

Grades 5–6 Science Stems and Expectations

Earth and Space Science

ESS1 - The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.

1. **ATMOSPHERE, CLIMATE, & WEATHER**
 - 1) Describe and make predictions about local and regional weather conditions using observation and data collection methods;
 - 2) Identify weather patterns by tracking weather related events, such as hurricanes.
 - 3) Explain the composition and structure of the Earth's atmosphere;
 - 4) Describe weather in terms of temperature, wind speed and direction, precipitation, and cloud cover;
 - 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.
2. **COMPOSITION AND FEATURES OF EARTH MATERIALS**
 - 1) Differentiate between renewable and non-renewable resources;
 - 2) Describe and define the different landforms on the Earth's surface, such as coastlines, rivers, mountains, deltas, canyons, etc.;
 - 3) Identify and distinguish between various landforms, using a map and/or digital images.
3. **FOSSILS**
 - 1) Recognize that fossils provide important evidence relating to changes in life forms and environmental conditions over geologic time;
 - 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.
4. **OBSERVATION OF EARTH FROM SPACE**
 - 1) Recognize that images taken of the Earth from space can show its features, and any changes in those features that appear over time;
 - 2) Explain that satellites can be used to view and track storms and Earth events, such as hurricanes and wild fires.
5. **PROCESSES AND RATES OF CHANGE OF THE EARTH'S SURFACE**
 - 1) Recognize that things change in steady, repetitive, or irregular ways, or sometimes, in more than one way at the same time;
 - 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;
 - 3) Recognize that vibrations in materials set up wavelike disturbances that spread away from the source, as with earthquakes.
6. **ROCK CYCLE**
 - 1) Explain how soil is formed from combinations of weathered rock and decomposed plant and animal remains, and that it contains living organisms.
 - 2) Identify the components of soil and other factors, such as bacteria, fungi and worms, that influence its texture, fertility, and resistance to erosion;
 - 3) Describe the properties of soil, such as color, texture, capacity to retain water, and its ability to support plant life;

7. WATER AND THE EARTH'S SURFACE

- 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.
 - 2) Explain that water quality has a direct effect on Earth's life forms.
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ESS2 - The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.

1. THE EARTH, SUN AND MOON

- 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.
- 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.

2. ENERGY

- 1) Recognize how the tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns;
- 2) Identify and describe seasonal, daylight and weather patterns as they relate to energy.

3. SOLAR SYSTEM

None at this grade span.

4. VIEW FROM EARTH

- 1) Explain the historical perspective of planetary exploration and man's achievements in space, beginning with Russia's Sputnik mission in 1957;
 - 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.
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ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.

1. SIZE AND SCALE

None at this grade span.

2. STARS AND GALAXIES

None at this grade span.

3. UNIVERSE

None at this grade span.

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.

1. DESIGN TECHNOLOGY
 - 1) Understand that technology is used to design tools that improve our ability to measure and observe the world.
 2. TOOLS
 - 1) Recognize that satellites and Doppler radar can be used to observe or predict the weather.
 - 2) Employ knowledge of basic weather symbols to read and interpret weather and topographic maps.
 - 3) Read and interpret data from barometers, sling psychrometers and anemometers.
 3. SOCIAL ISSUES (LOCAL AND GLOBAL)
USES OF EARTH MATERIALS
 - 1) Provide examples of products that man has developed which have humans do things that they could not do otherwise, and identify the natural materials used to produce these products.
 - 2) Identify the most appropriate materials for a given design task with requirements for specific properties, such as weight, strength, hardness, and flexibility.
ENVIRONMENTAL CHANGE
 - 3) Provide examples of how to reduce waste through conservation, recycling, and reuse.
 4. CAREER TECHNICAL EDUCATION CONNECTIONS
 - 1) Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of Earth science.
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Life Science

LS 1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

1. CLASSIFICATION
 - 1) Identify ways in which living things can be grouped and organized, such as taxonomic groups of plants, animals and fungi.
 - 2) Categorize organisms into kingdoms according to their shared characteristics.
2. LIVING THINGS AND ORGANIZATION
 - 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.
 - 2) Explain that the way in which cells function is similar in all organisms.

- 3) Recognize that cells use energy, which they obtain from food, to conduct the functions necessary to sustain life, such as cell growth.
 - 4) Recognize and describe the hierarchical organization of living systems, including cells, tissues, organs, organ systems, whole organisms, and ecosystems.
 - 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.
 - 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.
3. REPRODUCTION
- 1) Explain that cells repeatedly divide to make more cells for growth and repair.
 - 2) Explain that the same genetic information is copied in each cell of a new organism.
 - 3) Recognize that reproduction is a characteristic of all living things and is essential to the continuation of a species.
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LS 2 – Energy flows and matter recycles through an ecosystem.

