3 Identify and describe the basic personal hygiene habits for maintaining good health, such as washing one's hands with soap and water and brushing one's teeth.

Grade K ~ Physical Science	
Strand/Big Idea: PS2 – Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.	
Stem	GLE's (Grade Level Expectations)
ENERGY	S:PS2:2:3.2 Explain that the Sun provides the Earth with heat and light.
Strand/Big Idea: PS3 – The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
FORCES	S:PS3:2:1.2 Describe and demonstrate that things close to the Earth drop to the ground unless something supports them.
MOTION	S:PS3:2:2.1 Describe the many different ways things can move, such as in a straight line, zigzag or circular motion, back and forth, and fast and slow.

Grade 1 ~ Earth Space Science	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.	
Stem	GLE's (Grade Level Expectations)
ATMOSPHERE, CLIMATE, AND WEATHER	S:ESS1:2:1.1 Recognize that weather conditions change frequently, and that weather patterns change over the seasons. S:ESS1:2:1.2 Describe and compare weather using observations and measurements of local weather conditions.
WATER	S:ESS1:2:7.1 Recognize that water can be a liquid or a solid; and explain that it can be made to change from one state to the other, but the amount (mass) of water always remains the same in either state.
Strand/Big Idea: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.	
Stem	GLE's (Grade Level Expectations)
EARTH, SUN, AND MOON	S:ESS2:2:1.1 Recognize the basic patterns of the Sun, including its appearance during the daytime, and how its position in the sky changes through the seasons. S:ESS2:2:1.2 Recognize the basic patterns of the Moon, including its appearance sometimes at night and sometimes during the day; and how it appears to change shape through the month.
VIEW FROM EARTH	S:ESS2:2:4.1 Recognize that the Sun, Moon and stars all appear to move slowly across the sky. S:ESS2:2:4.2 Recognize that as the position of the Sun changes in relation to the Earth it creates shadows of varying length and direction. S:ESS2:2:4.3 Explain that people should not look directly at the Sun because it is dangerous and may cause injury to the eyes.

Grade 1 ~ Earth Space Science	
Strand/Big Idea: ESS3 – The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.	
Stem	GLE's (Grade Level Expectations)
STARS AND GALAXIES	S:ESS3:2:2.1 Recognize there are too many stars to count, and that they are unequal in their brightness.

Grade 1 ~ Life Science	
Strand/Big Idea: LS1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species).	
Stem	GLE's (Grade Level Expectations)
CLASSIFICATION	S:LS1:2:1.1 Differentiate between living and nonliving things; and categorize objects in each group using the significant observable characteristics they share, such as color, shape and size. S:LS1:2:1.2 Recognize plants and animals as living things and describe how they are alike and different.
REPRODUCTION	S:LS1:2:3.1 Recognize that parents and offspring of many species closely resemble one another; and describe the similarities in appearance of given plant and animal families S:LS1:2:3.2 Recognize that living things have a life cycle, during which they are born, grow, and die.
Strand/Big Idea: LS2 – Energy flows and matter recycles through an ecosystem.	
Stem	GLE's (Grade Level Expectations)
ENVIRONMENT	S:LS2:2:1.1 Recognize that living things can be found almost anyplace in the world; and that specific types of environments are required to support the many different species of plant and animal life. S:LS2:2:1.3 Recognize that some plants and animals go through changes in appearance when the seasons change.

Grade 1 ~ Life Science	
Strand/Big Idea: LS3 – Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry).	
Stem	GLE's (Grade Level Expectations)
NATURAL SELECTION	S:LS3:2:3.1 Recognize and describe the similarities and differences in both behavior and appearance of plants and animals.
Strand/Big Idea: LS4 – Humans are similar to other species in many ways, and yet are unique among Earth's life forms.	
Stem	GLE's (Grade Level Expectations)
BEHAVIOR	S:LS4:2:1.1 Recognize and describe how living things respond when exposed to helpful and harmful situations. S:LS4:2:1.3 Recognize that humans can gather different kinds of information about an object by adjusting their proximity to it.

Grade 1 ~ Physical Science	
Strand/Big Idea: PS1 – All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
PROPERTIES	S:PS1:2:2.1 Identify the observable properties of different objects, such as color, size, shape, weight and texture.
Strand/Big Idea: PS3 – The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
FORCES	S:PS3:2:1.1 Describe the properties of magnetism and demonstrate how magnets can be used to move some things without touching them.
MOTION	S:PS3:2:2.2 Describe and demonstrate how the position and motion of an object can be changed by applying force, such as pushing and pulling; and explain that the greater the force, the greater the change. S:PS3:2:2.3 Describe the position of an object by referencing its location in relation to another object or background.
Strand/Big Idea: PS4 – The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues	
Stem	GLE's (Grade Level Expectations)
TOOLS	S:PS4:2:2.1 Identify tools and simple machines, such as a wheel, and explain how they work.

Grade 2 ~ Earth Space Science	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.	
Stem	GLE's (Grade Level Expectations)
COMPOSITION AND FEATURES	S:ESS1:2:2.1 Recognize that solid rocks, soils, and water in its liquid and solid states can be found on the Earth's surface. S:ESS1:2:2.2 Use observable properties, such as color and texture, to classify and organize rocks and minerals. S:ESS1:2:2.3 Recognize that Earth materials have a variety of properties, including size, shape, color and texture.
PROCESSES AND RATES OF CHANGE	S:ESS1:2:5.1 Recognize that some changes are too slow or too fast to be easily observed.
ROCK CYCLE	S:ESS1:2:6.1 Explain that large rocks can be broken down into smaller rocks. S:ESS1:2:6.2 Describe rocks and soils in terms of their physical properties.
Strand/Big Idea: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.	
Stem	GLE's (Grade Level Expectations)
ENERGY	S:ESS2:2:2.1 Recognize that the light and heat the Sun provides to the Earth is necessary for life.

Grade 2 ~ Life Science	
Strand/Big Idea: LS1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).	
Stem	GLE's (Grade Level Expectations)
LIVING THINGS AND ORGANIZATION	S:LS1:2:2.1 Recognize that plants and animals have features that help them survive in different environments.
FLOW OF ENERGY	S:LS2:2:2.1 Identify the resources plants and animals need for growth and energy, and describe how their habitat provides these basic needs.
Strand/Big Idea: LS2 – Energy flows and matter recycles through an ecosystem.	
Stem	GLE's (Grade Level Expectations)
ENVIRONMENT	S:LS2:2:1.2 Recognize that animals, including humans, interact with their surroundings using their senses; and that different senses provide different kinds of information.
FLOW OF ENERGY	S:LS2:2:2.1 Identify the resources plants and animals need for growth and energy, and describe how their habitat provides these basic needs.
Strand/Big Idea: LS3 – Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry). (cont. next page)	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:LS3:2:1.1 Recognize that some living things, which lived on Earth long ago, are now extinct, such as dinosaurs, mammoths, giant tree ferns, and horsetail trees.
EVIDENCE OF EVOLUTION	S:LS3:2:2.1 Recognize that some plants and animals, which are alive today, are similar to living things which have become extinct, such as elephants and mammoths.

Grade 2 ~ Life Science	
NATURAL SELECTION	S:LS3:2:3.2 Recognize that there are different species of living things in various places around the world.
Strand/Big Idea: LS4 – Humans are similar to other species in many ways, and yet are unique among Earth's life forms.	
Stem	GLE's (Grade Level Expectations)
DISEASE	S:LS4:2:2.1 Recognize that proper nutrition, exercise and rest are all important factors in maintaining good health. S:LS4:2:2.2 Recognize that humans can spread germs that cause disease. S:LS4:2.2.3 Identify and describe the basic personal hygiene habits for maintaining good health, such as washing one's hands with soap and water and brushing one's teeth. S:LS4:2:2.4 Recognize symptoms, such as fever, rashes, coughing and congestion for common illnesses.
HUMAN IDENTITY	S:LS4:2:3.2 Identify the sense organs, including eyes, ears, nose mouth, and skin; and describe how each can warn an individual about danger. S:LS4:2:3.5 Recognize that humans need food, water, air, waste removal and a particular range of temperatures in their environment, just as other animals do.

Grade 2 ~ Physical Science	
Strand/Big Idea: PS1– All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
COMPOSITION	S:PS1:2:1.1 Recognize that objects can be composed of different types of materials, such as wood, metal, and paper. S:PS1:2:1.2 Recognize that objects can be made of one or more materials.
Strand/Big Idea: PS2 – Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:PS2:2:1.1 Describe how the properties of certain materials can change when specific actions are applied to them, such as freezing, mixing, heating, cutting, dissolving and bending. S:PS2:2:1.2 Recognize that not all materials react the same way when an action is applied to them.
ENERGY	S:PS2:2:3.1 Recognize that sound is produced by vibrating objects and that the pitch of the sound can be varied by changing the rate of vibration. S:PS2:2:3.3 Describe that heat can be produced in a variety of ways, such as burning, rubbing, and mixing substances together. S:PS2:2:3.4 Recognize that energy comes from different sources, such as electricity and water, and is utilized in many common objects.

Grade 2 ~ Physical Science	
Strand/Big Idea: PS4 – The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:PS4:2:1.1 Recognize that new objects can be made out of physical materials, such as cloth and paper.
TOOLS	S:PS4:2:2.2 Demonstrate how to use tools, such as rulers, scales, balances, magnifiers and thermometers to measure properties of objects, such as size, weight, temperature.
SOCIAL ISSUES (LOCAL AND GLOBAL) ENERGY, POWER, AND TRANSPORTATION MANUFACTURING	S:PS4:2:3.1 Provide examples of how man uses energy in everyday life, such as providing light, warmth in winter, cooling in summer, TVs, computers, telephones, transportation, factories. S:PS4:2:3.2 Provide examples of items that are manufactured or produced.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:PS4:2:4.1 Recognize that some jobs/careers require knowledge and use of physical science content and/or skills.

Grade 3 ~ Earth Space Science	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.	
Stem	GLE's (Grade Level Expectations)
ATMOSPHERE, CLIMATE, AND WEATHER	S:ESS1:4:1.1 Explain how water exists in the atmosphere in different forms and describe how it changes from one form to another through various processes such as freezing, condensation, precipitation and evaporation. S:ESS1:4:1.2 Explain that air surrounds the Earth, it takes up space, and it moves around as wind. S:ESS1:4:1.3 Based on data collected from daily weather observations, describe weather changes or weather patterns. [ESS1(K-4)POC-5] S:ESS1:4:1.4 Explain how the use of scientific tools helps to extend senses and gather data about weather (i.e., weather/wind vane– direction; wind sock– wind intensity; anemometer– speed; thermometer– temperature; meter sticks/rulers– snow depth; rain gauges– rain amount in inches). [ESS1(K-4)NOS-3]
OBSERVATION OF THE EARTH FROM SPACE	S:ESS1:4:4.1 Recognize features of the Earth as viewed by astronauts in orbit and as transmitted by scientific instruments on satellites and spacecraft.
WATER	S:ESS1:4:7.1 Recognize and describe the Earth's surface as mostly covered by water. S:ESS1:4:7.2 Explain that most of Earth's water is salt water, which is found in the oceans, and that fresh water is found in rivers, lakes, underground sources, and glaciers.

Grade 3 ~ Earth Space Science *Continued*	
Strand/Big Idea: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.	
Stem	GLE's (Grade Level Expectations)
EARTH, SUN, AND MOON	S:ESS2:4:1.1 Explain that night and day are caused by the Earth's rotation on its axis; and that the Earth rotates approximately once, every 24 hours. S:ESS2:4:1.2 Describe the Sun as a star.
ENERGY	S:ESS2:4:2.1 Recognize that the Sun provides the light and heat necessary to maintain the temperature of the Earth.
SOLAR SYSTEM	S:ESS2:4:3.1 Recognize that the Moon orbits the Earth. S:ESS2:4:3.2 Recognize that the Earth is one of a number of planets that orbit the Sun.
VIEW FROM EARTH	S:ESS2:4:4.1 Recognize that although star patterns seen in the sky appear to move slowly each night from east to west they actually remain the same, and explain why different stars can be seen during different seasons. S:ESS2:4:4.2 Explain why the planets look like stars, and why, over a period of time, they appear to wander among the constellations.

Grade 3 ~ Earth Space Science	
Strand/Big Idea: ESS3 – The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.	
Stem	GLE's (Grade Level Expectations)
SIZE AND SCALE	S:ESS3:4:1.1 Recognize that astronomical objects in space are massive in size and are separated from one another by vast distances. S:ESS3:4:1.2 Explain that telescopes magnify the size of distant objects and significantly increase the number of these objects that can be viewed from Earth.
STARS AND GALAXIES	S:ESS3:4:2.1 Recognize and describe the stars, like the Sun, as spherical in nature. S:ESS3:4:2.2 Recognize that stars come in different colors, and that the Sun is a yellow star.
Strand/Big Idea: ESS4 – The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:ESS4:4:1.1 Recognize that man uses various mechanical devices to record changes in the weather and the Earth.
TOOLS	S:ESS4:4:2.1 Demonstrate the use of simple instruments to collect weather data, including thermometers, windsocks, meter sticks, and rain gauges.
LOCAL AND GLOBAL ENVIRONMENTAL ISSUES	S:ESS4:4:3.1 Distinguish between and provide examples of materials that can be recycled/reused and those that cannot. S:ESS4:4:3.2 Provide examples of technology that have changed the environment and explain whether the effect had a positive or negative impact. S:ESS4:4:3.3 Explain how to dispose of waste so that it does not harm the environment.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:ESS4:4:4.1 Identify some jobs/careers that require knowledge and use of Earth science content and/or skills.

Grade 3 ~ Life Science	
Strand/Big Idea: LS1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species). (cont. next page)	
Stem	GLE's (Grade Level Expectations)
CLASSIFICATION	LS1:4:1.1 Recognize and identify the various ways in which living things can be grouped. S:LS1:4:1.2 Sort/classify different living things using similar and different characteristics; and describe why organisms belong to each group or cite evidence about how they are alike or not alike. [LS1(K-4)INQ+POC-1]
LIVING THINGS AND ORGANIZATION	S:LS1:4:2.1 Recognize that living organisms have certain structures and systems that perform specific functions, facilitating survival, growth and reproduction. S:LS1:4.2.2 Identify and describe the function of the plant structures responsible for food production, water transport, support, reproduction, growth and protection. S:LS1:4:2.4 Identify the basic needs of plants and animals in order to stay alive (i.e., water, air, food, space). [LS1(K-4)SAE-2]
REPRODUCTION	S:LS1:4:3.1 Distinguish between plant and animal characteristics that are inherited, such as eye color in humans and the shape of leaves in plants, and those that are affected by their environment, such as grass turning brown due to lack of water. S:LS1:4:3.2 Recognize that living organisms have life cycles, which include birth, growth and development, reproduction, and death; and explain how these life cycles vary for different organisms. S:LS1:4:3.3 Describe the reproductive process of plants, explaining some plants grow from seed, while others grow from the parts of other plants.

Grade 3 ~ Life Science *Continue*	
REPRODUCTION	S:LS1:4-3.4 Predict, sequence, or compare the life stages of organisms (plants and animals): e.g., put images of life stages of an organism in order, predict the next stage in sequence, and compare two organisms. [LS1(K-4)POC–3]
Strand/Big Idea: LS2 – Energy flows and matter recycles through an ecosystem.	
Stem	GLE's (Grade Level Expectations)
ENVIRONMENT	S:LS2:4:1.1 Describe how the nature of an organism's environment, such as the availability of a food source, the quantity and variety of other species present, and the physical characteristics of the environment affect the organism's patterns of behavior. S:LS2:4:1.2 Describe the interaction of living organisms with nonliving things.
RECYCLING OF MATERIALS	S:LS2:4:3.1 Recognize that plants and animals interact with one another in various ways besides providing food, such as seed dispersal or pollination. S:LS2:4:3.2 Describe ways plants and animals depend on each other (e.g., shelter, nesting, food). [LS2(K-4)SAE-6]
Strand/Big Idea: LS3 – Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry).	
Stem	GLE's (Grade Level Expectations)
NATURAL SELECTION	S:LS3:4:3.2 Recognize that for any particular environment, some kinds of animals and plants survive well, some less well, and some cannot survive at all.

Grade 3 ~ Life Science *Continue*	
Strand/Big Idea: LS4 – Humans are similar to other species in many ways, and yet are unique among Earth's life forms.	
Stem	GLE's (Grade Level Expectations)
BEHAVIOR	S:LS4:4:1.1 Recognize that an individual organism's behavior is affected by internal cues, such as hunger and thirst; and describe how an organism uses its senses to understand and respond to these cues. S:LS4:4:1.2 Recognize that an individual organism's behavior is influenced by external cues, such as seasonal change; and describe how an organism might react, such as migrating or hibernating. S:LS4:4:1.3 Recognize behaviors that may be unsafe or unhealthy for themselves and others.
DISEASE	S:LS4:4:2.1 Explain how the amount of rest and the types of food, exercise and recreation humans choose can influence and affect their well-being.
HUMAN IDENTITY	S:LS4:4:3.1 Identify what the physical structures of humans do (e.g., sense organs– eyes, ears, skin, etc.) or compare physical structures of humans to similar structures of animals. [LS4(K-4)FAF-8] S:LS4:4:3.2 Distinguish between characteristics of humans that are inherited from parents (i.e., hair color, height, skin color, eye color) and others that are learned (e.g., riding a bike, singing a song, playing a game, reading). [LS4(K-4)POC-9] S:LS4:4:3.3 Recognize the nutritional value of different foods and distinguish between healthy and unhealthy food choices using data gathered from food labels and dietary guidelines, such as the food pyramid.

Grade 3 ~ Life Science	
Strand/Big Idea: LS5 – The growth of scientific knowledge in Life Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
TOOLS	S:LS5:4:2.2 Identify and describe the purpose of tools used by health care professionals, such as X-rays and stethoscopes.
SOCIAL ISSUES (LOCAL AND GLOBAL) MEDICAL TECHNOLOGY BIOTECHNOLOGY	S:LS5:4:3.1 Recognize that medical technology provides information about a body's condition, such as determining blood pressure, and recognizing the need to repair, replace and support the affected body parts. S:LS5:4:3.2 Recognize that biotechnology refers to the different ways humans modify the living environment to meet their needs, including growing food, genetic engineering and using living organisms such as yeast to prepare foods.
CAREER TECHNICAL EDUCATION	S:LS5:4:4.1 Identify some jobs/careers that require knowledge and use of life science content and/or skills.

Grade 3 ~ Physical Science	
Strand/Big Idea: PS3 – The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
FORCES	S:PS3:4:1.4 Recognize that the Earth's gravitational force pulls any object toward it.

Grade 4~ Earth Space Science	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.	
Stem	GLE's (Grade Level Expectations)
COMPOSITION AND FEATURES	S:ESS1:4:2.1 Describe Earth materials such as gases found in the atmosphere, rocks, soils, and water in its liquid and solid states. S:ESS1:4:2.2 Describe rock as being composed of different combinations of minerals. S:ESS1:4:2.3 Given information about Earth materials, explain how their characteristics lend themselves to specific uses. [ESS1(K-4)FAF-6] S:ESS1:4:2.4 Given certain Earth materials (soils, rocks, or minerals) use physical properties to sort, classify, and/or describe them. [ESS1(K-4)INQ-1]
PROCESSES AND RATES OF CHANGE	S:ESS1:4:5.1 Identify and describe processes that affect the features of the Earth's surface, including weathering, erosion, deposition of sediment. S:ESS1:4:5.2 Explain how wind, water, or ice shape and reshape the Earth's surface. [ESS1(K-**4**)INQ+SAE-**4**]
ROCK CYCLE	S:ESS1:4:6.1 Explain that smaller rocks come from the breaking and weathering of larger rocks and bedrock. S:ESS1:4:6.2 Distinguish between the three categories of rocks (metamorphic, igneous and sedimentary) and describe the processes that create them. S:ESS1:4:6.3 Identify minerals by their physical properties, such as color, texture and cleavage, and describe simple tests used in the identification process. S:ESS1:4:6.4 Use results from an experiment to draw conclusions about how water interacts with earth materials (e.g., percolation, erosion, frost heaves). [ESS1(K-**4**)INQ-**2**]

Grade 4 ~ Life Science	
Strand/Big Idea: LS1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).	
Stem	GLE's (Grade Level Expectations)
CLASSIFICATION	S:LS1:4:1.2 Sort/classify different living things using similar and different characteristics; and describe why organisms belong to each group or cite evidence about how they are alike or not alike. [LS1(K-4)INQ+POC-1]
LIVING THINGS AND ORGANIZATION	S:LS1:4:2.3 Identify and explain how the physical structures of an organism (plants or animals) allow it to survive in its habitat/environment (e.g., roots for water; nose to smell fire). [LS1(K-4)FAF-4] S:LS1:4:2.4 Identify the basic needs of plants and animals in order to stay alive (i.e., water, air, food, space). [LS1(K-4)SAE-2]
Strand/Big Idea: LS2 – Energy flows and matter recycles through an ecosystem. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
FLOW OF ENERGY	S:LS2:4:2.1 Recognize that the transfer of energy through food is necessary for all living organisms and describe the organization of food webs. S:LS2:4:2.2 Recognize that energy is needed for all organisms to stay alive and grow or identify where a plant or animal gets its energy. [LS2(K-4)SAE-5]

Grade 4 ~ Life Science *Continued*	
RECYCLING OF MATERIALS	S:LS2:4:3.2 Describe ways plants and animals depend on each other (e.g., shelter, nesting, food). [LS2(K-4)SAE-6]
Strand/Big Idea: LS3 – Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry).	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:LS3:4:1.1 Provide examples of how environmental changes can cause different effects on different organisms. S:LS3:4:1.2 Provide examples of how an organism's inherited characteristics can adapt and change over time in response to changes in the environment. S:LS3:4:1.3 Using information (data or scenario), explain how changes in the environment can cause organisms to respond (e.g., survive there and reproduce, move away, die). [LS3(K-4)SAE-7]
EVIDENCE OF EVOLUTION	S:LS3:4:2.1 Compare information about fossils to living organisms and other fossils to determine any similarities and differences.
NATURAL SELECTION	S:LS3:4:3.1 Recognize that individuals of the same species differ in their characteristics; and explain that sometimes these differences give individuals an advantage in survival and reproduction.

Grade 4 ~ Life Science	
Strand/Big Idea: LS4 – Humans are similar to other species in many ways, and yet are unique among Earth's life forms.	
Stem	GLE's (Grade Level Expectations)
DISEASE	S:LS4:4:2.1 Explain how the amount of rest and the types of food, exercise and recreation humans choose can influence and affect their well-being. S:LS4:4:2.2 Recognize that vitamins and minerals are needed in small amounts and are essential to maintain proper health. S:LS4:4:2.3 Explain how proper food preparation and appropriate food handling practices can maintain the safety and quality of food.
Strand/Big Idea: LS5 – The growth of scientific knowledge in Life Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:LS5:4:1.1 Recognize that man uses various mechanical devices to record and describe living organisms.
TOOLS	S:LS5:4:2.1 Demonstrate the use of appropriate tools and simple equipment, such as thermometers, magnifiers and microscopes to gather data and extend the senses.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:LS5:4:4.1 Identify some jobs/careers that require knowledge and use of life science content and/or skills.

Grade 4 ~ Physical Science	
Strand/Big Idea: PS1 – All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
COMPOSITION	S:PS1:4:1.1 Explain that materials may be composed of parts that are too small to be seen without magnification. S:PS1:4:1.2 Use measures of weight (data) to demonstrate that the whole equals the sum of its parts. [PS1(K-4)SAE-3]
PROPERTIES	S:PS1:4:2.1 Recognize that substances can be classified by observable properties. S:PS1:4:2.2 Explain that some materials can exist in different states; and describe the distinct physical properties of each state of matter. S:PS1:4:2.3 Explain how some materials, such as water, can change from one state to another by heating or cooling. S:PS1:4:2.4 Make a prediction about what might happen to the state of common materials when heated or cooled; or categorize materials as solid, liquid, or gas. [PS1(K-4)POC-2] S:PS1:4:2.5 Collect and organize data about physical properties in order to classify objects or draw conclusions about objects and their characteristic properties (e.g., temperature, color, size, shape, weight, texture, flexibility). [PS1(K-4)INQ-1]

Grade 4 ~ Physical Science *Continued*	
Strand/Big Idea: PS2 – Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:PS2:4:1.1 Recognize that energy has the ability to create change.
ENERGY	S:PS2:4:3.1 Identify the various forms of energy, such as electrical, light, heat, sound. S:PS2:4:3.2 Recognize that electricity in circuits can produce light, heat, sound, and magnetic effects. S:PS2:4:3.3 Identify and describe the organization of a simple circuit. S:PS2:4:3.4 Differentiate between objects and materials that conduct electricity and those that are insulators of electricity. S:PS2:4:3.6 Given a specific example or illustration (e.g., simple closed circuit, rubbing hands together) predict the observable effects of energy (i.e., the bulb lights, a bell rings, hands warm up). A test item may ask, "What will happen when…?" [PS2(K-4)SAE-4] S:PS2:4:3.7 Use observations of light in relation to other objects/substances to describe the properties of light (i.e., can be reflected, refracted, or absorbed). [PS2(K-4)SAE-5] S:PS2:4:3.8 Experiment, observe, or predict how heat might move from one object to another. [PS2(K-4) INQ+SAE-6]

Grade 4 ~ Physical Science *Continued*	
Strand/Big Idea: PS3 – The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
FORCES	S:PS3:4:1.1 Recognize that magnets attract certain kinds of other materials; and classify objects by those magnets will attract and those they will not. S:PS3:4:1.2 Recognize that magnets attract and repel each other. S:PS3:4:1.3 Explain that electrically charged material pulls on all other materials and can attract or repel other charged materials. S:PS3:4:1.5 Use observations of magnets in relation to other objects to describe the properties of magnetism (i.e., attract or repel certain objects or has no effect). [PS3(K-4)INQ+SAE-8]
MOTION	S:PS3:4:2.1 Use data to predict how a change in force (greater/less) might affect the position, direction of motion, or speed of an object (e.g., ramps and balls). [PS3(K-4)INQ+SAE-7]

Grade 4 ~ Physical Science	
Strand/Big Idea: PS4 – The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:PS4:4:1.1 Understand that materials are used in certain products based on their properties, such as strength and flexibility. S:PS4:4:1.2 Recognize that products are made using a combination of technologies, such as how an escalator uses both a pulley system and an electrical motor.
TOOLS	S:PS4:4:2.1 Demonstrate how to use tools, such as magnifiers, scales, balances, rulers, and thermometers to gather data and extend the senses. S:PS4:4:2.2 Describe how some tools can be used to modify natural materials by processes such as separating, shaping, and joining, to produce new materials.
SOCIAL ISSUES (LOCAL AND GLOBAL) ENERGY, POWER, AND TRANSPORTATION MANUFACTURING	S:PS4:4:3.1 Give examples of transportation systems used in New Hampshire, such as buses, trains, cars, and bicycles; and describe the sources of energy they use. S:PS4:4:3.2 Explain that manufactured products are designed to solve a problem or meet a need. S:PS4:4:3.3 Provide an example to illustrate that manufacturing involves changing natural materials into finished products; and explain that this results in the production of a large number of objects that look almost identical.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:PS4:4:4.1 Identify some jobs/careers that require knowledge and use of physical science content and/or skills.

Grade 5 ~ Earth Space Science	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.	
Stem	GLE's (Grade Level Expectations)
COMPOSITION AND FEATURES	S:ESS1:6:2.1 Differentiate between renewable and non-renewable resources. S:ESS1:6:2.2 Describe and define the different landforms on the Earth's surface, such as coastlines, rivers, mountains, deltas, canyons, etc. S:ESS1:6:2.3 Identify and distinguish between various landforms using a map and/or digital images.
FOSSILS	S:ESS1:6:3.1 Recognize that fossils offer important evidence relating to changes in life forms and environmental conditions over geologic time. S:ESS1:6:3.2 Identify connections between fossil evidence and geological events, such as changes in atmospheric composition, movement of tectonic plates, and asteroid/comet impact; and develop a means of sequencing this evidence.
OBSERVATION OF THE EARTH FROM SPACE	S:ESS1:6:4.1 Recognize that images taken of the Earth from space can show its features and any changes in those features that appear over time.
PROCESSES AND RATES OF CHANGE	S:ESS1:6:5.1 Recognize that things change in steady, repetitive, or irregular ways, or sometimes in more than one way at the same time. S:ESS1:6:5.2 Explain how some changes to the Earth's surface happen abruptly, as a result of landslides, earthquakes and volcanic eruptions; while other changes happen very slowly as a result of weathering, erosions and deposition of sediment caused by waves, wind, water and ice. S:ESS1:6:5.3 Recognize that vibrations in materials set up wavelike disturbances that spread away from the source, as with earthquakes.

Grade 5 ~ Earth Space Science *Continued*	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.	
ROCK CYCLE	S:ESS1:6:6.1 Explain how soil is formed from combinations of weathered rock and decomposed plant and animal remains, and that it contains living organisms. S:ESS1:6:6.2 Identify the components of soil and other factors, such as bacteria, fungi and worms, which influence its texture, fertility, and resistance to erosion. S:ESS1:6.6.3 Describe the properties of soil, such as color, texture, capacity to retain water, and its ability to support plant life.
WATER	S:ESS1:6:7.2 Explain that water quality has a direct effect on Earth's life forms.
Strand/Big Idea: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.	
Stem	GLE's (Grade Level Expectations)
EARTH, SUN, AND MOON	S:ESS2:6:1.1 Recognize and describe how the regular and predictable motions of the Earth and Moon explain certain Earth phenomena, such as day and night, the seasons, the year, shadows and the tides. S:ESS2:6:1.2 Recognize that of all the known planets, Earth appears to be somewhat unique; and describe the conditions that exist on Earth that allow it to support life.
ENERGY	S:ESS2:6:2.1 Recognize how the tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns.
VIEW FROM EARTH	S:ESS2:6:4.1 Explain the historical perspective of planetary exploration and man's achievements in space, beginning with Russia's Sputnik mission in 1957. S:ESS2:6:4.2 Describe man's perception of the constellations throughout history; and explain how he has used them to his advantage, including navigational purposes and to explain historical events.

Grade 5 ~ Earth Space Science	
Strand/Big Idea: ESS4 –The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:ESS4:6:1.1 Understand that technology is used to design tools that improve our ability to measure and observe the world.
LOCAL AND GLOBAL ENVIRONMENTAL ISSUES	S:ESS4:6:3.1 Provide examples of products that man has developed which allow humans to do things that they could not do otherwise; and identify the natural materials used to produce these products. S:ESS4:6:3.2 Identify the most appropriate materials for a given design task with requirements for specific properties, such as weight, strength, hardness, and flexibility. S:ESS4:6:3.3 Provide examples of how to reduce waste through conservation, recycling, and reuse.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:ESS4:6:4.1 Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of Earth science.

Grade 5 ~ Life Science	
Strand/Big Idea: LS1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).	
Stem	GLE's (Grade Level Expectations)
CLASSIFICATION	S:LS1:6:1.1 Identify ways in which living things can be grouped and organized, such as taxonomic groups of plants, animals and fungi. S:LS1:6:1.2 Categorize organisms into kingdoms that are currently recognized, according to shared characteristics.
LIVING THINGS AND ORGANIZATION	S:LS1:6:2.1 Recognize that all living things are composed of cells, and explain that while many organisms are single celled, such as yeast, others, including humans, are multicellular. S:LS1:6:2.2 Explain that the way in which cells function is similar in all organisms. S:LS1:6:2.3 Recognize that cells use energy obtain from food, to conduct the functions necessary to sustain life, such as cell growth. S:LS1:6:2.4 Recognize and describe the hierarchical organization of living systems, including cells, tissues, organs, organ systems, whole organisms, and ecosystems. S:LS1:6:2.5 Explain that multicellular organisms have specialized cells, tissues, organs and organ systems that perform certain necessary functions, including digestion, respiration, reproduction, circulation, excretion, movement, control and coordination and protection from disease. S:LS1:6:2.6 Recognize that the human cells found in tissues and organs are similar to those of other animals, but somewhat different from cells found in plants.
REPRODUCTION	S:LS1:6:3.1 Explain that cells repeatedly divide to make more cells for growth and repair. S:LS1:6:3.2 Explain that the same genetic information is copied in each cell of a new organism. S:LS1:6:3.3 Explain that all living things reproduce in order to continue their species.

Grade 5 ~ Life Science *Continued*	
Strand/Big Idea: LS2 – Energy flows and matter recycles through an ecosystem.	
Stem	GLE's (Grade Level Expectations)
ENVIRONMENT	S:LS2:6:1.1 Identify and describe the factors that influence the number and kinds of organisms an ecosystem can support, including the resources that are available, the differences in temperature, the composition of the soil, any disease, the threat of predators, and competition from other organisms. S:LS2:6:1.2 Explain that most microorganisms do not cause disease and that many are beneficial to the environment.
FLOW OF ENERGY	S:LS2:6:2.1 Describe how energy is transferred in an ecosystem through food webs; and explain the roles and relationships between producers, consumers and decomposers. S:LS2:6:2.2 Recognize that one of the most general distinctions among organisms is between plants, which use sunlight to make their own food, and animals, which consume energy-rich foods. S:LS2:6:2.3 Describe the process of photosynthesis and explain that plants can use the food they make immediately or store it for later use. S:LS2:6:2.4 Recognize that energy, in the form of heat, is usually a byproduct when one form of energy is converted to another, such as when living organisms transform stored energy to motion.
RECYCLING OF MATERIALS	S:LS2:6:3.1 Define a population as all individuals of a species that exist together at a given place and time; and explain that all populations living together in a community, along with the physical factors with which they interact, compose an ecosystem. S:LS2:6:3.2 Using food webs, identify and describe the ways in which organisms interact and depend on one another in an ecosystem. S:LS2:6:3.3 Explain how insects and various other organisms depend on dead plant and animal matter for food; and describe how this process contributes to the system.

Grade 5 ~ Life Science *Continued*	
Strand/Big Idea: LS3 – Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry).	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:LS3:6:1.1 Provide examples of how all organisms, including humans, impact their environment; and explain how some changes can be detrimental to other organisms. S:LS3:6:1.2 Explain how changes in environmental conditions can affect the survival of individual organisms and the entire species.
EVIDENCE OF EVOLUTION	S:LS3:6:2.1 Describe the fundamental concepts related to biological evolution, such as biological adaptations and the diversity of species.
NATURAL SELECTION	S:LS3:6:3.1 Recognize that there are genetic variations among individuals in groups of organisms and provide examples of how these variations affect the survival of an organism. S:LS3:6:3.2 Recognize that only organisms that are able to reproduce can pass on their genetic information to the next generation.
Strand/Big Idea: LS4 – Humans are similar to other species in many ways, and yet are unique among Earth's life forms. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
BEHAVIOR	S:LS4:6:1.1 Recognize that learning requires more than just storage and retrieval of information and that prior knowledge needs to be tapped in order to make sense out of new experiences or information. S:LS4:6:1.2 Explain that people can learn about others from direct experience, from the media, and from listening to others talk about their life and work. S:LS4:6:1.3 Provide examples of how humans make judgments about new situations based on memories of past experiences.

Grade 5 ~ Life Science *Continued*	
DISEASE	S:LS4:6:2.1 Explain that the human body has ways to defend itself against disease-causing organisms and describe how defenders, including tears, saliva, the skin, some blood cells and stomach secretions support the defense process. S:LS4:6:2.2 Recognize that there are some diseases that human beings can only get once; and explain how many diseases can be prevented by vaccination. S:LS4:6:2.3 Explain how vaccines induce the body to build immunity to a disease without actually causing the disease itself. S:LS4:6:2.4 Recognize a healthy body cannot fight all germs that invade it; and explain how some germs interfere with the body's defenses.
SOCIAL ISSUES (LOCAL AND GLOBAL) MEDICAL TECHNOLOGY BIOTECHNOLOGY	S:LS5:6:3.3 Recognize that the quality of personal health can be influenced by society and technology.
HUMAN IDENTITY	S:LS4:6:3.1 Recognize that the length and quality of human life are influenced by many factors, including sanitation, diet, medical care, gender, genes, environmental conditions, and personal health behaviors.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:LS5:6:4.1 Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of life science.
Strand/Big Idea: LS5 – The growth of scientific knowledge in Life Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:LS5:6:1.1 Recognize that an agricultural system is designed to maximize the use of all the elements in the system, including using plants for food, oxygen, for the filtration of air and water, and for making compost.