1. ENVIRONMENT
- 1) Identify and describe the factors that affect the number and types of organisms an ecosystem can support, including the resources that are available, the range of temperatures, the composition of the soil, disease, the threat of predators, and competition from other organisms.
 - 2) Explain that most microorganisms do not cause disease and that many are beneficial to the environment.
2. FLOW OF ENERGY AND RECYCLING OF MATERIALS
- 1) Describe how energy is transferred through food webs in an ecosystem, and explain the roles and relationships between producers, consumers and decomposers.
 - 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.
 - 3) Describe the process of photosynthesis and explain that plants can use the food they make immediately or store it for later use.
 - 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.
3. RECYCLING OF MATERIALS
- 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.
 - 2) Identify and describe the ways in which organisms interact and depend on one another in an ecosystem, using food webs.
 - 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.
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LS 3 – Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry).

Proficiency Targets for NECAP Assessment are designated as *boxed and italicized* on the Grade 7 – 8 Stems and Proficiencies.

1. CHANGE
 - 1) Provide examples of how all organisms, including humans, impact their environment and explain how some changes can be detrimental to other organisms.
 - 2) Explain how changes in environmental conditions can affect the survival of individual organisms and the entire species.
 2. EVIDENCE OF EVOLUTION
 - 1) Describe the fundamental concepts related to biological evolution, such as biological adaptations and the diversity of species.
 3. NATURAL SELECTION
 - 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.
 - 2) Recognize that only organisms that are able to reproduce can pass on their genetic information to the next generation.
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LS4 – Humans are similar to other species in many ways, and yet are unique among Earth’s life forms.

1. BEHAVIOR
 - 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.
 - 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.
 - 3) Provide examples of how humans make judgments about new situations based on memories of past experiences.
 2. DISEASE
 - 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.
 - 2) Recognize that there are some diseases that human beings can only get once, and explain how many diseases can be prevented by vaccination.
 - 3) Explain how vaccines induce the body to build immunity to a disease without actually causing the disease itself.
 - 4) Recognize a healthy body cannot fight all germs that invade it, and explain how some germs interfere with the body’s defenses.
 3. HUMAN IDENTITY
 - 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.
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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.

1. DESIGN TECHNOLOGY

- 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.

2. TOOLS

- 1) Demonstrate the appropriate use of tools, such as thermometers, probes, microscopes and computers to gather, analyze and interpret data in the life sciences.

3. SOCIAL ISSUES (LOCAL AND GLOBAL)

MEDICAL TECHNOLOGIES

- 1) Provide examples of early health care technology that helped to extend the life expectancy of humans, such as the discovery of penicillin, sterilization of surgical instruments.
- 2) Differentiate between vaccines, which help prevent diseases from developing and spreading, and medicines, which relieve symptoms or cure diseases.
- 3) Recognize that the quality of personal health can be influenced by society and technology.

BIOTECHNOLOGIES

- 4) Identify and describe some of the processes and systems used to grow food in New Hampshire, including irrigation, pest control and harvesting.

4. CAREER AND TECHNICAL EDUCATION CONNECTIONS

- 1) Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of life science.
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Physical Science

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).

1. COMPOSITION

- 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.
- 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.
- 3) Recognize that over one hundred elements exist, and identify the periodic table as a tool for organizing the information about them.

2. PROPERTIES

- 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.

Proficiency Targets for NECAP Assessment are designated as ***boxed and italicized*** on the Grade 7 – 8 Stems and Proficiencies.

- 2) Identify substances by their physical and chemical properties, such as magnetism, conductivity, density, solubility, boiling and melting points.
 - 3) Differentiate between weight and mass.
 - 4) Identify energy as a property of many substances.
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PS2 – Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.

1. CHANGE
 - 1) Differentiate between a physical change, such as melting, and a chemical change, such as rusting.
 2. CONSERVATION
 - 1) Describe how mass remains constant in a closed system and provide examples relating to both physical and chemical change.
 3. ENERGY
 - 1) Explain that the pitch of a sound is dependent on the frequency of the vibration producing it.
 - 2) Explain that sound vibrations move at different speeds, have different wavelengths and establish wave-like disturbances that emanate from the source.
 - 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.
 - 4) Explain that heat energy moves from warmer materials or regions to cooler ones through conduction, convection, and radiation.
 - 5) Explain how electrical circuits can be used to transfer energy in order to produce heat, light, sound, and chemical changes.
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PS3 – The motion of an object is affected by force.

1. FORCES
 - 1) Recognize that just as electric currents can produce magnetic forces, magnets can cause electric currents.
 - 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.
 - 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.
 2. MOTION
 - 1) Explain the how balanced and unbalanced forces are related to an object's motion.
 - 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.
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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.

1. DESIGN TECHNOLOGY

- 1) Understand that scientific principles are used in the design of technology.

2. TOOLS

- 1) Recognize that manufacturing processes use a variety of tools and machines to separate, form, combine and condition natural and synthetic materials.

3. SOCIAL ISSUES (LOCAL & GLOBAL)

ENERGY, POWER AND TRANSPORTATION

- 1) Explain how a battery changes chemical energy into electrical energy.
- 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.

MANUFACTURING

- 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.

4. CAREER TECHNICAL EDUCATION CONNECTIONS

- 1) Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of physical science.