Grade 5 ~ Life Science	
TOOLS	S:LS5:6:2.1 Demonstrate the appropriate use of tools, such as thermometers, probes, microscopes and computers to gather, analyze and interpret data in the life sciences.
SOCIAL ISSUES (LOCAL AND GLOBAL) MEDICAL TECHNOLOGY BIOTECHNOLOGY	S:LS5:6:3.1 Provide examples of early health care technology that helped to extend the life expectancy of humans, such as the discovery of penicillin and sterilization of surgical instruments. S:LS5:6:3.2 Differentiate between vaccines, which help prevent diseases from developing and spreading, and medicines, which relieve symptoms or cure diseases. S:LS5:6:3.4 Identify and describe some of the processes and systems used to grow food in New Hampshire, including irrigation, pest control and harvesting.

Grade 6 ~ Earth Space Science	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.	
Stem	GLE's (Grade Level Expectations)
ATMOSPHERE, CLIMATE, AND WEATHER	S:ESS1:6:1.1 Describe and make predictions about local and regional weather conditions using observation and data collection methods. S:ESS1:6:1.2 Identify weather patterns by tracking weather related events, such as hurricanes. S:ESS1:6:1.3 Explain the composition and structure of the Earth's atmosphere. S:ESS1:6:1.4 Describe weather in terms of temperature, wind speed and direction, precipitation, and cloud cover. S:ESS1:6:1.5 Describe how clouds affect weather and climate, including precipitation, reflecting light from the sun, and retaining heat energy emitted from the Earth's surface.
OBSERVATION OF THE EARTH FROM SPACE	S:ESS1:6:4.2 Explain that satellites can be used to view and track storms and Earth events, such as hurricanes and wild fires.
WATER	S:ESS1:6:7.1 Explain the properties that make water an essential component of the Earth's system, including solvency and its ability to maintain a liquid state at most temperatures.
Strand/Big Idea: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.	
Stem	GLE's (Grade Level Expectations)
ENERGY	S:ESS2:6:2.1 Recognize how the tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns. S:ESS2:6:2.2 Identify and describe seasonal, daylight and weather patterns as they relate to energy.

Grade 6 ~ Earth Space Science	
Strand/Big Idea: ESS4 –The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
TOOLS	S:ESS4:6:2.1 Recognize that satellites and Doppler radar can be used to observe or predict the weather. S:ESS4:6:2.2 Employ knowledge of basic weather symbols to read and interpret weather and topographic maps. S:ESS4:6:2.3 Read and interpret data from barometers, sling psychrometers and anemometers.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:ESS4:6:4.1 Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of Earth science.

Grade 6 ~ Physical Science	
Strand/Big Idea: PS1 – All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
COMPOSITION	S:PS1:6:1.1 Recognize that all matter is composed of minute particles called atoms; and explain that all substances are composed of atoms, each arranged into different groupings. S:PS1:6:1.2 Identify elements as substances that contain only one kind of atom; and explain that elements do not break down by normal laboratory reactions, such as heating, exposure to electric current, and reaction to acid. S:PS1:6:1.3 Recognize that over one hundred elements exist, and identify the periodic table as a tool for organizing the information about them.
PROPERTIES	S:PS1:6:2.1 Identify elements according to their common properties, such as highly reactive metals, less reactive metals, highly reactive non-metals and almost non-reactive gases. S:PS1:6:2.2 Identify substances by their physical and chemical properties, such as magnetism, conductivity, density, solubility, boiling and melting points. S:PS1:6:2.3 Differentiate between weight and mass. S:PS1:6:2.4 Identify energy as a property of many substances.
Strand/Big Idea: PS2 – Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:PS2:6:1.1 Differentiate between a physical change, such as melting, and a chemical change, such as rusting.
CONSERVATION	S:PS2:6:2.1 Describe how mass remains constant in a closed system and provide examples relating to both physical and chemical change.

Grade 6 ~ Physical Science *Continued*	
ENERGY	S:PS2:6:3.1 Explain that the pitch of a sound is dependent on the frequency of the vibration producing it. S:PS2:6:3.2 Explain that sound vibrations move at different speeds, have different wavelengths; and establish wave-like disturbances that emanate from the source. S:PS2:6:3.3 Recognize that energy, in the form of heat, is usually a by-product when one form of energy is changed to another, such as when machines convert stored energy to motion. S:PS2:6:3.4 Explain that heat energy moves from warmer materials or regions to cooler ones through conduction, convection, and radiation. S:PS2:6:3.5 Explain how electrical circuits can be used to transfer energy in order to produce heat, light, sound, and chemical changes.
Strand/Big Idea: PS3 – The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
FORCES	S:PS3:6:1.1 Recognize that just as electric currents can produce magnetic forces, magnets can cause electric currents. S:PS3:6:1.2 Explain that when a force is applied to an object, it reacts in one of three ways: the object either speeds up, slows down, or goes in a different direction. S:PS3:6:1.3 Describe the relationship between the strength of a force on an object and the resulting effect, such as the greater the force, the greater the change in motion.
MOTION	S:PS3:6:2.1 Explain the how balanced and unbalanced forces are related to an object's motion. S:PS3:6:2.2 Explain that an object's motion can be tracked and measured over time and that the data can be used to describe its position.

Grade 6 ~ Physical Science	
Strand/Big Idea: PS4 – The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:PS4:6:1.1 Understand that scientific principles are used in the design of technology.
TOOLS	S:PS4:6:2.1 Recognize that manufacturing processes use a variety of tools and machines to separate, form, combine and condition natural and synthetic materials.
SOCIAL ISSUES (LOCAL AND GLOBAL) ENERGY, POWER, AND TRANSPORTATION MANUFACTURING	S:PS4:6:3.1 Explain how a battery changes chemical energy into electrical energy. S:PS4:6:3.2 Demonstrate how to produce a magnetic force with an electric current, such as an electromagnet, and how to produce an electric current with a magnet, such as a generator. S:PS4:6:3.3 Provide an example to show that manufacturing processes involve changing natural materials into finished products through a series of processes that involve physical and/or chemical changes.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:PS4:6:4.1 Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of physical science.

Grade 7 ~ Life Science	
Strand/Big Idea: LS1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species). (cont. next page)	
Stem	GLE's (Grade Level Expectations)
CLASSIFICATION	S:LS1:8:1.1 Recognize that similarities among organisms are found in anatomical features and patterns of development; and explain how these can be used to infer the degree of relatedness among organisms. S:LS1:8:1.2 Describe or compare how different organisms have mechanisms that work in a coordinated way to obtain energy, grow, move, respond, provide defense, enable reproduction, or maintain internal balance (e.g., cells, tissues, organs and systems). [LS1(5-**8**)SAE+FAF-**2]**
LIVING THINGS AND ORGANIZATION	S:LS1:8:2.1 Identify the functions of the human body's systems, including digestion, respiration, reproduction, circulation, excretion, movement, control and coordination and protection from disease; and describe how they interact with one another. S:LS1:8:2.2 Define a population and describe the factors that can affect it. S:LS1:8:2.3 Explain why it is beneficial for an organism to be able to regulate its internal environment while living in a constantly changing external environment. S:LS1:8:2.4 Explain relationships between or among the structure and function of the cells, tissues, organs, and organ systems in an organism. [LS1(5-8)FAF-4] S:LS1:8:2.5 Using data and observations about the biodiversity of an ecosystem, make predictions or draw conclusions about how the diversity contributes to the stability of the ecosystem. [LS1(5-**8**)INQ+SAE-**1**]

Grade 7 ~ Life Science *Continued*	
REPRODUCTION	S:LS1:8:3.1 Differentiate between asexual and sexual reproduction, and explain that in some kinds of organisms, all the genes come from one parent, while in organisms requiring two sexes to reproduce, typically half the genes come from each parent. S:LS1:8:3.2 Explain that a species of sexually reproducing organisms is comprised of all the organisms that can mate to produce fertile offspring. S:LS1:8:3.3 Explain that in sexual reproduction, a single specialized cell from a female merges with a specialized cell from a male in a process called fertilization. S:LS1:8:3.4 Explain that the fertilized egg cell, carrying genetic information from each parent, multiplies to form the complete organism. S:LS1:8:3.5 Explain how the basic tissues of an embryo form. S:LS1:8:3.6 Compare and contrast sexual reproduction with asexual reproduction. [LS1(5-8)POC-3] S:LS1:8:3.7 Using data provided, select evidence that supports the concept that genetic information is passed on from both parents to offspring. [LS4(5-**8**)INQ+POC-**11**]
Strand/Big Idea: LS2 – Energy flows and matter recycles through an ecosystem. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
ENVIRONMENT	S:LS2:8:1.1 Explain how changes in environmental conditions can affect the survival of individual organisms and an entire species. S:LS2:8:1.2 Explain that in all environments, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter, and that in any particular environment the growth and survival of organisms depend on the physical conditions. S:LS2:8:1.3 Using data and observations, predict outcomes when abiotic/biotic factors are changed in an ecosystem. [LS2(5-8)INQ+SAE-5]

Grade 7 ~ Life Science *Continued*	
FLOW OF ENERGY	S:LS2:8:2.1 Explain how food provides energy and materials for growth and repair of body parts. S:LS2:8:2.2 Given a scenario, trace the flow of energy through an ecosystem, beginning with the sun, through organisms in the food web, and into the environment (includes photosynthesis and respiration). [LS2(5-8)SAE-6]
RECYCLING OF MATERIALS	S:LS2:8:3.1 Identify autotrophs as producers who may use photosynthesis, and describe this as the basis of the food web. S:LS2:8:3.2 Explain the process of respiration and differentiate between it and photosynthesis. S:LS2:8:3.3 Know that all organisms, including humans, are part of, and depend on, two main interconnected global food webs: one which includes microscopic ocean plants, and the other which includes land plants. S:LS2:8:3.4 Describe how matter is recycled within ecosystems and explain that the total amount of matter remains the same, though its form and location change. S:LS2:8:3.5 Identify carbon, hydrogen, oxygen, nitrogen and phosphorus as common elements of living matter. S:LS2:8:3.6 Given an ecosystem, trace how matter cycles among and between organisms and the physical environment (includes water, oxygen, food web, decomposition and recycling, but not carbon cycle nor nitrogen cycle). [LS2(5-8)SAE-7]
Strand/Big Idea: LS3 – Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry). (cont. next page)	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:LS3:8:1.1 Describe the type of impact certain environmental changes, including deforestation, invasive species, increased erosion, and pollution containing toxic substances, could have on local environments.

Grade 7 ~ Life Science *Continued*	
EVIDENCE OF EVOLUTION	S:LS3:8:2.1 Describe how the fossil record provides geologic evidence verifying the existence of now extinct life forms, and explains how this evidence provides documented proof of their appearance, diversification and extinction. S:LS3:8:2.2 Explain the concept of extinction and describes its importance in biological evolution. S:LS3:8:2.3 Use a model, classification system, or dichotomous key to illustrate, compare, or interpret possible relationships among groups of organisms (e.g., internal and external structures, anatomical features). [LS3(5-8)MAS+FAF-8]
NATURAL SELECTION	S:LS3:8:3.1 Recognize that hereditary information is contained in genes, which are located in the chromosomes of each cell; and explain that inherited traits can be determined by either one or many genes, and that a single gene can influence more than one trait, such as eye and hair color. S:LS3:8:3.2 Recognize that in any given environment the growth and survival of organisms depend on the physical conditions that exist; and explain that in all environments, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter. S:LS3:8:3.3 Explain how individual organisms with certain traits are more likely than others to survive and have offspring. S:LS3:8:3.4 Recognize that humans are able to control some characteristics of plants and animals through selective breeding; and explain how this results in small differences between the parents and offspring, which can accumulate in successive generations so that decedents are very different from their ancestors. S:LS3:8:3.5 Cite examples supporting the concept that certain traits of organisms may provide a survival advantage in a specific environment and therefore, an increased likelihood to produce offspring. [LS3(5-8)POC-9]

Grade 7 ~ Life Science *Continued*

Strand/Big Idea: LS4 – Humans are similar to other species in many ways, and yet are unique among Earth's life forms. (cont. next page)

Stem	GLE's (Grade Level Expectations)
BEHAVIOR	S:LS4:8:1.1 Recognize that unlike human beings, behavior in insects and many other species is determined almost entirely by biological inheritance. S:LS4:8:1.2 Explain that organism's behavioral response is a reaction to internal or and environmental stimuli, and that these responses may be determined by heredity or from past experience. S:LS4:8:1.3 Explain how all behavior is affected by both inheritance and experience.
DISEASE	S:LS4:8:2.1 Recognize that disease in organisms can be caused by intrinsic failures of the system or infection from other organisms. S:LS4:8:2.2 Describe how viruses, bacteria, fungi, and parasites may affect the human body and provide examples of how they can interfere with normal body function. S:LS4:8:2.3 Describe the function of white blood cells and explain how they support the body's defense system. S:LS4:8:2.4 Use data and observations to support the concept that environmental or biological factors affect human body systems (biotic and abiotic). [LS4(5-8)INQ-10]

Grade 7 ~ Life Science *Continued*	
HUMAN IDENTITY	S:LS4:8:3.1 Compare patterns of human development with those of other vertebrates. S:LS4:8:3.2 Recognize that an organism can be described in terms of a combination of traits; and differentiate between inherited traits and those that result from interactions with the environment. S:LS4:8:3.3 Describe the major changes that occur over time in human development from single cell through embryonic development to new born (i.e., group of cells during the first trimester, organs form during the second, organs mature during the third). [LS4(5-8)POC-12] S:LS4:8:3.4 Using data provided, select evidence that supports the concept that genetic information is passed on from both parents to offspring. [LS4(5-8)INQ+POC-11]
Strand/Big Idea: LS5 – The growth of scientific knowledge in Life Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:LS5:8:1.1 Explain how technology has influenced the course of history, and provide examples such as those that relate to agriculture, sanitation and medicine. S:LS5:8:1.2 Provide examples of ways technology is used to protect the environment, such as using bacteria to clean water.
TOOLS	S:LS5:8:2.1 Recognize and provide examples of how technology has enhanced the study of life sciences, as in the development of advanced diagnosing equipment improving medicine.

Grade 7 ~ Life Science	
SOCIAL ISSUES (LOCAL AND GLOBAL) MEDICAL TECHNOLOGY BIOTECHNOLOGY	S:LS5:8:3.1 Explain the necessity of and purpose for the proper disposal of medical products. S:LS5:8:3.2 Give examples of how increased understanding of biology has led to improvements in biotechnology, such as scientific methods for increasing the yield or the pest-resistance of important food crops. S:LS5:8:3.3 Describes ways biotechnology helps humans, including improved health and medicine.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:LS5:8:4.1 Understand that some scientific jobs/careers involve the application of life science content knowledge and experience in specific ways that meet the goals of the job.

Grade 8 ~ Earth Space Science	
Strand/Big Idea: ESS1 – The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
ATMOSPHERE, CLIMATE, AND WEATHER	S:ESS1:8:1.1 Identify and describe the processes of the water cycle and explain their effects on climatic patterns. S:ESS1:8:1.2 Identify and describe the impact certain factors have on the Earth's climate, including changes in the oceans' temperature, changes in the composition of the atmosphere, and geological shifts due to events such as volcanic eruptions and glacial movements.
COMPOSITION AND FEATURES	S:ESS1:8:2.1 Describe the layers of the Earth, including the core, mantle, lithosphere, hydrosphere, and atmosphere. S:ESS1:8:2.2 Use geological evidence provided to support the idea that Earth's crust/lithosphere is composed of plates that move. [ESS1(5-8)INQ+POC-1]
FOSSILS	S:ESS1:8:3.1 Explain how fossils found in sedimentary rock can be used to support the theories of Earth's evolution over geologic time; and describe how the folding, breaking, and uplifting of the layers affects the evidence.
OBSERVATION OF THE EARTH FROM SPACE	S:ESS1:8:4.1 Describe how catastrophic changes that have taken place on the Earth's surface can be revealed by satellite images.
PROCESSES AND RATES OF CHANGE	S:ESS1:8:5.1 Explain that the Earth's crust is divided into plates which move at extremely slow rates in response to movements in the mantle. S:ESS1:8:5.2 Explain how Earth events, abruptly and over time, can bring about changes on Earth's surface (e.g., landforms, ocean floor, rock features, climate). [ESS1(5-8)POC-3] S:ESS1:8:5.3 Explain the role of differential heating or convection in ocean currents, winds, weather and weather patterns, atmosphere, or climate. [ESS1(5-8)SAE+POC-4]

Grade 8 ~ Earth Space Science *Continued*	
ROCK CYCLE	S:ESS1:8:6.1 Describe the processes of the rock cycle. S:ESS1:8:6.2 Explain that sedimentary, igneous, and metamorphic rocks contain evidence of the minerals, temperatures, and forces that created them. S:ESS1:8:6.3 Explain how sediments of sand and smaller particles, which may contain the remains of organisms, are gradually buried and cemented together by dissolved minerals to form solid rock. S:ESS1:8:6.4 Using data about a rock's physical characteristics, make and support an inference about the rock's history and connection to the rock cycle. [ESS1(5-8)SAE+POC-5]
WATER	S:ESS1:8:7.1 Describe how water flows into and through a watershed, falling on the land, collecting in rivers and lakes, soil, and porous layers of rock, until much of it flows back into the ocean. S:ESS1:8:7.2 Identify the physical and chemical properties that make water an essential component of the Earth's system. S:ESS1:8:7.3 Explain the processes that cause cycling of water into and out of the atmosphere and their connections to our planet's weather patterns. [ESS1(5-8)SAE-2]

Grade 8 ~ Earth Space Science *Continued*

Strand/Big Idea: ESS2– The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships. (cont. next page)

Stem	GLE's (Grade Level Expectations)
EARTH, SUN, AND MOON	S:ESS2:8:1.1 Identify the characteristics of the Sun and its position in the universe. S:ESS2:8:1.2 Recognize and describe how the regular and predictable motions of the Earth and Moon account for phenomena, such as the phases of the Moon and eclipses. S:ESS2:8:1.3 Recognize the relationships between the tides and the phases of the moon; and use tide charts and NOAA information to describe them. S:ESS2:8:1.4 Explain the temporal or positional relationships between or among the Earth, Sun and Moon (e.g., night/day, seasons, year, tide). [ESS2(5-8)SAE+POC-8]
ENERGY	S:ESS2:8:2.1 Describe the Sun as the principle energy source for phenomena on the Earth's surface.
SOLAR SYSTEM	S:ESS2:8:3.1 Identify the characteristics and movement patterns of the planets in our Solar System and differentiate between them. S:ESS2:8:3.2 Explain the effects of gravitational force on the planets and their moons. S:ESS2:8:3.3 Explain why Earth and our Solar System appear to be somewhat unique, while acknowledging recent evidence that suggests similar systems exist in the universe. S:ESS2:8:3.4 Compare and contrast planets based on data provided about size, composition, location, orbital movement, atmosphere, or surface features (includes moons). [ESS2(5-8)MAS-6] S:ESS2:8:3.5 Explain how gravitational force affects objects in the Solar System (e.g., moons, tides, orbits, satellites). [ESS2(5-8)SAE+POC-8]
VIEW FROM EARTH	S:ESS2:8:4.1 Explain how technological advances have allowed scientists to re-evaluate or extend existing ideas about the Solar System. [ESS2(5-8)NOS-7]

Grade 8 ~ Earth Space Science *Continued*	
CAREER TECHNICAL EDUCATION CONNECTIONS	S:ESS4:8:4.1 Understand that some scientific jobs/careers involve the application of Earth Space science content knowledge and experience in specific ways that meet the goals of the job.
Strand/Big Idea: ESS3 – The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.	
Stem	GLE's (Grade Level Expectations)
SIZE AND SCALE	S:ESS3:8:1.1 Define an astronomical unit as the distance from the Earth to the Sun. S:ESS3:8:1.2 Explain that special units of measure, such as light years and astronomical units, are used to calculate distances in space.
STARS AND GALAXIES	S:ESS3:8:2.1 Describe objects such as asteroids, comets and meteors in terms of their characteristics and movement patterns.
UNIVERSE	S:ESS3:8:3.1 Describe the universe as being comprised of billions of galaxies, each containing many billions of stars; and explain that there are vast distances separating these galaxies and stars from one another and from the Earth.

Grade 8 ~ Earth Space Science	
Strand/Big Idea: ESS4 –The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:ESS4:8:1.1 Describe ways in which technology has increased our understanding of the world in which we live. S:ESS4:8:1.2 Recognize the importance of technology as it relates to science, for purposes such as: access to space and other remote locations, sample collection and treatment, measurement, data collection, and storage, computation, and communication of information.
TOOLS	S:ESS4:8:2.1 Calculate temperature in degrees Celsius. S:ESS4:8:2.2 Perform calculations using metric measurements. S:ESS4:8:2.3 Describe how man uses land-based light telescopes, radio telescopes, satellites, manned exploration, probes and robots to collect data.
LOCAL AND GLOBAL ENVIRONMENTAL ISSUES	S:ESS4:8:3.1 Provide examples of how creative thinking and economic need has shaped the way people use natural materials, such as the use of metal ores, petroleum, and fresh water. S:ESS4:8:3.2 Explain how to test natural materials to measure and compare their properties. S:ESS4:8:3.3 Explain how technologies can reduce the environmental impact of natural disasters. S:ESS4:8:3.4 Identify the potential impact of converting forested land to uses such as farms, homes, factories, or tourist attractions.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:ESS4:8:4.1 Understand that some scientific jobs/careers involve the application of Earth Space science content knowledge and experience in specific ways that meet the goals of the job.

Grade 8 ~ Physical Science	
Strand/Big Idea: PS1 – All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
COMPOSITION	S:PS1:8:1.1 Explain that atoms often combine to form a molecule or formula unit (crystal). S:PS1:8:1.2 Recognize that elements can combine in a variety of ways to form compounds. S:PS1:8:1.3 Differentiate between an atom and an molecule. S:PS1:8:1.4 Differentiate between a mixture and a pure substance. S:PS1:8:1.5 Identify methods used to separate mixtures, such as boiling, filtering, chromatography and screening. S:PS1:8:1.7 Given graphic or written information, classify matter as atom/molecule or element/compound (not the structure of an atom). [PS1(5-8)MAS-5]
PROPERTIES	S:PS1:8:2.1 Differentiate between volume and mass and define density. S:PS1:8:2.2 Explain how different substances of equal volume usually have different weights. S:PS1:8:2.3 Identify a molecule as the smallest part of a substance that retains its properties. S:PS1:8:2.4 Investigate the relationships among mass, volume and density. [PS1(5-8)INQ-1] S:PS1:8:2.5 Given data about characteristic properties of matter (e.g., melting and boiling points, density, solubility), identify, compare, or classify different substances. [PS1(5-8)INQ+POC-2] S:PS1:8:2.6 Represent or explain the relationship between or among energy, molecular motion, temperature, and states of matter. [PS1(5-8)SAE+MAS-4]

Grade 8 ~ Physical Science *Continued*	
Strand/Big Idea: PS2 – Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
CHANGE	S:PS2:8:1.1 Explain how substances react chemically with other substances to form new substances, known as compounds, and that in such recombinations, the properties of the new substances may be very different from those of the old. S:PS2:8:1.2 Identify factors that affect reaction rates, such as temperature, concentration and surface area; and explain that dissolving substances in liquids often accelerates reaction rates. S:PS2:8:1.3 Explain that oxidation involves combining oxygen with another substance, as in burning or rusting. S:PS2:8:1.4 Explain that states of matter depend on the arrangement of the molecules and their motion. S:PS2:8:1.5 Given a real-world example, show that within a system, energy transforms from one form to another (i.e., chemical, heat, electrical, gravitational, light, sound, mechanical). [PS2(5-8)SAE+POC-6]
CONSERVATION	S:PS2:8:2.1 Explain the law of conservation of energy. S:PS2:8:2.2 Collect data or use data provided to infer or predict that the total amount of mass in a closed system stays the same, regardless of how substances interact (conservation of matter). [PS1(5-8)INQ+SAE-3]

Grade 8 ~ Physical Science *Continued*	
ENERGY	S:PS2:8:3.1 Differentiate between kinetic energy, which is the energy of motion and potential energy, which depends on relative position. S:PS2:8:3.2 Recognize the Sun is a major energy source for the Earth, and describes how it affects the planet's surface. S:PS2:8:3.3 Describe ways light can interact with matter, such as transmission (which includes refraction), absorption, and scattering (which includes reflection). S:PS2:8:3.4 Explain that the human eye can only detect wavelengths of electromagnetic radiation within a narrow range; and explain that the differences of wavelength within that range of visible light are perceived as differences in color. S:PS2:8:3.5 Recognize that most chemical and nuclear reactions involve a transfer of energy. S:PS2:8:3.6 Use data to draw conclusions about how heat can be transferred (convection, conduction, radiation). [PS2(5-8)INQ+SAE+POC-7]
Strand/Big Idea: PS3 – The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
FORCES	S:PS3:8:1.1 Explain that the force of gravity gets stronger the closer one gets to an object and decreases the further away one gets from it. S:PS3:8:1.2 Recognize the general concepts related to gravitational force. S:PS3:8:1.3 Use data to determine or predict the overall (net) effect of multiple forces (e.g., friction, gravitational, magnetic) on the position, speed, and direction of motion of objects. [PS3(5-8)INQ+POC-8]
MOTION	S:PS3:8:2.1 Explain that an object in motion that is unaffected by a force will continue to move at a constant speed and in a straight line. S:PS3:8:2.2 Explain how the motion of an object can be described by its position, direction of motion, and speed; and illustrate how that motion can be measured and represented graphically.

Grade 8 ~ Physical Science	
Strand/Big Idea: PS4 – The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY	S:PS4:8:1.1 Understand that design features, such as size shape, weight, and function, must be considered when designing new technology.
TOOLS	S:PS4:8:2.1 Demonstrate appropriate use of tools, such as rulers, calculators, balances, and graduated cylinders to measure and calculate volume and mass.
SOCIAL ISSUES (LOCAL AND GLOBAL) ENERGY, POWER, AND TRANSPORTATION MANUFACTURING	S:PS4:8:3.1 Explain how humans use natural resources, such as flowing water and burning of coal, oil, or natural gas to generate electrical energy in power plants. S:PS4:8:3.2 Describe how natural resources, such as coal, oil and natural gas are tapped for use in power plants, and how alternative sources, such as solar, wind, water, nuclear are tapped for power; and compare the advantages and disadvantages of each source. S:PS4:8:3.3 Differentiate between durable goods, which are designed to operate for a long period of time, and non-durable goods, which are only intended to operate for a short period of time.
CAREER TECHNICAL EDUCATION CONNECTIONS	S:PS4:8:4.1 Understand that some scientific jobs/careers involve the application of physical science content knowledge and experience in specific ways that meet the goals of the job.

ADVANCED PLACEMENT SCIENCE COURSES

www.collegeboard.org/ap

Introduction

The Advanced Placement Program consists of 33 college-level courses and exams in 19 disciplines designed for highly motivated students in secondary schools. Its exceptional reputation is made possible by the close cooperation of secondary schools, colleges, and the College Board. More than 2,900 universities and colleges worldwide grant credit, advanced placement, or both to students who have performed satisfactorily on the exams, and approximately 1,400 institutions grant sophomore standing to students who have demonstrated their competence in three or more of these exams. Each course is developed by a committee made up of college faculty and AP teachers. Members of these Development Committees are appointed by the College Board and serve for overlapping terms of up to four years.

For information on Advanced Placement courses offered at Goffstown High School, please contact the Guidance Department and/or the Curriculum Coordinator. Currently, Goffstown High School offers Advanced Placement Chemistry, Advanced Placement Biology and Advanced Placement Physics.

PROJECT RUNNING START

The New Hampshire Running Start Program is a special higher education initiative for high school students to enroll in college courses offered by the New Hampshire Community College System. College courses are offered during the day at Goffstown High School at a significant reduction in tuition. Successful students earn dual credit, meeting high school and college requirements at the same time. A fee of $100 is paid to NHCC for each course.

For information on Project Running Start, offered at Goffstown High School, please contact the Guidance Department and/or the Curriculum Coordinator. Currently, Goffstown High School offers Project Running Start: Human Anatomy and Physiology.

Astronomy	
Standard: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships: Students will demonstrate understanding of how the Earth's motion through space accounts for Earthly cycles and other phenomena.	
Stem	GLE's (Grade Level Expectations)
Earth, Sun, And Moon	Explain how the Earth, Moon and Sun were formed. Explain how the rotation of the Earth on its axis and the revolution about the sun account for the day and the year. Describe how the angle of tilt of the Earth's axis to the ecliptic determines the seasons. Recognize the significance of equinoxes and solstices and to also describe the sun's path on these days. Explain how the elevation of the sun above the horizon and the length of day are a function of the season. Explain how the Moon's motion about the Earth accounts for the length of the lunar month and the lunar phases. Describe how solar and lunar eclipses occur.
Standard: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.	
Stem	GLE's (Grade Level Expectations)
Energy	Identify the Earth's major external source of energy as solar energy. Explain how the inclination of incoming solar radiation can impact the amount of energy Earth receives on any given surface area. Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading).

Astronomy *Continued*	
Standard: ESS2 – The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships: Students will demonstrate knowledge of the solar system and its bodies.	
Stem	GLE's (Grade Level Expectations)
Solar System	Explain how gravitational force influenced the formations of the planets and their moons; and describe how these objects move in patterns under its continued influence. Explain how the Solar System formed from a giant cloud of gas and debris about 5 billion years ago. Describe the Solar Nebula hypothesis and explain why this theory is consistent with the observed features of our solar system, such as planetary differentiation and planetary motions in the ecliptic plane. Compare and contrast solar system bodies such as comets, asteroids, planets and moons. Classify planets into terrestrial and gaseous planets and describe any special geological and atmospheric characteristics of the nine planets and their moons. Appreciate how special Earth is in comparison to our planetary neighbors in terms of resources, temperatures, atmospheric composition, and the presence of liquid water. Describe how scientists search for extra-solar planets around nearby stars.
Standard: The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.	
Stem	GLE's (Grade Level Expectations)
Size and Scale	Recognize electromagnetic waves can be used to locate objects in the universe, and track their movement. Define a light year.

Astronomy *Continued*	
Standard: The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time: Students will demonstrate knowledge of the classification, structure, and lifecycle of stars.	
Stem	GLE's (Grade Level Expectations)
Stars	Identify and describe the characteristics common to most stars in the universe. Describe the ongoing processes involved in star formation, their life cycles and their destruction. Explain the relationships between or among the energy produced from nuclear reactions, the origin of elements, and the life cycles of stars. Describe how stars form and their possible life cycle. Explain the stellar classification system of stars by temperature, composition and size. Describe some basic features of H-R diagrams. Explain how stars produce their energy via the thermonuclear reaction. Explain how stars can become white dwarfs, neutron stars and black holes as they die. Describe how supernovae can seed the interstellar medium with heavy elements that ultimately make life possible. (We are stardust) Describe some of the essential feature of our star, the Sun such as photosphere, corona, and magnetic field. Explain how solar flares, coronal mass ejections, sunspots and the solar wind effect the Earth.

Astronomy *Continued*	
Standard: The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time: Students will demonstrate knowledge of the Milky way Galaxy.	
Stem	GLE's (Grade Level Expectations)
Galaxies	Locate our solar system within one arm of the Milky Way Galaxy that is composed of billions of stars and recognize that our galaxy is but one of billions in the universe. Distinguish between galactic star clusters, globular star clusters, and the various types of nebulae that populate our galaxy.
Standard: The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time: Students will demonstrate increased knowledge of the nature of the universe.	
Stem	GLE's (Grade Level Expectations)
Universe	Explain that current scientific evidence supports the Big Bang Theory as a probable explanation of the origin of the universe, and describe the theory. Explain the evidence that suggests the universe is expanding. Provide scientific evidence that supports or refutes the "Big Bang" theory of how the universe was formed. Based on the nature of electromagnetic waves, explain the movement and location of objects in the universe or their composition (e.g., red shift, blue shift, line spectra). Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes and visual, radio and x-ray telescopes). Describe some of the mysteries presently in need of understanding such as Quasars, gamma ray bursters, and large scale structures such as walls and voids. Explain how observation of the red shift of light, and the cosmic microwave background radiation is strong evidence in support of the Big Bang Theory. Recognize how Einstein's view of gravity seems to better explain large-scale features of our universe better than Isaac Newton's idea of gravity.

Astronomy *Continued*	
Standard: Students will demonstrate an increased recognition of the markers of the visible night sky.	
Stem	GLE's (Grade Level Expectations)
Night Sky	Locate the north celestial pole, celestial equator and ecliptic. Recognize the major constellations visible at this time of year as well as some of the brighter stars. Locate any major planets, and several well-known star clusters and nebulae. Observe our own galaxy, the Milky Way; spread horizon to horizon as a faint glow of countless stars. Use a telescope to find objects of interest. Use Starry Night to locate objects of interest in the night sky.
Standard: Students will demonstrate increased awareness of the historical development of astronomy as a science.	
Stem	GLE's (Grade Level Expectations)
History of Astronomy	Summarize how Astronomy is an example of an experimental science that uses testable hypotheses and Physics as a means to understand the universe. Explain why Astrology, paranormal and psychic studies are not science. Describe the role of people such as Aristotle, Ptolemy, Copernicus and Galileo played in the geocentric and heliocentric models of the solar system. Explain how Newton's laws of motion and gravitation help in the understanding of celestial motions. Recognize the vast scale of distances and sizes inherent in the study of Astronomy, such as measurements in Astronomical Units and light years.

Astronomy *Continued*	
Standard: The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues: Students will demonstrate understanding of the tools and technology used by astronomers	
Stem	GLE's (Grade Level Expectations)
Design Technology	Describe ways in which technology has increased our understanding of the universe. Understand that technology is designed with a particular function in mind; and principles of Earth Space science are useful in creating technology for the Earth space sciences.
Standard: The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
Tools	Describe the use and benefits of land-based light telescopes, radio telescopes, spectrophotometers, satellites, manned exploration, probes, and robots to the study of Earth Space Science. Explain how scientists study the Earth using computer-generated models and observations from both land-based sites and satellites; and describe the value of using these tools in unison. Describe how an understanding of light and atomic spectra helped in the understanding the composition of stars. Explain that light is but one form of electromagnetic radiation and relate why it is such an important scientific tool in studying the universe. Describe how the three major types of optical telescope work and explain the usefulness of x-ray and other non-optical telescopes.

Astronomy *Continued*	
Standard: The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
Local, Global and Environmental Issues	Differentiate between and provide examples of renewable and nonrenewable sources of energy; and explain the advantages and limitations of each. Describe the means for transforming a natural material, such as iron ore, into useful products during different historical periods, such as the Stone Age, Iron Age, Renaissance, the Industrial Period and the current Age of Information. Explain how the use of technologies at a local level, such as burning of fossil fuels for transportation or power generation, may contribute to global environmental problems.
Standard: The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues: Students will demonstrate greater understanding of the nature of space exploration	
Stem	GLE's (Grade Level Expectations)
Space Exploration	Explain some of the benefits and liabilities of having an active exploration program. Describe some of the past and present manned space missions such as the Apollo program, Space Shuttle and International Space Station. Identify and describe some of the successful robot missions such as Voyager, Galileo and Pathfinder and Stardust.

Astronomy *Continued*	
Standard: The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
Career	Explain the kinds of applications of knowledge and skills necessary for jobs/careers specific to Earth or space sciences.
Strand/Big Idea: SPS1 – Scientific Inquiry and Critical Thinking (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.

Astronomy *Continued*	
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.
Strand/Big Idea: SPS2 – Unifying Concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.

Astronomy	
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
Models and Scale	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules. S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.

Biology	
Strand (1 of 3): All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).	
Stem	GLE's (Grade Level Expectations)
CLASSIFICATION *(1 of 3)*	Describe how organisms are classified into a hierarchy of groups and subgroups, which are based on similarities that reflect their evolutionary relationships. Explain that organisms that possess similar DNA code are more closely related than those in which DNA varies greatly. Identify plants and animals according to binomial nomenclature. Differentiate between prokaryotic and eukaryotic cells according to general structure and degrees of complexity.

Biology *Continued*	
Strand (2 of 3): All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).	
Stem	GLE's (Grade Level Expectations)
LIVING THINGS and ORGANIZATION *(2 of 3)*	Identify the structures of different types of cell parts/organelles and explain the functions they perform. Recognize how cell functions are regulated through changes in the activity of the functions performed by proteins, and through the selective expression of individual genes; and explain how this regulation allows cells to respond to their environment and to control and coordinate cell growth and division. Recognize how an organism's organization and complexity accommodate its need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain it. Explain how the processes of photosynthesis and cellular respiration are interrelated and contribute to biogeochemical cycles. Describe the structures of proteins and their role in cell function. Describe the chemical reactions involved in cell functions using examples from the nervous, immune and endocrine systems in multi cellular animals. Recognize that because all matter tends toward more disorganized states, living systems need a continuous input of energy to maintain their chemical and physical organizations. Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA transport, nerve cells).

Biology *Continued*	
Strand (3 of 3): All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).	
Stem	GLE's (Grade Level Expectations)
REPRODUCTION (3 of 3)	Describe the chemical and structural properties of DNA and explain its role in identifying the characteristics of an organism. Recognize that new heritable characteristics can only result from new combinations of existing genes or from mutations of genes in an organism's sex cells, and explain why other changes in an organism cannot be passed on. Describe the alternation of generations, life cycles with haploid and diploid phases in living organisms, such as bacteria, plants and animals. Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations).

Biology *Continued*	
Strand (1 of 2): Energy flows and matter recycles through an ecosystem.	
Stem	GLE's (Grade Level Expectations)
ENVIRONMENT *(1 of 2)*	Explain how the amount of life an environment can sustain is restricted by the availability of matter and energy, and the ability of the ecosystem to recycle materials. Describe how the interrelationships and interdependencies among organisms generate stable ecosystems that fluctuate around a state of rough equilibrium for hundreds or thousands of years. Identify the factors in an ecosystem that can affect its carrying capacity. Analyze and describe how environmental disturbances, such as climate changes, natural events, human activity and the introduction of invasive species, can affect the flow of energy or matter in an ecosystem. Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem Explain or evaluate potential bias in how evidence is interpreted in reports concerning a particular environmental factor that impacts the biology of humans. Use examples from local ecosystems to describe the relationships among organisms at the different trophic levels

Biology *Continued*	
Strand (2 of 2): Energy flows and matter recycles through an ecosystem.	
Stem	GLE's (Grade Level Expectations)
RECYCLING OF MATERIALS *(2 of 2)*	Explain that as matter and energy flow through different levels of organization in living systems and between living systems and the environment, elements, such as carbon and nitrogen, are recombined in different ways. Trace the cycling of matter (e.g., carbon cycle) and the flow of energy in a living system from its source through its transformation in cellular, biochemical processes (e.g., photosynthesis, cellular respiration, fermentation)
Strand (1 of 3): Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry)	
Stem	GLE's (Grade Level Expectations)
CHANGE *(1 of 3)*	Identify ways humans can impact and alter the stability of ecosystems, such as habitat destruction, pollution, and consumption of resources; and describe the potentially irreversible effects these changes can cause. Identify ways of detecting, and limiting or reversing environmental damage. Analyze the aspects of environmental protection, such as ecosystem protection, habitat management, species conservation and environmental agencies and regulations; and evaluate and justify the need for public policy in guiding the use and management of the environment.

Biology *Continued*	
Strand (2 of 3): Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry)	
Stem	GLE's (Grade Level Expectations)
EVIDENCE OF EVOLUTION *(2 of 3)*	Explain the currently accepted theory for the development of life on Earth, including the history of its origin and the evolutionary process. Recognize that the abilities and behaviors an organism has, and likelihood of its survival strongly depend on its heritable characteristics, which can be biochemical and anatomical. Explain the contributions of Darwin, Malthus, Wallace and Russell to the advancement of life science. Explain evolution in terms of how the Earth's present-day life forms evolved from earlier, distinctly different species as a consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection. Explain how evidence from technological advances supports or refutes the genetic relationships among groups of organisms (e.g., DNA analysis, protein analysis) Given information about living or extinct organisms, cite evidence to explain the frequency of inherited characteristics of organisms in a population, OR explain the evolution of varied structures (with defined functions) that affected the organisms' survival in a specific environment

Biology *Continued*	
Strand (3 of 3): Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry)	
Stem	GLE's (Grade Level Expectations)
NATURAL SELECTION *(3 of 3)*	Explain the concept of natural selection. Explain the diversity and unity of past and present life forms on Earth using currently accepted theories. Recognize how a species chance of survival increases with each variation of an organism within the species, and explain how, in the event of a major global change, the great diversity of species on Earth, the greater the chance for survival of life. Analyze present day data and research in areas, including antibiotic resistance in bacteria, changes in viral genomes, such as bird flu, DNA sequencing, and relate it to the concepts of natural selection. Identify and describe ways genes may be changed and combined to create genetic variation within a species. Explain that gene mutations and new combinations may have a variety of effects on the organism, including positive and negative ones, or none at all. Explain the concepts of Mendelian genetics. Use pedigree charts and Punnet Squares to determine patterns of inheritance. Given a scenario, provide evidence that demonstrates how sexual reproduction results in a great variety of possible gene combinations and contributes to natural selection (e.g., Darwin's finches, isolation of a species, Tay Sach's disease)

Biology *Continued*	
Strand (1 of 3): Humans are similar to other species in many ways, and yet are unique among Earth's life forms	
Stem	GLE's (Grade Level Expectations)
BEHAVIOR *(1 of 3)*	Recognize that the immune system, endocrine system, and nervous system can affect the homeostasis of an organism. Describe how the functions of all the human body systems are interrelated at a chemical level and how they maintain homeostasis
Strand (2 of 2): Humans are similar to other species in many ways, and yet are unique among Earth's life forms	
Stem	GLE's (Grade Level Expectations)
DISEASE *(2 of 3)*	Explain that disease in organisms can be caused by intrinsic failures of the system or infection by other organisms, and describe as well as provide examples of how some diseases are caused by: the breakdown in cellular function, congenital conditions, genetic disorders, malnutrition, and emotional health, including stress. Explain that vaccines were developed to reduce or eliminate diseases, and provide examples of how these medical advances have proven to be successful. Describe and provide examples of how new medical techniques, efficient health care delivery systems, improved sanitation, and a more complete understanding of the nature of disease provides today's humans a better chance of staying healthier than their forebears. Describe how some drugs mimic or block the molecules involved in transmitting nerve or hormone signals and explain how this disturbs the normal operations of the brain and body. Explain that gene mutation in a cell can result in uncontrolled division, which is called cancer and describe how exposure of cells to certain chemicals and radiation increase mutation, and thus the chance for cancer. Use evidence to make and support conclusions about the ways that humans or other organisms are affected by environmental factors or heredity (e.g., pathogens, diseases, medical advances, pollution, and mutations).

Biology *Continued*	
Strand (3 of 3): Humans are similar to other species in many ways, and yet are unique among Earth's life forms	
Stem	GLE's (Grade Level Expectations)
HUMAN IDENTITY *(3 of 3)*	Describe how the length and quality of human life are influenced by many factors, including sanitation, diet, medical care, gender, genes, and environmental conditions and personal health behaviors. Explain how the immune system functions to prevent and fight disease. Explain how the immune system, endocrine system, or nervous system works and draw conclusions about how systems interact to maintain homeostasis in the human body.
Strand (1 of 2): The growth of scientific knowledge in Life Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY *(1 of 2)*	Describe ways in which technology has increased our understanding of the life sciences. Understand that technology is designed with a particular function in mind, and principles of life science are useful in creating technology for the life sciences.

Biology *Continued*	
Strand (2 of 2): The growth of scientific knowledge in Life Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
TOOLS *(2 of 2)*	Describe the use and benefits of equipment such as, light microscopes, transmission electron microscopes, scanning electron microscopes, spectrophotometers, probes, and robotics to the study of the life sciences.
Strand/Big Idea: SPS1 - Scientific Inquiry and Critical Thinking (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.

Biology *Continued*	
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.
Strand/Big Idea: SPS2 - Unifying concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.

Biology *Continued*	
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
Models and Scale	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.

Biology	
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules. S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.

College Chemistry	
Strand (1 of 2): All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
COMPOSITION *(1 of 2)*	Name and describe the four states of matter. 12.3.5.1.1 Relate the states to the intermolecular kinetic energy of said states. State the difference between an element and a compound. Define the terminology of atoms and their components. Summarize Dalton's atomic theory and explain the contradictions to modern atomic theory. Discuss the concept of the Bohr model of atoms. Define isotopes and atomic mass. Develop the model of relative abundance (weighted mean) through a laboratory exploration. Quantify atomic constituents. Identify the charge, mass, location and quantity of each atomic constituent. State the mass and charge ratio of nucleus to electron cloud. Determine the electron configurations of elements using the principles of orbital energy, orbital capacity and electron spin. Describe atomic orbitals in terms of their shapes size and energy. Describe atomic orbitals in terms of their shapes size and energy. Uses models to describe the resulting shape of molecules due to VSEPR Theory. Use VSEPR Theory and models to predict and describe the potential bonding configurations of organic molecules. Identify elements, their symbols and location on the periodic table. Identify groups, periods and major divisions of the periodic chart. State the periodic law and relate it to family trends. Recognize Mendeleev and Mosley contributions. Correlate the elemental positions of the periodic chart with respect to trends in boiling point, atomic radii, and electro negativity ionization energy, and electron affinity. Use these trends to predict reactivity, reactions and type of resulting bonds.

College Chemistry *Continued*	
Strand (2 of 2): All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
PROPERTIES *(2 of 2)*	Define physical and chemical properties of matter. Compare heterogeneous and homogeneous mixtures. Relate to chemical reactions; the reactants and the products. Describe techniques to separate mixtures. Define a chemical reaction. State the law of conservation of matter and demonstrate the law through laboratory experimentation and mathematical models the application of the law. Identify Boyle's and Charles' Laws Gay-Lussac's Law, Combined Gas Law, Dalton's Law of Partial Pressures, And Ideal Gas Law from laboratory experiments.

College Chemistry *Continued*	
Strand: Understands scientific measurements and problem solving techniques.	
Stem	GLE's (Grade Level Expectations)
MEASUREMENT	Distinguish between qualitative and quantitative measures. Distinguish between accuracy and precision of a measurement. Identify the number of significant figures in a measurement. Use the rules for significant figures in calculations. Explain and have working knowledge of the metric system. State the difference between mass and weight. Manipulate the equation for density determination to solve for different variables. Convert between Celsius and Kelvin temperature scales. State applications for specific gravity measurements Construct conversion factors and use dimensional analysis from equivalent measurements. Use the mole concept in experimental calculations.

College Chemistry *Continued*	
Strand: Understands energy types, sources and conversions and their relationship to heat and temperature.	
Stem	GLE's (Grade Level Expectations)
ENERGY	Distinguish between kinetic and potential energy. State the law of conservation of mass energy. Name and define the units of heat energy. Use these units to solve problems mathematically. Identify factors of heat capacity determination and use these factors to determine specific heat using mathematical means. Give examples of energy conversions. Using Charles Law and graphing techniques explain what is meant by absolute zero. Define heat and temperature and relate differences to Kinetic Theory. Explain how energy is involved in chemical reactions. Distinguish between exothermic and endothermic reactions and mathematically quantify energy changes in reactions.

College Chemistry *Continued*	
Strand: Understands concepts of chemical bonding and formula synthesis.	
Stem	GLE's (Grade Level Expectations)
CHEMICAL BONDS	Define the terms caution and anion and show how they are related to the terms metal and nonmetal. Differentiate between ionic and covalent compounds and between formula units and molecules. Understand the law of multiple proportions and relate the law to quantities in reactions (mass or moles). Describe the characteristics of ionic and covalent compounds. Define the octet rule and use to predict compound and ion formation. Recognize and understand exceptions to the octet rule. Use electro negativity to predict the difference between polar and non polar covalent compounds. Using your electro negativity rules describe the difference between polar and nonpolar covalent compounds. Write names for ionic and molecular compounds. Describe the VSEPR theory. Use VSEPR theory to predict the common shapes of molecules. Understand the rules governing oxidation numbers and how they relate to chemical formulas and nomenclature. Determine empirical and molecular formulas.

College Chemistry *Continued*	
Strand: Understands predictions of a variety of chemical reactions and their associated stoichiometry.	
Stem	GLE's (Grade Level Expectations)
CHEMICAL REACTIONS	Identify the reactants and products in chemical reactions. Use appropriate symbols when writing an equation to accurately describe the chemical reaction. Balance and compose chemical reaction equations. Identify major types of reactions. Predict products of certain reaction types. Balance equations and predict products of certain reaction types. Perform stoichiometric calculations and predictions. Calculate limiting reagents and percent yields. Define oxidation and reduction. Give the characteristics of a redox reaction. Identify the oxidizer and reducer.

College Chemistry *Continued*	
Strand: Understands solutions and their behaviors.	
Stem	GLE's (Grade Level Expectations)
SOLUTIONS	Explain the difference between saturation levels in a solution. Use mathematical models to predict saturation and/or precipitation. List factors that determine rate of solutions. Use Henry's law to solve gas solubility problems. Explain what is meant by the concentration of a solution. Define and work problems involving the molarity, molality, and molar fraction of a solution of a solution.
Strand: Understands concepts of acids and bases.	
Stem	GLE's (Grade Level Expectations)
ACIDS and BASES	List properties of acids and bases. Write the equation for the self ionization of water. Classify solutions as neutral, acidic or basic. Calculate the pH and pOH of a solution given the hydrogen ion or hydroxide ion concentrations using mathematical methods. of a solution using laboratory techniques. State the Arrhenius, Brönsted-Lowry and Lewis definitions of an acid and a base and distinguish between each definition in a reaction. Using titration techniques in the laboratory determine the strength of an acid or base.

College Chemistry *Continued*	
Strand/Big Idea: SPS1 - Scientific Inquiry and Critical Thinking	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.
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College Chemistry *Continued*	
Strand/Big Idea: SPS2 - Unifying concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.
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College Chemistry	
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.
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College Physics	
Standard: Students will demonstrate an understanding of kinematics principles in one dimension.	
Stem	GLE's (Grade Level Expectations)
1-DIMENSIONAL MOTION	Explain the differences between vector and scalar quantities and be capable of adding one-dimensional vectors. Describe motion in terms of displacement, time, and velocity. Explain how Aristotle's idea of absolute motion is in conflict with Galileo's idea of relative motion. Be able to calculate average velocity, average speed, distance traveled, and displacement from initial conditions. Relate how instantaneous velocity can be considered as the limit of the average velocity as the time interval approaches zero. Distinguish between accelerated motion and motion at constant velocity. Apply kinematics equations to solve problems involving displacement, time, velocity, and acceleration. Create k-graphs such as position vs. time, velocity vs. time, acceleration vs. time graphs from provided or collected data. Recognize the slope of linear graphs as velocities or accelerations, and areas beneath certain graphs as displacements and changes in velocities. Analyze k- graphs for information about displacements, velocities and accelerations. Explain how Galileo arrived at the notion that falling objects accelerate as they fall contrary to the Aristotelian idea of falling at constant velocity, and are thus examples of uniformly accelerated motion. Describe how the acceleration of falling objects is independent of mass in the absence of air resistance. Create tables that display displacements and velocities of falling objects as a function of time. Be able to modify k-equations to include falling objects and to solve associated problems. Be able to use technology to design, run and analyze experiments involving kinematics. For example: measuring the acceleration of gravity.

College Physics *Continued*

Standard: Students will extend their understanding of kinematics by including the analysis of two dimensional motion. (cont. next page)

Stem	GLE's (Grade Level Expectations)
2-DIMENSIONAL MOTION *continued*	Extend the vector concept to two dimensions then add and subtract the vectors graphically using protractor and ruler. Describe the various ways in which the direction of a vector can be stated. Resolve vectors into components on the Cartesian coordinate plane. Add several non-perpendicular vectors analytically using x and y components. Determine the direction of the resultant using a trigonometric function. Solve two-dimensional physics problems that involve velocities, displacements and forces. Given a weight suspended by two or more strings, determine its weight by adding the tensions in the supporting strings. Check the results by using a balance. Given a vector problem to solve, students will calculate the resultant vector and verify their work by arranging these forces on a force table. If their work is correct the force table will balance. Identify common examples of projectiles and characteristics of projectile motion. Discuss how the exact shape of a projectile's path is a function of perspective. Recognize that projectile motion can be analyzed utilizing the methods of vector analysis. Describe the motion of a projectile as the combination of two independent motions and thus why the time of fall of a projectile is independent of its horizontal velocity. Explain the Physics behind the fact that the ballistics cart on the track will catch its launched ball regardless of the state of motion of the cart or angle of incline of the track. Explain why the tranquilizer dart hits Curious George even though he lets go of the branch as the dart is being fired.

College Physics *Continued*	
Standard: Students will extend their understanding of kinematics by including the analysis of two dimensional motion.	
2-DIMENSIONAL MOTION	Explain how Galileo showed that a projectile's parabolic path in a consequence of it moving horizontally at constant velocity and vertically at constant acceleration. Extend kinematics equations to two dimensions and solve problems involving projectile motion. Describe how Newton extended the idea of the parabolic projectile paths to include the circular paths of satellites orbiting the earth and planets and space probes orbiting the sun. Explain how satellites such as the Space Shuttle fall toward the earth at the same rate as the earth's surface 'curves' away resulting in an ever-falling projectile. Explain how air resistance affects the paths of projectiles. Launch projectiles (golf ball football cannon balls (tennis-ball cannon) and determine the initial velocities by measuring needed parameters and applying the kinematics-projectile equations. Predict the landing spot of a launched projectile by using kinematics and projectile equations.

College Physics *Continued*	
Standard (1 of 2): Students will demonstrate an ability to extend their kinematics concepts understanding to include motion in circular paths (rotational kinematics).	
Stem	GLE's (Grade Level Expectations)
CIRCULAR MOTION *(1 of 2)*	Explain how circular motion for a point object is only possible if a center directed force, known as a centripetal force is applied. Summarize why centrifugal force is an example of a fictitious force, and why Newton's first law more properly explains the affects. Explain that the forces acting on an object moving in circular motion such as a rider on the Turkish Twist are inward directed and that if they ceased to act the object (person) would move tangent to the circular path. Describe how the inward centripetal force results in an inward acceleration known as the centripetal acceleration. Recognize that a vector quantity such as velocity can be changed in either its magnitude or direction by the application of a force. Outline how the equation for centripetal acceleration is arrived at and apply it to the solution of problems involving centripetal force and acceleration. Be able to calculate the greatest period of rotation of a pail of water swung at arm's length that keeps the water in the pail and verify the result by experiment. Verify the centripetal force equation by using force sensors and photogates. Solve problems related to circular motion.

College Physics *Continued*	
Standard (2 of 2): Students will extend their understanding of circular motion to include the circular and elliptical paths of planets and satellites.	
Stem	GLE's (Grade Level Expectations)
CIRCULAR MOTION *(2 of 2)*	Summarize how Newton arrived at the inverse square relationship between gravitational force and distance. Explain the difficulty that this 'action at a distance' creates. State Newton's law of universal gravitation. Using your own mass determine the mass of the earth. Solve problems involving gravitation, such as finding the acceleration of gravity at Space Shuttle height. Explain how Einstein's theory of gravitation, General Relativity provides an alternative explanation of gravity and taken to extreme provides an explanation for black holes. Compare and contrast Einstein's and Newton's view of gravity. Manipulate the gravitational law equation to arrive at expressions for the acceleration of gravity, g, at any distance from the surface of the earth.

College Physics *Continued*	
Standard (1 of 2): Students will demonstrate knowledge of force	
Stem	GLE's (Grade Level Expectations)
FORCE *(1 of 2)*	Distinguish between contact and field forces and give examples of each. Explain how contact forces can be categorized as tensile, compressive or shear in nature. Describe how Galileo arrived at his Law of Inertia and give examples that illustrate that zero net force results in motion at constant velocity. Compare Galileo's ideas with Aristotle's idea of natural states of motion. State Newton's First law of Motion and cite examples of objects of it State the First Condition for Equilibrium and explain why this is just an alternative statement of the First Law of Motion. State Newton's Second Law of Motion and relate it to everyday situations such as automobile design and travel. Define the unit of force, the Newton in terms of kilograms, meters and seconds. Recognize that inertial mass is the slope of a force vs. acceleration graph. Describe how gravitational mass is always equal to inertial mass and yet each is measured differently. Explain how weight is different than mass and calculate weight for various locations on earth as well as on other planets. Given situations, identify the action-reaction forces as specified in Newton's Third Law of Motion. Explain why the action-reaction pairs do not result in equilibrium. Identify types of resistive forces that act in every-day situations such as air resistance and friction. Solve one-dimensional problems involving forces including those with given resistive forces. Discuss everyday situations such as baseball in terms of Newton's Laws.

College Physics *Continued*	
Standard (2 of 2): Students will demonstrate an ability to apply Newton's laws to a wide variety of situations that involve one or several forces	
Stem	GLE's (Grade Level Expectations)
FORCE (2 of 2)	Identify and calculate the size of the normal force in various situations including those on inclines. Draw, interpret and analyze free-body diagrams (F.B.D.). Write force equations from the Free body diagrams. Solve problems involving static equilibrium and situations of non-equilibrium. In lab, determine the resultant force acting given several forces and compare this experimental result to that obtained through mathematical analysis. Solve problems involving forces by utilizing force equations including those involving connected objects. Describe the cause of resistive forces such as friction. Explain the significance of the coefficients of static and kinetic friction and apply them to every-day situations such as those encountered in driving, walking and running. Determine the coefficients of static and kinetic friction through the design and running of an experiment. Solve problems involving resistive forces. Demonstrate the grasp of Newton's Laws by designing and running labs involving forces and the motions of an object. These labs may involve dynamic carts and the Science Workshop sensors, such as smart pulleys, motion sensors, photogates, force and acceleration sensors. Discover Hooke's law that relates restoring force to the displacement from equilibrium position via a lab exercise. Explain how the value of the spring constant, k, affects the stiffness of a spring

College Physics *Continued*	
Standard: Students will extend their understanding of Mechanics by applying the work-energy concept and the law of conservation of energy to the solution of problems.	
Stem	GLE's (Grade Level Expectations)
WORK	Recognize the difference between the scientific and the every-day definition of work. Define work in terms of displacement and the component of the force in the direction of the displacement. Calculate the net work done when many forces act. Recognize that the area under a force-displacement graph is the work done by the force. In addition be able to calculate the work done. Describe how the scalar quantities of work and energy simplify the solution of many problems we solved earlier dynamically. Define kinetic energy and use this definition to solve problems. Explain, using the kinetic energy concept, why a car accident at 60mph is four times as dangerous as one at 30 mph. Describe the work- energy theorem in terms of work being needed to change the kinetic energy of an object. Given an example such as a car braking to a stop, explain the example in terms of work and energy. Explain how the work-energy theorem can be derived from Newton's second law. Show how the unit of work/energy, the Joule, is a derived unit. Solve problems involving the work-energy theorem. Identify various forms of energy such as chemical potential energy, heat, electrical energy, electromagnetic (light), kinetic energy and gravitational potential energy. Given a situation such as an automobile traveling down a road describe how work and various forms of energy are involved. For example; the conversion of chemical potential energy into heat, electrical energy, light; sound and kinetic energy.

College Physics *Continued*	
Standard: Students will extend their understanding of Mechanics by applying the work-energy concept and the law of conservation of energy to the solution of problems.	
WORK	Using the work concept, derive expressions for gravitational potential energy. Using the work concept and Hooke's Law develop an equation for the energy stored in a spring. Classify energy as either mechanical or non-mechanical. State the law of conservation of mechanical energy. Solve problems that involve the conservation of energy, for example, pole-vaulters and high jumpers. Explain how mass can be considered as a form of energy via Einstein's equation. Define power as the rate of doing work or the rate at which energy is transformed from one type to another. Solve problems involving power and work. Verify the law of conservation of energy in lab by checking whether the energy stored in the plunger spring on a dynamics cart is equal to the kinetic energy of the cart once the plunger in tripped. Verify the law of conservation of energy in lab using the following technique. Suspend a mass by a string attached to the ceiling. Upon release this mass will become a projectile once the string is cut by a razor blade at the bottom of its arc. The landing spot can be predicted by using the conservation of energy. Verify the work-energy theorem by colliding a dynamics cart into a force sensor and monitoring the change in the kinetic energy of the cart by using motion sensors or photogates.

College Physics *Continued*	
Standard: Students will extend their understanding of Dynamics to include the concept of torque.	
Stem	GLE's (Grade Level Expectations)
TORQUE	Distinguish between torque and force. Calculate torque in lab situations and solve problems involving them. Determine the mass of an unknown by setting up balanced torques in lab. Explain the relationship between torque and angular acceleration. Calculate the moment of inertia for point objects and be able to apply given moments of inertia for extended objects to the solution of rotation problems Compare and contrast mass and the moment of inertia.

College Physics *Continued*

Standard: Students will show an increased ability to solve mechanics problems by applying the impulse-change in momentum theorem as well as the law of conservation of momentum. (cont. next page)

Stem	GLE's (Grade Level Expectations)
MOMENTUM	Develop the impulse-change in momentum theorem via Newton's second law. Recognize that momentum and impulse are vector quantities and are thus subject to the rules of vector addition. Explain how impulse always equals the change in momentum of an object but that altering the time over which the force acts can change the size of the force. Identify the units of impulse and change in momentum as kg m/s. Solve problems involving momentum and impulse. Explain how the impulse-change in momentum theorem applies to automobile safety features such as crumple zones, padded dashboards, seatbelts, shoulder harnesses and airbags. Identify examples other than those cited above where increasing the contact time can lessen the force. Compare the total momentum of two objects before and after a collision. State the law of conservation of momentum. Predict the final velocities of objects after collisions, given initial velocities. Identify collisions as either elastic or inelastic. State the characteristics of each type of collision.

College Physics *Continued*	
MOMENTUM	Determine how much kinetic energy is lost in inelastic collisions, and speculate on what other forms of energy was produced in the collision (e.g. heat). Recognize that there are really no perfectly elastic collisions and that there is always some kinetic energy lost in interactions. Solve conservation of momentum problems in one dimension. Solve problems similar to a ballistic pendulum in which both energy and momentum aspects are involved. Verify the law of conservation of momentum in lab by designing an experiment involving the dynamics carts and Science Workshop sensors. Verify the impulse-change in momentum theorem by colliding dynamics carts into a force sensor and by monitoring the change in velocity with a photogate. Create and solve a problem dealing with the conservation of momentum

College Physics *Continued*

Standard (1 of 2): Students will advance their understanding of oscillatory motion and waves. (cont. next page)

Stem	GLE's (Grade Level Expectations)
WAVES *(1 of 2)*	Identify the conditions of simple harmonic motion. Explain how force, velocity and acceleration change as an object vibrates with simple harmonic motion. Calculate the springs restoring force using Hooke's law. Identify the amplitude of vibration as the maximum displacement from equilibrium position. Recognize the relationship between period and frequency. Calculate the period and frequency of an object undergoing simple harmonic motion. Write an expression for the displacement of an object from equilibrium position as a function of the cosine function. Explain the process of damping oscillations and give examples of its occurrence. Determine the velocity of waves traveling on a string given its tension and mass per unit length. Explain under what circumstances a pendulum is an example of simple harmonic motion. Conduct a laboratory investigation of simple harmonic motion by using a mass vibrating on a spring. Science Workshop will collect data from motion sensors and force sensors. Students will analyze the results to determine how well experimental results match theory. Distinguish between local particle vibrations from overall wave motion.

College Physics *Continued*	
WAVES *(1 of 2)*	Differentiate between pulse waves and periodic waves. Interpret waveforms of transverse and longitudinal waves. Apply the relationship between wave speed, frequency and wavelength to solve problems. Relate energy to wave amplitude. Apply the superposition principle for waves. Differentiate between constructive and destructive interference. Predict when a reflected wave will be inverted. Identify nodes and antinodes of standing waves and relate them to interference effects. Conduct a laboratory investigation of waves traveling in springs and strings using Science Workshop interface and power amplifier.

College Physics *Continued*	
Standard (2 of 2): Students will increase their understanding of sound as a specific form of wave phenomena.	
Stem	GLE's (Grade Level Expectations)
WAVES *(2 of 2)*	Explain how sound waves are produced and relate the wave concepts of amplitude, wavelength, and frequency to sound waves. Relate frequency to pitch Compare the speed of sound in various media and calculate its speed in air at various temperatures. Recognize the Doppler effect, and determine the direction of the frequency shift when there is relative motion between a source and an observer. Relate intensity, decibel level and perceived loudness. Explain the phenomena of shock waves, sonic booms and the Mach factor. Explain why resonance occurs and give examples of it. Differentiate between the harmonic series produced by open and closed pipes. Calculate the harmonics of a vibrating string and of open and closed pipes. Relate harmonics to the quality or timbre of sound. Relate the frequency difference between two waves to the frequency of the beats heard. Determine the speed of sound experimentally by finding resonance points in an air column of adjustable length. Design a lab or research project around waves and sound Investigate the sound produced by tuning forks, voice and musical instruments using sound sensors and Science Workshop.

College Physics *Continued*	
Standard (1 of 4): Students will increase their understanding of the phenomena of electric force and electric field.	
Stem	ELEGLE's (Grade Level Expectations)
ELECTRICITY *(1 of 4)*	Understand the basic properties of electric charge as a result of atomic theory. Differentiate between electric conductors and insulators. Distinguish between charging by contact and charging by induction. Calculate the electric force between two or more point charges using Coulomb's law and the methods of vector addition. Compare the strength of the electric forces field to that of gravitational forces. Describe the concept of force field and compare the gravitational force field,g, with the electric force field. E. Relate the rules for drawing field lines and draw and interpret field lines for given distribution of charges. Identify the four properties associated with a conductor in electrostatic equilibrium. Explain voltage in terms of energy and how its distinct from electric current. Explain how static electricity differs from current electricity and identify conditions that lead to the buildup of static charge. Use the Van De Graaf generator to explain the ideas of grounding, charge storage (capacitance), electric field, St. Elmo's Fire, insulators, conductors, insulators and voltage and properties of conductors. Explain the phenomenon of a Faraday cage and relate it to devices such as coaxial cable and to the reason why people are safe in an automobile during a lightning storm. Explain how Benjamin Franklin used a Leyden Jar to store huge charges and thus formed the first capacitor. Explain why our Van de Graaf generator is harmless but our Leyden jar is dangerous when fully charged.

College Physics *Continued*	
Standard (2 of 4): Students will expand their understanding of electrical phenomena to include the concepts of electric potential and capacitance.	
Stem	GLE's (Grade Level Expectations)
ELECTRICITY *(2 of 4)*	Define electrical potential energy. Compute the electrical potential energy for various charge distributions. Distinguish between electrical potential energy, electric potential and potential difference. Define the unit of electrical potential difference as the J/C or the volt. Use a digital multimeter to measure the potential difference between the electrodes of batteries. Relate capacitance to the storage of electrical potential energy due to the separation of charge. Give several uses of capacitors in electrical circuits.

College Physics *Continued*

Standard (3 of 4): Students will have an increase in understanding of electricity by understanding the concepts of electric current, resistance, Ohm's law and electric power.

Stem	GLE's (Grade Level Expectations)
ELECTRICITY *(3 of 4)*	Define current as the rate of charge flow per unit time and also define the ampere as the flow of one coulomb of charge per second. Use a digital multimeter to measure direct currents from batteries. Describe the basic properties of electric current. Solve problems involving current, charge and time Differentiate between direct current and alternating current. State Ohm's law and explain its significance for electrical conductors. Summarize the analogy between the flow of water through pipes and the flow of electric current through wires, making connections between the terms: current, voltage and resistance in each case. Use a digital multimeter and measure resistance of various resistors and wires. Compute current, voltage, and resistance using Ohm's law. Explain how these factors affect the resistance of a conductor: temperature, cross-sectional area, type of material the conductor is made from. Describe the unique features of superconductors by relating back to our demonstration of the Meisner effect demonstrated with the liquid nitrogen. Relate electric power to the rate at which electrical energy is converted into other forms of energy and state the three versions of the power equation. Calculate electric power using the power equation in conjunction with Ohm's law. Calculate the cost of running electrical appliances. Set up and run experiments relating to the following: verifying Ohm's law, making a resistance thermometer and using it to measure the temperature of a candle flame, verifying the resistivity equation.

College Physics *Continued*	
Standard (4 of 4): Students will gain an increased understanding of electric current, series and parallel DC circuits.	
Stem	GLE's (Grade Level Expectations)
ELECTRICITY *(4 of 4)*	Summarize the development of the battery by Volta and Galvani. Explain how the demonstration battery made from zinc, copper and salt water works. Identify and draw the schematic circuit symbols for various circuit elements such as the battery, resistor, capacitor, switch, and meter. Explain the differences between parallel and series circuits and draw both types given written directions or a sketch. Build both types of circuits and measure the current flow through various branch circuits and measure the voltage drops around the circuit. Explain what happens to the current flow through a circuit as additional resistors are added first in series and then in parallel. Calculate the equivalent resistance for a circuit of resistors in series, and find the current in, and the potential difference (voltage drop) across each resistor in the circuit. Repeat the above for a parallel circuit of resistors. Determine the equivalent resistance for a complex circuit involving both series and parallel portions by reducing the circuit to simpler ones. Calculate the current in and the potential difference across (voltage drop) individual elements within a complex circuit. Draw and analyze household circuits.

College Physics *Continued*	
Standard (1 of 2): Students will expand their understanding of magnetism and magnetic effects. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
ELECTROMAGNETISM *(1 of 2)*	Describe the magnet field around a permanent magnet. Explain a possible explanation for the existence of the earth's magnetic field. Describe the magnetic field produced by an electric current in a straight conductor and in a solenoid. Explain magnetism in terms of the domain theory of magnetism. Given the force on a charge in a magnetic field, determine the strength of the magnet field Given the magnetic field and the velocity and charge on a particle, determine the size and direction of the magnetic force acting on the particle. Use the right-hand rule to find the direction of the force on a charge moving through a magnetic field. Solve problems involving charges and currents in the presence of magnetic fields. Explain how electric and magnetic fields are used to accelerate charged particles in particle accelerators. Experiment with St. Louis demonstration motors and discover how motors work and be able to identify the various parts of a motor, to include: commutator, armature, brushes, and field magnets. Use Science Workshop to map the field if a permanent magnets and solenoids. Build solenoids (electromagnets) that maximize strength of field given definite limitations on materials that can be used. Explain phenomena such as the aurora borealis using magnetic and electrical principles.

College Physics *Continued*	
Standard (2 of 2): Students will expand their understanding of electromagnetic effects.	
Stem	GLE's (Grade Level Expectations)
ELECTROMAGNETISM *(2 of 2)*	Describe the experiments that Michael Faraday conducted that led him to the law of electromagnetic induction. Describe how the change in the number of magnetic field lines through a circuit loop affects the magnitude and direction of the induced current. State Faraday's law of induction. Explain Lenz's law and describe some of its effects. Describe some practical uses of electromagnetic induction such as relays and tape recorders. Explain how an electric generator works via electromagnetic induction. Explain demonstrations that involve induction such as the "flying ring of aluminum', and the 'magnet through an aluminum tube' that seems to defy gravity. Describe the makeup of an AC transformer and use the transformer equation to determine the induced voltages and currents. Investigate step-up and step-down transformers by using voltage sensors and Science Workshop.

College Physics *Continued*	
Standard (1 of 2): Students will demonstrate an increased ability to understand the nature of electromagnetic radiation as well as geometric optics. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
ELECTROMAGNECTIC RADIATION *(1 of 2)*	Identify the various components of the electromagnetic spectrum and recognize the relationship between frequency and energy as the wavelength of the radiation increases. Give examples of the nature and use for various parts of the electromagnetic spectrum. Calculate the frequency and wavelength of electromagnetic radiation. Summarize the attempts to measure the speed of light and explain the technique used by Fizeau and Michelson that eventually succeeded. Describe the present understanding of the duel nature of light, particle (photon) and wave. Explain the light intensity is an inverse-square law similar to the force relationships for gravitation and electric and magnetic fields. In lab, verify the inverse square nature of electromagnetic radiation using light sensors and Science Workshop. Apply the law of reflection to plane mirrors and describe the nature of images formed in plane mirrors. Using the lens-mirror equation, calculate image distances and focal lengths for concave and convex spherical mirrors. Draw ray diagrams to find the image distance and magnification for concave and convex spherical mirrors. Distinguish between real and virtual images, by stating the characteristics of each. Describe how parabolic mirrors differ from spherical mirrors. Recognize situations in which refraction will occur.

College Physics *Continued*	
ELECTROMAGNETIC RADIATION *(1 of 2)*	Identify which direction light will bend when it passes from medium to another. Explain that the degree of refraction depends upon light's relative speed of travel in the media, which depends upon the indices of refraction of the media. Solve problems using Snell's law. Verify Snell's law in lab by measuring angles of refraction. Use ray diagrams to find the position of an image produced by a converging or diverging lens, and identify the image as real or virtual. Predict whether light will be refracted or undergo total internal reflection. Explain dispersion and phenomena such as rainbows in terms of the relationship between the index of refraction and the wavelength of light. Recognize how the additive process and subtractive process determines the color of light seen in a situation. Explain how polarized light is formed and detected and some of the applications of polarized light such as liquid crystal displays. Given lenses and mirrors in lab, locate the real images that are formed and calculate the focal length based upon the positions of the object and image. Describe the causes for spherical and chromatic aberrations and techniques to minimize their effects. Solve problems dealing with geometric optics.

College Physics *Continued*	
Standard (2 of 2): Students will increase their understanding of electromagnetic radiation and physical optics.	
Stem	GLE's (Grade Level Expectations)
ELECTROMAGNETIC RADIATION *(2 of 2)*	Explain how Thomas Young's double slit experiment seemed to determine the unequivocally, the wave nature of light. Describe how light waves interfere with each other to produce bright and dark fringes. Compare interference effects in sound, light and water waves, and wave in strings. Identify the conditions for noticeable interference of light waves to occur. Predict the location of interference fringes using the equation for double-slit interference. In lab, given monochromatic light sources and diffraction gratings, determine the wavelength of the light source using the double–slit equation. Explain the bright and dark fringes produced in lab when two glass plates are pressed together and illuminated by monochromatic light. Explain the rainbow of colors seen in thin films such as soap bubbles in terms of interference between the reflected waves from multiple surfaces. Describe the properties of laser light and some of its applications.

College Physics *Continued*	
Strand/Big Idea: SPS1 - Scientific Inquiry and Critical Thinking	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.

College Physics *Continued*	
Strand/Big Idea: SPS2 - Unifying concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.

College Physics	
Models and Scale	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules. S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.

Earth Science	
Strand (1 of 5): Understands that the Earth and Earth materials have developed over long periods of time, through constant change processes by . . .	
Stem	GLE's (Grade Level Expectations)
ATMOSPHERE, CLIMATE, and WEATHER *(1 of 5)*	Explaining how winds and ocean currents are created on the Earth's surface Explaining how heat and energy transfer in and out of the atmosphere, and provide examples of how it is related to weather and climate. Describing how Earth's atmospheric composition has changed from the formation of the Earth through current time. Explaining how Earth's features can affect wind and weather patterns by causing air to rise and increasing precipitation.

Earth Science *Continued*	
Strand (2 of 5): Understands that the Earth and Earth materials have developed over long periods of time, through constant change processes by . . .	
Stem	GLE's (Grade Level Expectations)
COMPOSITION, FEATURE TECTONIC THEORY *(2 of 5)*	Recognizing that elements exist in fixed amounts and describe how they move through the solid Earth, oceans, atmosphere, and living things as part of geochemical cycles, such as the water, carbon and nitrogen cycles. Describing the conditions that enable the Earth to support life, such as the availability of water, the gravitational force, the EM field and the intensity of radiation from the Sun. Explaining the theory of plate tectonics. Tracing the development of the theory of plate tectonics Providing supporting geologic/geographic evidence that supports the validity of the theory of plate tectonics Describing the movement of crustal plates and explaining how the effects have altered the Earth's features. Explaining that the Earth is composed of interactive layers, which have distinct compositions, physical properties and processes Relating plate movement to earthquakes and volcanic activity, and explaining how it results in tectonic uplift and mountain building Predicting the likelihood for an earth event provided with geologic data on a given locale

Earth Science *Continued*	
Strand (3 of 5): Understands that the Earth and Earth materials have developed over long periods of time, through constant change processes by . . .	
Stem	GLE's (Grade Level Expectations)
FOSSILS and GEOLOGIC TIME *(3 of 5)*	Identifying and describing the methods used to measure geologic time, such as fossil identification, radioactive dating, and rock sequences Relating how geologic time is determined using various dating methods (e.g., radioactive, decay, rock sequences, fossil records).
Strand (4 of 5): Understands that the Earth and Earth materials have developed over long periods of time, through constant change processes by . . .	
Stem	GLE's (Grade Level Expectations)
PROCESSES, RATES OF CHANGE and ROCK *(4 of 5)*	Explaining that the Earth is composed of interactive layers, which have distinct compositions, physical properties and processes Explaining that throughout the rock cycle, the total amount of the material remains the same Identify and describe the major external and internal sources of energy on Earth.

Earth Science *Continued*	
Strand (5 of 5): Understands that the Earth and Earth materials have developed over long periods of time, through constant change processes by . . .	
Stem	GLE's (Grade Level Expectations)
WATER *(5 of 5)*	Explaining that water quality can be affected positively or negatively by outside sources
Strand SPS1: Scientific Inquiry and Critical Thinking (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.

Earth Science *Continued*	
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.
Strand SPS2: Unifying Concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.

Earth Science *Continued*	
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
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Earth Science	
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules. S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.

General Chemistry	
Strand (1 of 2): All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
COMPOSITION *(1 of 2)*	Name and describe the four states of matter. State the difference between an element and a compound. Define the terminology of atoms and their components. Summarize Dalton's atomic theory. Define isotopes and atomic mass. Develop the model of relative abundance (weighted mean) through a laboratory exploration. Quantify atomic constituents. Identify the charge, mass, location and quantity of each atomic constituent. Determine the electron configurations of elements using the principles of orbital energy, orbital capacity and electron spin. Uses models to describe the resulting shape of molecules due to VSEPR Theory. Identify elements, their symbols and location on the periodic table. Identify groups, periods and major divisions of the periodic chart. State the periodic law and relate it to family trends. Recognize Mendeleev and Mosley contributions. Correlate the elemental positions of the periodic chart with respect to trends in boiling point, atomic radii, and electro negativity. Use these trends to predict reactions and type of resulting bonds.

General Chemistry *Continued*	
Strand (2 of 2): All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
PROPERTIES *(2 of 2)*	Define physical and chemical properties of matter. Compare heterogeneous and homogeneous mixtures. Describe techniques to separate mixtures. Define a chemical reaction. State the law of conservation of matter and demonstrate the law through laboratory experimentation. Identify Boyle's and Charles' Laws from laboratory experiments.

General Chemistry *Continued*	
Strand: Understands scientific measurements and problem solving techniques.	
Stem	GLE's (Grade Level Expectations)
MEASUREMENT	Distinguish between qualitative and quantitative measures. Distinguish between accuracy and precision of a measurement. Identify the number of significant figures in a measurement. Use the rules for significant figures in calculations. Explain and have working knowledge of the metric system. State the difference between mass and weight. Manipulate the equation for density determination to solve for different variables. Convert between Celsius and Kelvin temperature scales. Construct conversion factors and use dimensional analysis from equivalent measurements. Use the mole concept in experimental calculations.

General Chemistry *Continued*	
Strand: Understands energy types, sources and conversions and their relationship to heat and temperature.	
Stem	GLE's (Grade Level Expectations)
ENERGY	Distinguish between kinetic and potential energy. State the law of conservation of mass energy. Determination of Specific Heat for a metal through laboratory experimentation. Using Charles Law and graphing techniques explain what is meant by absolute zero. Define heat and temperature. Explain how energy is involved in chemical reactions. In a laboratory setting distinguish between exothermic and endothermic reactions.

General Chemistry *Continued*	
Strand: Understands concepts of chemical bonding and formula synthesis.	
Stem	GLE's (Grade Level Expectations)
CHEMICAL BONDS	Define the terms cation and anion and show how they are related to the terms metal and nonmetal. Differentiate between ionic and covalent compounds. Understand the law of multiple proportions as an explanation to molecular formulas. Describe the characteristics of ionic and covalent compounds. Define the octet rule and the trends that families follow in forming ions. Explain what determines polar bonds. Using your electro negativity rules describe the difference between polar and nonpolar covalent compounds. Write names for ionic and molecular compounds. Identify the common shapes of molecules. Use models to recognize how the VSEPR Theory determines molecular shape. Determine empirical and molecular formulas.

General Chemistry *Continued*	
Strand: Understands predictions of a variety of chemical reactions and their associated stoichiometry.	
Stem	GLE's (Grade Level Expectations)
CHEMICAL REACTIONS	Identify the reactants and products in chemical reactions. Use appropriate symbols when writing an equation to accurately describe the chemical reaction. Balance and compose chemical reaction equations. Identify major types of reactions. Balance equations and predict products of certain reaction types. Perform stoichiometric calculations and predictions. Calculate limiting reagents and percent yields.
Strand: Understands solutions and their behaviors.	
Stem	GLE's (Grade Level Expectations)
SOLUTIONS	Explain the difference between saturation levels in a solution. Explain what is meant by the concentration of a solution. Define and work problems involving the molarity of a solution.

General Chemistry *Continued*	
Strand: Understands concepts of acids and bases.	
Stem	GLE's (Grade Level Expectations)
ACIDS and BASES	List properties of acids and bases. Write the equation for the self ionization of water. Classify solutions as neutral, acidic or basic. Determine the pH of a solution using laboratory techniques. State the Arrhenius, Brönsted-Lowry and Lewis definitions of an acid and a base. Using titration techniques in the laboratory determine the strength of an acid or base.
Strand/Big Idea: SPS1 - Scientific Inquiry and Critical Thinking. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies

General Chemistry *Continued*	
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.

General Chemistry *Continued*	
Strand/Big Idea: SPS2 - Unifying concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.

General Chemistry	
Models and Scale	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules. S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.

Geology	
Strand: Students will demonstrate understanding of the processes and evidence of Plate Tectonic Theory.	
Stem	GLE's (Grade Level Expectations)
PLATE TECTONICS *continued*	Relates Wegner's Theory of Continental Drift. Describes methodologies and evidence, e.g., puzzle fit, age of rock, fossil record, climate record, supporting Wegner's theory. Explain the theory of Continental Drift and provide evidence that supports that theory. Explain why Wegner's Theory of Continental Drift was dismissed. Give a brief history of Pangea, Gondwanaland, and Laurasia. Piece together continents at five different time periods using rock ages and fossil catalogues. Describe what evidence and what events gave rise to the theory of Plate Tectonics. Determine plate boundaries given earthquake and volcanic activity. Describe the Theory of Palate Tectonics. Use models and activities to describe and illustrate the three major plate boundary types. Use models and activities to describe the types of convergent plate boundaries: ocean to ocean, continent to continent, ocean to continent. Use models and activities to describe the types of divergent plate boundaries: ocean from ocean, continent from continent. Use models and activities to describe the transformation of plate boundaries. Give examples of each plate boundary type. Locate plate boundaries using earthquake location and depth. Describe how volcanic mountain ranges are formed by the interaction of plates. Discuss how folded faulted mountain ranges are formed by the interaction of plates. Explain how convection currents could move plates. Explain the concept of seafloor spreading and how it is proved by rock ages and magnetic records in rocks and by ocean sediments.

Geology - *Continued*	
PLATE TECTONICS	Define normal and reversed polarity. Explain how the position of continents has changed over the years and how it has effected the species of animals on the different continents. Explain how Plate Tectonic Theory changed scientists' thinking about the Earth's surface. Use maps and globes to identify surface features. Locate and describe the lithosphere and the asthenosphere and relate both to Plate Tectonics. Describe the differences in silica content and density between continental and ocean crust. Explain the difference between magma and lava, and describe the composition, properties, and behavior of mafic and felsic magmas and lavas. Discuss the occurrence of hot spots and the features associated with them. Use models of hot spots to determine plate movement and direction. Describe the active and passive continental margins and give examples of each.
Strand: Students will demonstrate knowledge of minerals. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
MINERALOGY *continued*	Define mineral and mineralology. . Distinguish the difference between intrusive (internal) and extrusive (External) mineral forming environments. Explain Bowen's Reaction Series. Describe the intrusive mineral forming environments: plutonic igneous, pegnatitic hot water vein, and metamorphic. Describe the extrusive mineral forming environments: ground water, weathering, and sedimentary. Classify minerals based upon chemical composition. Describe the following mineral groups: native elements, sulfide minerals, oxide minerals, halide minerals, carbonates, sulfates, phosphates, and silicates. Discuss how minerals can be identified using chemical and physical properties. List the eight elements by weight in the Earth's crust (97%).

Geology - *Continued*	
MINERALOGY	List the four elements that comprise 90% of the Earth. Describe the special physical properties that can be used to identify minerals: double refraction, magnetism, taste, chemical reaction, fluorescence, phosphorescence, odor, feel and striation. Describe the common physical properties that can be used to identify minerals: hardness, luster, color, tenacity, fractive, cleavage, crystal habit, crystal aggregates, and specific gravity. Use tools to determine a mineral's physical properties. Identify minerals using special and common physical properties and appropriate identification charts. Identify common rock-forming minerals. Discuss the economic importance of various minerals.
Strand: Students will demonstrate knowledge of rocks. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
ROCKS *continued*	Define rock and petrology. Define igneous rock. Illustrate and define the rock cycle. Examine the formation of igneous rocks and describe the environments in which they form. Describe and illustrate intrusive (plutonic) features: Batholith, laccolith, stock, sill, dike. Describe and illustrate extrusive (volcanic) features: Volcano, volcanic neck, lava plateau. Recognize the different igneous texture types: Aphanitic, phaneritic, glassy, and vesicular. Recognize the different igneous compositions: Felsic and mafic. Identify igneous rocks using texture type, composition, and appropriate charts. Define metamorphic rock. Describe the metamorphic rock forming environments: Contact and regional metamorphism. Discuss how the amount of metamorphism alters the pre-existing rock.

Geology - *Continued*	
ROCKS	Explain and give examples of the metamorphic process of re-crystallization, chemical recombination, and chemical replacement. Define foliated and non-foliated texture types. Explain the relationship between texture type and environment. Distinguish between and identify gneissic, schistose phyllitic, and salty foliated textures. Identify metamorphic rocks using texture type, composition, parent rock and appropriate charts. Define sedimentary rock. Explain and give examples of all the sedimentary rock forming environments: Marine, transitional, continental, and replacement. Describe and find examples of mechanic and chemical weathering. Describe, illustrate and identify sedimentary structures, such as bedding, mud cracks, ripple marks, cross bedding, cut and fill, nodules, concretions, and geodes. Distinguish between porosity and permeability. Define lithification and describe how cementation, compaction, desiccation, and re-crystallization form sedimentary rocks. Explain how materials carried in suspension are deposited differently than materials carried in solution. Distinguish and identify clastic and nonclastic texture types. Identify sedimentary rocks using texture, grain size, composition and appropriate charts.
Strand: Students will demonstrate skill in using maps in geological contexts. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
MAPS and MAPPING *continued*	Define map and cartography. Identify common characteristics of all maps. Use activities to identify map projection types: Sheet, cone, cylinder. Use activities to illustrate the difficulties of showing the features of a spherical surface on a flat map.

MAPS and MAPPING	Locate points on a map using latitude and longitude. Locate points on a map using township and range, compass direction from a landmark, and grid systems. Determine distances on a map using graphic, verbal, and proportional scales. Define topography and topographic map. Construct topographic maps from elevation data. Visualize topographic maps in three dimensions. Define contour line and contour interval. Explain why different maps have different contour intervals. Determine topographical features by interpretation of contour lines. Use the rule of Vs to determine flow direction of rivers. Use contour lines to determine elevation of points on a map. Describe uses of topographic maps. Construct cross sections (profiles) of topographic maps. Locate geologic features on a map through the interpretation of contour lines. Use symbols to identify man-made features on topographic maps. Examine USGS topographic maps in detail and prepare a presentation to classmates. Define geologic map. Describe how a geologic map is made. Construct and interpret a topographic profile, geologic cross-section, and geologic column using a geologic map. Use map symbols to identify and interpret geologic features. Recognize uses of geologic maps. Use map symbols of rock types. Determine and interpret geologic features and structures on geologic maps: Faults, folds, glaciers, drainage systems.

Geology – *Continued*	
Strand: Students will demonstrate knowledge of mountains and mountain building.	
Stem	GLE's (Grade Level Expectations)
MOUNTAIN BUILDING	Identify and classify major features of the Earth's crust. Recognize the basic types of geologic mountains: Folded, fault block, dome, volcanic, and complex. Examine the origin and erosive process at work on mountains. Locate on a map or globe the major mountain systems of the world. Predict the location of new mountain systems. Describe how folds are formed. Label parts of a fold. Describe and illustrate anticlines and synclines. Distinguish between symmetrical, asymmetrical, overturned and recumbent folds. Describe and illustrate plunging and double plunging folds. Identify and locate all fold types using a geologic map. Define strike and dip. Interpret strike and dip data and draw conclusions about geologic features. Construct geologic maps and cross sections of all folds using geologic maps. Discuss how folds can build mountains. Define fault. Define and illustrate reverse, normal, and strike slip faults. Discuss if the crust is lengthened, shortened, or neither. Explain tensional, compressional and shear forces. Identify and locate all fault types on geologic maps. Discuss how faults can build mountains. Construct geologic cross sections of all faults using geologic maps.

Geology – *Continued*	
Strand: Students will demonstrate knowledge of glaciation.	
Stem	GLE's (Grade Level Expectations)
GLACIATION	Examine the mechanics of glacial development. Investigate the conditions necessary for glacial formation. Identify methods of glacial erosion. Describe the formation and characteristics of various glacial erosion features. Describe the variety of load carried by glaciers. Identify and classify the three ways glacial materials are deposited. Describe the formation and characteristics of various glacial deposition features. Identify characteristics of valley and continental glaciers. Locate present valley and continental glaciers. Examine past glacial activity. Cite evidence for past worldwide glaciation. Recognize that glaciation occurs in cycles. Locate the geographic extent of the Pleistocene ice sheets. Examine the effects of the Pleistocene ice sheets on landscape and life.

Geology – *Continued*	
Strand: Students will demonstrate knowledge of running water, its characteristics, and erosive effects.	
Stem	GLE's (Grade Level Expectations)
WATER and EROSION	Identify sources of running water. Recognize the types of stream erosion and stream flow. Examine factors affecting the energy of stream flow. Distinguish between methods of transportation of stream load. Classify ad describe depositional features. Examine the development of drainage systems. Describe and classify various drainage patterns. Investigate stream valley development. Examine types of stream valleys.
Strand: Students will demonstrate knowledge of the process of weathering.	
Stem	GLE's (Grade Level Expectations)
WEATHERING	Recognize the factors that create different types of climates. Examine and classify various forms of physical and chemical weathering. Identify various factors that influence weathering. Identify some problems associated with weathering.

Geology – *Continued*	
Strand: Students will demonstrate knowledge of volcanoes, volcanic activity, and volcanic products.	
Stem	GLE's (Grade Level Expectations)
VOLCANOES	Identify the various locations within the Earth where magma may originate. Classify various volcanic products as to structure and origin. Examine and identify various volcanic products. Review intrusive igneous structures and their products. Recognize major volcanic structures. Examine the variety of features found in volcanic rocks. Distinguish between the stages of development of a volcanic region. Relate volcanic activity to its effects, positive and negative, on people.
Strand: Students will demonstrate knowledge of the causes and effects of earthquakes.	
Stem	GLE's (Grade Level Expectations)
EARTH QUAKES	Identify the causes of earthquakes. Describe the effects of earthquakes. Compute the location of an earthquake's epicenter. Use the major earthquake measurement scales. Recognize the possible ways that earthquakes can be predicted.

Geology – *Continued*	
Strand/Big Idea: SPS1 – Scientific Inquiry and Critical Thinking	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.

Geology – *Continued*	
Strand/Big Idea: SPS2 – Unifying Concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
Models and Scale	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.

Geology	
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.

Human Biology	
Standard: Students will demonstrate an increasing awareness of the interdependence of all human body systems as it relates to the entire human being.	
Stem	GLE's (Grade Level Expectations)
Interdependence	Describe/explain homeostasis (the maintenance of internal stability within the human body), i.e. regulation and communication between parts of the body on a microcellular and macro cellular scale. Describe in the human body how structure determines function in various tissue types. Investigate how the different systems of the human body are interrelated, e.g. nervous system, digestive system, endocrine system, etc. Explain the role DNA plays in controlling cell function and in diagnostics.
Standard: Students will demonstrate an increasing knowledge of anatomical, spatial and directional terminology.	
Stem	GLE's (Grade Level Expectations)
Terminology .	Students will demonstrate the ability to understand and accurately use medical terms correctly. Create and demonstrate anatomical position. Describe using directional terminology where one part of the body is located in relationship to another part. Demonstrate the use of anatomical reference points during dissection.

Human Biology *Continued*	
Standard: Students will demonstrate an increasing understanding of the mechanisms of disease.	
Stem	GLE's (Grade Level Expectations)
Disease	Students will describe various disorders and their pathologies. Predict based upon data given the cause of various medical abnormalities. Discuss the advantages and disadvantages of various diagnostics methodologies used. Formulate questions and use the appropriate concepts to guide scientific investigations to solve real world health problems.
Standard: Students will demonstrate an increasing understanding of the fundamentals of biochemistry.	
Stem	GLE's (Grade Level Expectations)
Biochemistry	Recognize the lock and key mechanism involved in enzyme action. Describe how catalysts and ions influence cellular activity. Can recognize the acid/base relationship in buffer systems. Identify anaerobic and aerobic pathways in cellular respiration.

Human Biology *Continued*	
Standard: Students will demonstrate an increasing awareness of human anatomy.	
Stem	GLE's (Grade Level Expectations)
Dissection and Anatomy	Perform various dissections, comparing and contrasting the specimen to the human body. Recognize various organs in relationship to the system that they belong to in the human body. Compare dissected organs and their individual structures to the human body. Use proper dissecting technique. Relate lab experience to the concepts covered in class. Demonstrate their knowledge of the human body through lab practicals.
Strand/Big Idea: SPS1 - Scientific Inquiry and Critical Thinking (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.

Human Biology *Continued*	
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units
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Strand/Big Idea: SPS2 - Unifying Concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.

Human Biology *Continued*	
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
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Human Biology	
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Lab and Field Science	
Standard (1 of 3): Students will demonstrate an increasing ability to understand that the Earth is a unique member of our solar system, located in a galaxy, within the universe.	
Stem	GLE's (Grade Level Expectations)
Earth and Space Science (1 of 3)	Use a model to describe the location and motion of the Earth and its Moon in the solar system.
Standard (2 of 3): Students will demonstrate an increasing ability to understand that the Earth is a complex planet with five interacting systems, which consists of solid Earth (lithosphere), air (atmosphere), water (hydrosphere), ice (cryosphere), and life (biosphere).	
Stem	GLE's (Grade Level Expectations)
Earth and Space Science (2 of 3)	Use maps and globes to identify surface features of the Earth. Identify soil conservation methods. Identify the composition and physical characteristics of the atmosphere. Explain the roles of water and weather in distributing the Sun's heat energy. Explain weather-related phenomena such as thunderstorms, tornados, hurricanes, drought, or acid precipitation. Use a variety of weather measurement instruments and recording methods such as barometers, anemometers, and charts. Relate observed weather conditions to large and small scale weather systems, e.g. highs, lows, and fronts. Demonstrate how living things alter the Earth's atmosphere, lithosphere, and hydrosphere

Lab and Field Science *Continued*	
Standard (3 of 3): Students will demonstrate an increasing ability to understand that the Earth contains a variety of renewable and non-renewable resources.	
Stem	GLE's (Grade Level Expectations)
Earth and Space Science (3 of 3)	Investigate how human activities, such as reducing the amount of forest cover and increasing the amount and variety of chemicals released into the atmosphere have changed the Earth's land, ocean, and atmosphere. Cite evidence that our fresh water supply is essential for life and also for most industrial processes. Describe possible consequences of reducing or eliminating some of the Earth's natural resources. Identify natural, as well as human-induced, factors which contribute to changes in the Earth's systems.
Standard (1 of 2): Students will demonstrate an increasing ability to distinguish among materials by utilizing observable properties.	
Stem	GLE's (Grade Level Expectations)
Physical Science (1 of 2)	Obtain reliable and valid quantitative data through careful and skilled use of measuring instruments, e.g. balances, graduated cylinders, computer probes. Distinguish between qualitative and quantitative properties based upon observations of a substance. Experiment to determine specific properties of substances that are useful in identification of the substance such as density, acidity, corrosiveness, strength, stretch ability, melting point or solubility.

Lab and Field Science *Continued*

Standards (2 of 2): Students will demonstrate an increasing understanding that energy can be transmitted by waves, using light and sound as examples.

Stem	GLE's (Grade Level Expectations)
Physical Science (2 of 2)	Distinguish among amplitude, wave length and frequency of longitudinal and transverse waves. Identify and distinguish among the various forms of electromagnetic radiation, e.g. visible light, microwaves, X-rays.

Standard: Content Standard: Students will demonstrate an increasing ability to understand how environmental factors affect all living systems (i.e. individuals, community, biome, the biosphere) as well as species to species interactions.

Stem	GLE's (Grade Level Expectations)
Life Science	Design a controlled investigation that demonstrates the interdependence of plants and animals found within a specific New Hampshire ecosystem, e.g. forest, seashore, lake, river, stream. Trace the history of an interaction between mans and the environment that demonstrates how human activities can deliberately or inadvertently alter the equilibrium in an ecosystem.

Strand/Big Idea: SPS1 - Scientific Inquiry and Critical Thinking (cont. next page)

Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms. S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose. S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.

Lab and Field Science *Continued*	
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses. S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.

Lab and Field Science *Continued*	
Strand/Big Idea: SPS2 - Unifying Concepts of Science (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how things work in the world but not to absolute truth.

Lab and Field Science	
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
Models and Scale	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules.

Physical Science	
Strand (1 of 2): All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
COMPOSITION (1 of 2)	Recognize and describe the structure of an atom and explain how the major components interact with one another. Recognize how elements are arranged in the periodic table, and explain how this arrangement illustrates the repeating patterns among elements with similar properties, such as the relationship between atomic number and atomic mass. Explain that neutrons and protons are made up of even smaller constituents. Define isotopes, recognize that most elements have two or more isotopes, and explain that although the number of neutrons has little affect on how the atom interacts with others, they do affect the mass and stability of the nucleus. Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that changed our understanding of the atom and the development of atomic theory. Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms.

Physical Science *Continued*	
Strand (2 of 2): All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).	
Stem	GLE's (Grade Level Expectations)
PROPERTIES *(2 of 2)*	Explain that the physical properties of a compound are determined by its molecular structure and the interactions among the molecules. Determine whether an atom is either electrically neutral or an ion by referring to the its number of electrons. Explain how the chemical properties of an element are governed by the electron configuration of atoms, and describe how atoms interact with one another by transferring or sharing the outermost electrons. Explain that radioactive materials are unstable and undergo spontaneous nuclear reactions, which emit particles and/or wavelike radiation. (Not addressed through PLATO) Explain that states of matter rely on the arrangement and motion of molecules, and differentiate between the structures of solids, liquids, and gases. Use physical and chemical properties as determined through an investigation to identify a substance. Explain how properties of elements and the location of elements on the periodic table are related.

Physical Science *Continued*	
Strand (1 of 3): Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.	
Stem	GLE's (Grade Level Expectations)
CHANGE *(1 of 3)*	Recognize and explain that atoms may be bonded together into molecules or formula units (crystalline solids). Recognize that atoms interact with one another by transferring or sharing electrons that are furthest from the nucleus and explain that the outer electrons govern the chemical properties of an element. Explain that compounds are formed through both ionic and covalent bonding. Recognize that the rates of chemical reactions can vary greatly, and identify the factors that influence these reaction rates, such as how often the reacting atoms and molecules encounter one another, the temperature, and the properties of the reacting species, including shape. Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.

Physical Science *Continued*	
Strand (2 of 3): Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.	
Stem	GLE's (Grade Level Expectations)
CONSERVATION *(2 of 3)*	Explain that chemical reactions either release or consume energy. Explain that chemical reactions can be accelerated by catalysts, such as enzymes. Recognize that a large number of important reactions involve the transfer of either electrons or hydrogen ions between reacting ions, molecules, or atoms. Identify the variety of structures that may be formed from the bonding of carbon atoms, and describe their roles in various chemical reactions, including those required for life processes. Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and physical systems)

Physical Science *Continued*	
Strand (3 of 3): Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.	
Stem	GLE's (Grade Level Expectations)
ENERGY *(3 of 3)*	Explain that all energy can be considered to be either kinetic energy, potential energy, or energy contained by a field. Provide examples of how kinetic and potential energy can be transformed from one to the other. Describe how the energy associated with individual atoms and molecules can be used to identify the substances they comprise; and explain that each kind of atom or molecule can gain or lose energy only in particular discrete amounts, absorbing and emitting light only at wavelengths corresponding to these amounts. Explain the range of the electromagnetic spectrum as it relates to both wavelength and energy, and provide examples of practical applications of the different wavelengths in the spectrum. Recognize that the human eye can only see a narrow range of wavelengths within the electromagnetic spectrum; and explain how the variations of wavelength within that range of visible light are perceived as differences in color. Describe the relationship between heat and temperature, explaining that heat energy consists of the random motion and vibrations of atoms, molecules, and ions and that the higher the temperature, the greater the atomic or molecular motion. Explain that waves, such as light, seismic, sound waves, have energy and can transfer energy when they interact with matter. Explain that nuclear reactions convert a fraction of the mass of interacting particles into energy and release much greater amounts of energy than atomic interactions. Describe how electrons flow easily in some materials, such as metals, whereas in insulating materials, such as glass, they can hardly flow at all. Using information provided about chemical changes, draw conclusions about the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions)

Physical Science *Continued*	
Strand (1 of 2): The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
FORCES *(1 of 2)*	Explain that magnetic forces are related to the action of electrons and can be thought of as different aspects of a single electromagnetic force; and describe how the interplay of these forces is the basis for electric motors, generators, radio, television, and many other modern technologies. Recognize that the strength of the electric force between two charged objects is proportional to the charges and, as with gravitation, is inversely proportional to the square of the distance between them. Recognize that the strength of the gravitational force between two masses is proportional to the masses and inversely proportional to the square of the distance between them. Compare the strength of nuclear, electromagnetic and gravitational forces; and explain that the strength of nuclear forces account for the great amounts of energy released from the nuclear reactions in atomic or hydrogen bombs, and in the Sun and other stars. Recognize that electromagnetic forces exist within and between atoms. Recognize that different kinds of materials respond to electric forces in various ways, and differentiate between insulators, semiconductors, conductors and superconductors. Recognize that different kinds of materials respond to electric forces in various ways, and differentiate between insulators, semiconductors, conductors and superconductors. Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, acceleration to predict and explain the motion of objects.

Physical Science *Continued*	
Strand (2 of 2): The motion of an object is affected by force.	
Stem	GLE's (Grade Level Expectations)
MOTION *(2 of 2)*	Interpret and apply the laws of motion to determine the effects of forces on the motion of objects. Recognize that apparent changes in wavelength can provide information about changes in motion, explain that the observed wavelength of a wave depends upon the relative motion of the source and the observer, and relates these to the differences between shorter and longer wavelengths. Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky).

Physical Science *Continued*	
Strand (1 of 3): The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
DESIGN TECHNOLOGY *(1 of 3)*	Recognize the basic principles of energy, work and power are related to design technology.
Strand (2 of 3): The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
TOOLS *(2 of 3)*	Identify tools, such as thermostats and thermal sensors, and explain their use in environmental control systems.

Physical Science *Continued*	
Strand (3 of 3): The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.	
Stem	GLE's (Grade Level Expectations)
SOCIAL ISSUES: ENERGY, POWER and TRANSPORTATION *(3 of 3)*	Explain that power systems have a source of energy, a process, loads, and some have a feedback system. Demonstrate and explain how an engine converts chemical energy in the form of fuel, into mechanical energy in the form of motion. Calculate the efficiency of an engine, and explain why a perfectly efficient engine is impossible. Explain the relationship between energy and power. Explain the benefits of standardization of parts.

Physical Science *Continued*	
Strand/Big Idea: SPS1 - Scientific Inquiry and Critical Thinking	
Stem	GLE's (Grade Level Expectations)
Making Observations and Asking Questions	S:SPS1:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot. S:SPS1:11:1.2 Use complex classification criteria and keys to identify items/organisms S:SPS1:11:1.3 Evaluate complex methods of classification for a specific purpose S:SPS1:11:1.4 Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies
Designing Scientific Investigations	S:SPS1:11:2.1 Apply scientific theories and laws to new situations to generate hypotheses S:SPS1:11:2.2 State a hypothesis and prediction based on available evidence and background information.
Conducting Scientific Investigations	S:SPS1:11:3.1 Select and use apparatus and material safely. S:SPS1:11:3.2 Use instruments effectively and accurately for collecting data. S:SPS1:11:3.3 Compile and organize data, using appropriate units.
Representing and Understanding Results of Investigations	S:SPS1:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.
Evaluating Scientific Explanations	S:SPS1:11:5.1 Explain how data support or refute the hypothesis or prediction. S:SPS1:11:5.2 Provide a statement that addresses and answers the question investigated in light of the evidence generated in the investigation.

Physical Science *Continued*	
Strand/Big Idea: SPS1 – Unifying Concepts of Science. (cont. next page)	
Stem	GLE's (Grade Level Expectations)
Nature of Science	S:SPS2:11:1.1 Explore new phenomena through investigations conducted for different reasons, or to check on previous results. S:SPS2:11:1.2 Test how well a theory predicts a phenomena. S:SPS2:11:1.3 Recognize that sometimes scientists can control conditions in order to focus on the effect of a single variable; when that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. S:SPS2:11:1.4 Show how hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available). S:SPS2:11:1.5 Understand that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings. S:SPS2:11:1.6 Show how the usefulness of a model can be tested by comparing its predictions to actual observations in the real world; but a close match does not mean that the model is the only "true" model or the one that would work. S:SPS2:11:1.7 Realize that in science, the testing, revising, and occasional discarding of theories, new and old, never ends; this ongoing process leads to an increasingly better understanding of how.
Systems and Energy	S:SPS2:11:2.1 Realize that systems may be so closely related that there is no way to draw boundaries that separate all parts of one from all parts of the others. S:SPS2:11:2.2 Give examples to show that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts. S:SPS2:11:2.3 Demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
Models and Scale	S:SPS2:11:3.1 Understand that the basic idea of mathematical modeling is to find a mathematical relationship that behaves in the same way as the objects or processes under investigation; a mathematical model may give insight about how something really works or may fit observations very well without any intuitive meaning.

Physical Science	
Patterns of Change	S:SPS2:11:4.1 Recognize that things can change in detail, but remain the same in general (e.g., the players change but the team remains, the cells are replaced but the organism remains); sometimes counterbalancing changes are necessary for a thing to retain its essential constancy in the presence of changing conditions. S:SPS2:11:4.2 Describe how graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change. S:SPS2:11:4.3 Give examples of how a system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small; but large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium. S:SPS2:11:4.4 Describe how in evolutionary change, the present arises from the materials and forms of the past, more or less gradually, and in ways that can be explained.
Form and Function	S:SPS2:11:5.1 Explore how the movement of ocean floor plates under continental plates or two continental plates moving against each other can deform the earth's surface. S:SPS2:11:5.2 Provide data and evidence on how folding in crustal plates can cause mountain ranges. S:SPS2:11:5.3 Understand that an atom's electron configuration determines how the atom can interact with other atoms. S:SPS2:11:5.4 Provide examples of how configuration of atoms in a molecule determines a molecule's properties. S:SPS2:11:5.5 Discover how the shape of large molecules affects the interaction with other molecules. S:SPS2:11:5.6 Demonstrate that a variety of biological, chemical and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules.