EXTENDED LEARNING MODULES

STUDENT PACKET

GRADE 8

14: STUDY GUIDE AND ASSESSMENT

OFFICE OF ACADEMICS AND TRANSFORMATION

2012 – 2013
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INTRODUCTION

The purpose of this document is to provide students with an enhancement tutorial session to expand and enrich their in-depth content knowledge of the Annually Assessed Benchmarks, and using aligned FCAT items, expand the student skills and ability to respond to FCAT items.

It is important that students have an in-depth discussion of all choices for every question. The teachers should facilitate a discussion of all choices for every question. The students should understand why the wrong choices are wrong and what makes the correct choice, the right one.

As always, teachers are encouraged to generate an inquiry-based environment where students grow in scientific thinking while creating and responding to higher-order questions.

Assessment Review Protocol

1. Students should respond to the items individually.
2. Review answer selections by asking students to raise their hands or a pre-prepared index card with the letter representing their responses.
3. Place the number of responses next to the letter selection.
4. Review each answer choice and eliminate the ones that are incorrect with a discussion as to why that selection is incorrect. Draw a line through the incorrect choices and write the reason why beside it. Note: Show calculations for gridded response items.
5. Ask students to correct their papers and indicate reasons why the selection is the best answer.
Big Ideas and Background Information

BIG IDEA 1: THE PRACTICE OF SCIENCE

A. Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.

B. The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."

C. Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.

D. Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations.

Science is not just a list of facts and laws. Science is always in motion. One of the principles of scientific study is that knowledge is available to all people and any scientific study is open to criticism or testing by other scientists.

No scientific knowledge provides the whole “truth.” Instead, knowledge is tested and added to what scientists have learned in the past. This is why the efforts of scientists that made observations hundreds and even thousands of years ago are still very important. When a scientist makes a discovery, it is usually termed that he or she is “standing on the shoulders of giants.” This means that the scientist could not have made this discovery without using the knowledge gained by many scientists in the past.

Another way that past scientific knowledge is important is because it allows new scientists to look at older studies and knowledge with fresh perspective. Many scientific discoveries are made by scientists who study older scientific theories and then offer new ideas.

Sarah, I want you to REPPLICATE Jorge’s experiment to see if you get the same results.

Replication – by others

http://depositphotos.com
Scientists use controlled experiments to test ideas and hypotheses. A controlled experiment seeks to keep all factors, or variables, the same except for the factor that is being tested. All the parts of the experiment that must stay constant are called constant variables. If constant variables are allowed to change, the results of the experiment may not be valid.

The test variable/independent variable is the factor that the scientist changes in order to test the hypothesis. For example, if a scientist wants to test whether a certain type of fuel releases less air pollution in a car, the fuel type is the independent variable. To test this, the scientist needs to control the other variables, such as the type of car, the amount of fuel used, etc.

The outcome variable/dependent variable is the factor that is measured by the scientist. In the example above, the amount of air pollution released by the cars using different fuels is the dependent variable.

BIG IDEA 2: THE CHARACTERISTICS OF SCIENTIFIC KNOWLEDGE

A. Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.

B. Scientific knowledge is durable and robust, but open to change.

C. Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery.

It is important for all scientists to keep honest records of their investigations and to report their findings. Scientists must provide all of the data they collected, even if it does not support their hypothesis.

It is also important for other scientists to review the investigation and make criticisms. For this reason, a scientific investigation is not considered valid until it has been published in a reputable science magazine. At that point, other scientists can determine if the
investigation was conducted correctly and if the data was interpreted in a fair way. Other scientists may also conduct the investigation for themselves to see if they get similar results.

Scientists who do not keep good records or are not honest about data are not conducting good science. Their results cannot be trusted, and may create confusion or errors.

**BIG IDEA 3: THE ROLE OF THEORIES, LAWS, HYPOTHESES, AND MODELS**

The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science.

**BIG IDEA 4: SCIENCE AND SOCIETY**

As tomorrow's citizens, students should be able to identify issues about which society could provide input, formulate scientifically investigable questions about those issues, construct investigations of their questions, collect and evaluate data from their investigations, and develop scientific recommendations based upon their findings.

**BIG IDEA 5: EARTH IN SPACE AND TIME**

The origin and eventual fate of the Universe still remains one of the greatest questions in science. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the planetary systems, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of the nature of the Universe.

The solar system is made up of all the objects that orbit
our Sun. The Sun is easily the largest object in the solar system.

To the right is an image that shows the relative sizes of the planets and the Sun.

The moons of each planet are much smaller than the planets themselves. Almost all moons are thought to come from the same material as the planets they orbit. Remember that most of the inner planets in our solar system are small and rocky, while most of the outer planets are very large and are made of gases.

**Earth-Sun-Moon Interactions: Moon Phases and Tides**

[Diagram of Earth-Sun-Moon interactions]

http://www.museumscience.org/oceans/motion/tides.html
All stars in our universe are basically made of hydrogen that is fusing to become helium. However, stars can be different sizes, colors, temperatures, and ages. They often have different characteristics because of these differences. The color of a star varies from red to blue, as the star becomes hotter. Our sun is a very average star in most respects. It is slightly above average in size. The smallest stars may be as small as $\frac{1}{12}$th the size of our sun and the largest may be thousands of times as massive.

As stars age, they burn through their hydrogen fuel and eventually collapse into smaller forms called a White Dwarfs. If the star is more massive, it may explode into a supernova before collapsing into a neutron star. However, if a star is very massive, it may instead for a black hole after collapsing. Many things can affect how a star appears from Earth. A star that looks smaller than another star may actually be larger, but farther away.

The Sun is the center of our solar system. Our solar system is one of billions, or even trillions, of stars in our Milky Way galaxy. A galaxy is a collection of stars that move as a group together. The universe is filled with millions of galaxies. These galaxies are held together by gravity. Galaxies generally come in either spiral or elliptical form, although many galaxies are also irregularly shaped. Elliptical galaxies are generally very young, and become spiral-shaped as they get older. Many spiral galaxies also develop “arms” or bars of stars that extend from the center of the galaxy. Most of the stars in a galaxy are located in the center of the galaxy. Our sun is located along the edge of the Milky Way Galaxy.

[Image of Hertzsprung-Russell Diagram]

http://www.kcvs.ca

APPARENT MAGNITUDE
(BRIGHTNESS)

[Diagram of apparent magnitude]

LUMINOSITY
(ABSOLUTE BRIGHTNESS)

[Diagram of luminosity]

http://www.astrodidyouknow.blogspot.com
BIG IDEA 6: EARTH STRUCTURES

Over geologic time, internal and external sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's internal and external energy and material resources.

Earth's biosphere affects the lithosphere in many ways. The main way that organisms affect the lithosphere is through the relationship that plants have with the soil. Plants hold soil together with their roots. They also cycle nutrients through the soil. Plants create organic carbon by fixing carbon dioxide in the air and converting it to food and organic material. This material is used by many organisms, such as insects and worms, which live in the soil. Almost all organisms contribute organic material to the soil when they die and decompose.

When you look at Earth's surface, you should recognize the role that erosion and deposition play in changing its shape. Erosion is the wearing down of soil and rock. Deposition occurs when material accumulates in another location. Most erosion and deposition is done by water or wind. Wind is responsible for shaping some of Earth's surface, but wind tends to act more slowly and less dramatically. Water can move materials quickly because it typically has a stronger force and can dissolve minerals and soil. Water can also change state to take on the form of rain, snow, and ice that changes the landscape. For example, large ice glaciers have moved across the continents, like enormous bulldozers, creating flat lands and large lakes.
BIG IDEA 7: EARTH SYSTEMS AND PATTERNS

The scientific theory of the evolution of Earth states that changes in our planet are driven by the flow of energy and the cycling of matter through dynamic interactions among the atmosphere, hydrosphere, cryosphere, geosphere, and biosphere, and the resources used to sustain human civilization on Earth.

BIG IDEA 8: PROPERTIES OF MATTER

A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass which gives it inertia.

B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

Substances can differ from each other in a variety of observable ways. You may be able to observe differences in color, size, shape, or texture merely by looking at two objects. Other differences may need to be measured. For example, the mass of an object is the measurement of how much material an object has. You would measure the mass of an object with a balance scale that gives the measurement in grams. The weight of an object can also be measured by a
scale, but while the mass of an object remains the same no matter the location of the object, the weight of an object is a measure of the pull of gravity on the object, and can change depending on the location. Weight is usually measured in Newtons, since it is a measure of the force of gravity. Objects are also commonly defined by weight in terms of pounds.

Some characteristic physical properties of substances that allow them to be compared and classified are density; thermal or electrical conductivity; solubility; magnetic properties; melting and boiling points. **No matter the amount of the sample substance, the properties remain the same**

The volume of an object is a measure of how much space it takes up. Volume is measured in units of liters for liquids and cubic centimeters for solids. An object’s density is a measurement of its mass divided by its volume. Therefore, a dense object will take up less volume than another object that is less dense but has the same mass. For example, iron is denser than wood, so a gram of iron will be smaller, or take up less volume, than a gram of wood.

**BIG IDEA 9: CHANGES IN MATTER**

A. Matter can undergo a variety of changes.
B. When matter is changed physically, generally no changes occur in the structure of the atoms or molecules composing the matter.
C. When matter changes chemically, a rearrangement of bonds between the atoms occurs. This results in new substances with new properties.

Clarification for Grades 6-8: The target understanding for students in the middle grades should begin to transition the focus to: C. When matter changes chemically, a rearrangement of bonds between the atoms occurs. This results in new substances with new properties.
BIG IDEA 10: FORMS OF ENERGY

A. Energy is involved in all physical processes and is a unifying concept in many areas of science.

B. Energy exists in many forms and has the ability to do work or cause a change.

Electromagnetic Spectrum

Energy can exist as potential energy or kinetic energy. Kinetic energy is the energy of motion, while potential energy is energy due to an object’s position that can be released at some future point. You can imagine kinetic energy as a ball rolling down a hill. In that example, the ball’s energy is released through its motion. However, if the ball sits at the top of the hill, it has potential energy. The potential energy is due to the position of the ball and the force that gravity exerts on it.

Potential energy can be calculated based on the amount of work that can be done by the object. To calculate this, you need to know the mass of the object and the distance it moves. Other sources of potential energy include potential chemical energy and potential electrical energy. An object exposed to pressure, such as a stretched rubber band or a diving board, also has potential energy.

You can remember different types of energy by thinking of their key words, which are designated in parenthesis: electrical energy (wires), mechanical energy (machines), nuclear energy (nuclei of atoms), and chemical energy (burn).

Make sure you are familiar with the structure and properties of waves.

Visualize the wave as shown above moving through a medium represented by the black horizontal line. The period from one peak to the next makes up one complete wavelength, or cycle. The number of cycles a wave moves through in a given unit of time is its frequency. The amplitude of a wave is the distance from the undisturbed
medium (shown by the black line) on the top, or bottom of the wave.

Remember that waves represent the movement of many types of energy. This energy may move through a medium, for example, sound waves move through the air or water or earthquake waves move through the earth. Waves may also move energy without a medium, for example light moves through empty space. The amplitudes, frequency, and wavelengths all affect the properties of the wave. For example, light energy appears as different colors depending on the wavelength of the light waves. These properties can also change when a wave moves between different mediums.

**BIG IDEA 11: ENERGY TRANSFER AND TRANSFORMATIONS**

A. Waves involve a transfer of energy without a transfer of matter.
B. Water and sound waves transfer energy through a material.
C. Light waves can travel through a vacuum and through matter.
D. The Law of Conservation of Energy: Energy is conserved as it transfers from one object to another and from one form to another.

Energy can be transferred from potential energy to kinetic energy and from kinetic energy to potential energy.

Energy is neither created nor destroyed in energy transformations; rather it moves from one form to another, ex. in a flashlight: chemical energy transfers to electrical energy then light energy

Try to visualize energy transformations that are occurring in any given scenario. For example, coal is burned at an electric power plant and transformed into electricity that travels to a house and is converted into sound and light energy by a television that is plugged into the electrical outlet.

You know that energy conversions are never completely efficient. When you feel the running engine of an automobile, you feel the heat energy being released as waste instead of being transformed into the motion of the car.

Heat flows from warm to cool
BIG IDEA 12: MOTION OF OBJECTS

A. Motion is a key characteristic of all matter that can be observed, described, and measured.
B. The motion of objects can be changed by forces.

BIG IDEA 13: FORCES AND CHANGES IN MOTION

A. It takes energy to change the motion of objects.
B. Energy change is understood in terms of forces--pushes or pulls.
C. Some forces act through physical contact, while others act at a distance.

Clarification for grades 6-8: The target understanding for students in grades 6-8 should begin to transition the focus to a more specific definition of forces and changes in motion. Net forces create a change in motion. A change in momentum occurs when a net force is applied to an object over a time interval.

A force is something that causes a change in motion of an object. Forces can either be contact forces, which require contact between two objects, or field forces, which do not require contact. Examples of contact forces include a hammer hitting a nail or an explosion. Examples of field forces include gravity or magnetic forces. If you are faced with a question that asks you about force acting on an object, try to visualize what is occurring. You may wish to draw a diagram of the objects and forces involved. Include descriptions of the forces and results involved in your diagram.

When determining the affect of one or more forces on an object, you should diagram the direction and relative size of the force to help you determine the result of the force or forces. For example:
A. Your brother is applying force to a bicycle (pedals).

\[ \text{bicycle} \rightarrow \]

B. You apply additional force to the bicycle (push it back) as your brother is applying force to his bicycle.

\[ \text{you} \rightarrow \text{bicycle} \rightarrow \]

The bicycle moves forward with the net force (add the forces) that you and your brother are applying to the bicycle. The bicycle moves faster than when he was applying the force alone.

C. You apply an equal but opposite force as your brother applies force (pedals).

\[ \text{bicycle} \rightarrow \leftarrow \text{you} \]

D. You apply a greater opposite force as your brother applies force (pedals).

\[ \text{you} \rightarrow \leftarrow \text{bicycle} \]

When you add the forces together (his small positive force and your greater negative force) they equal a negative number. The bicycle moves backward.

**BIG IDEA 14: ORGANIZATION AND DEVELOPMENT OF LIVING ORGANISMS**

A. All living things share certain characteristics.
B. The scientific theory of cells, also called cell theory, is a fundamental organizing principle of life on Earth.
C. Life can be organized in a functional and structural hierarchy.
D. Life is maintained by various physiological functions essential for growth, reproduction, and homeostasis.

All matter is made of atoms. Living things are matter and, therefore, made of atoms. All living things are made of cells. The scientific theory of cells (cell theory) states that:

1. all organisms are composed of cells (single-celled or multicellular),
2. all cells come from preexisting cells,
3. cells are the basic unit of life

An organism can be as simple as a cell or complex as involving the following organization:

**Simple organism:** atoms to molecules to cells (ex., amoeba, paramecium, bacteria, etc.)
Complex organism: Atoms to molecules to cells to tissues to organs to organ systems to organisms (ex., plant, cat, dog, human, whale, etc.)

All organisms are classified according to shared characteristics with Domain being the largest category and species being the smallest. Organisms of the same species can reproduce and have offspring capable of reproducing and continuing the species.

A plant and animal cell comparison:

<table>
<thead>
<tr>
<th>Animal Cells</th>
<th>Plant Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell membrane</td>
<td>Cell Wall</td>
</tr>
<tr>
<td>Ribosomes</td>
<td>Chloroplasts</td>
</tr>
<tr>
<td>Nucleus</td>
<td></td>
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<tr>
<td>Endoplasmic Reticulum</td>
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<td>Golg: Apparatus</td>
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<tr>
<td>Vacuoles</td>
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<tr>
<td>Mitochondria</td>
<td></td>
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<tr>
<td>Lysosomes</td>
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The major body systems that help the body function include the skeletal system, muscular system, digestive system, nervous system, circulatory system, respiratory system, reproductive system, immune system, and excretory system.

Skeletal system: The skeletal system is made up of bones that support the body and help it move. (Closely related to the muscular system to help bones move.)

Muscular system: The muscular system is composed of muscles throughout the body. Muscles are responsible for moving the body, as well as providing the motion for other body organs, such as the heart and lungs, to function. (Closely related to the skeletal system.)
Digestive system: The digestive system takes in food and breaks it down into nutrients the body can absorb and use. Parts of the digestive system include the mouth, teeth, esophagus, stomach, liver, gallbladder, pancreas, small intestines, and large intestines. (Closely related to the urinary system.)

Nervous system: The nervous system processes information about the environment and transmits information and commands throughout the body. The brain and spinal cord are the main components of the nervous system, along with the network of nerve cells that transmit information. (Closely related to the muscular system)

Circulatory system: The circulatory system is made up of blood vessels that transport blood throughout the body. Blood provides nutrients to the body’s cells and collects waste from them. The circulatory system is powered by the heart. (Closely related to the respiratory system)

Respiratory system: The respiratory system takes in oxygen and releases carbon dioxide. Gas exchange takes place in the lungs. (Closely related to the circulatory system)

Reproductive system: The reproductive system produces male and female gametes that combine to create a fetus for reproduction. (Closely related to endocrine system.)

Immune system: The immune system, which is made up of special cells, proteins, tissues, and organs, defends people against germs and microorganisms every day. In most cases, the immune system does a great job of keeping people healthy and preventing infections. But sometimes problems with the immune system can lead to illness and infection. (Closely related to the integumentary system.)

Excretory system: The excretory system is important in getting rid of wastes and extra water that your body doesn’t need. (Closely related to the digestive system.)
BIG IDEA 15: DIVERSITY AND EVOLUTION OF LIVING ORGANISMS

A. The scientific theory of evolution is the organizing principle of life science.
B. The scientific theory of evolution is supported by multiple forms of evidence.
C. Natural Selection is a primary mechanism leading to change over time in organisms.

The ultimate goal for behavior or characteristics of an organism or species is to survive and reproduce. When you must evaluate a characteristic or change, try to think about how that change might help or hurt an organism’s ability to survive or create offspring.

Over many generations, characteristics or behaviors that help an organism survive will typically become more common. Characteristics that hurt an organism’s chances of surviving or reproducing will eventually disappear as organisms with these characteristics do not survive long enough to reproduce. Most new characteristics or behaviors begin as random events. It is only after several generations of reproduction that some of these traits become more common as they have caused individuals that have the traits to be more successful than other organisms.

Although the new physical characteristics or behaviors that organisms exhibit are usually random in origin, they may be either helpful or harmful to the organism’s ability to survive and reproduce. If the adaptation is helpful, it will increase in occurrence because it will allow those organisms to live and reproduce, passing on their characteristics to new offspring.

The new characteristics that develop can be either a change in a specific structure of an organism, such as a change in a bird’s beak, or an animal’s claw, or the change can also take the form of a behavior, such as a mating ritual or nesting ability. It may take the form of a difference in physiology, or body type.

When thinking about whether a change is adaptive (helpful) or non-adaptive (harmful), it is wise to consider the organism’s environment. Most organisms develop specific characteristics or behaviors that help them adapt to a specific environment, or niche. By becoming better at surviving in this specific environment, they are able to out-compete other organisms’ lack of special skills or structures.

Specialization can make them successful in their environments. For example, polar bears are white. Since they live in snowy environments, their white fur helps them hide from potential prey.
BIG IDEA 16: HEREDITY AND REPRODUCTION

A. Reproduction is characteristic of living things and is essential for the survival of species.
B. Genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.
C. Changes in the DNA of an organism can cause changes in traits, and manipulation of DNA in organisms has led to genetically modified organisms.

Reproduction in organisms can occur through sexual or asexual means, depending on the organism.

Asexual reproduction produces an identical copy of the parent.

Sexual reproduction creates new combinations of traits in offspring because each parent contributes different genes that are passed on. You should be familiar with Punnett squares, and how they work. You may need to fill out a Punnett square in order to answer questions about how genes are passed on to offspring from parents.

You should first know whether a gene is dominant or recessive. Dominant genes express themselves even if there is only one dominant gene present. They are usually indicated by a capital letter. For example, if B represents the gene that give a dog brown fur, then a dog with one dominant and one recessive gene would be designated by Bb and would have brown hair. A BB god would have both dominant genes and be brown, white a bb dog would have only recessive genes and would not be brown.

You can fill out a Punnett square to determine the probability of different genes being passed on to offspring. If you had a dog with brown fur that had both dominant genes mate with a dog with white fur that had both recessive genes, you might make a table like this:

You then fill in the four squares between them with the genes that would be passed on. In this case, the dominant dog would pass along either one B gene or another B gene. The recessive dog would pass on one b gene or another b gene.
In this case, all offspring would be genotype Bb, with phenotype brown fur.

**BIG IDEA 17: INTERDEPENDENCE**

A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.
B. Both human activities and natural events can have major impacts on the environment.
C. Energy flows from the sun through producers to consumers.

Energy travels through organisms in a food chain. As energy moves from one level to the next, some energy is lost as waste heat.

Producers are organisms that convert energy from sunlight into sugars that can be used by themselves and by other organisms. Consumers are other organisms that obtain energy from producers or other consumers. Herbivores are organisms that obtain energy directly from eating plants. Carnivores are organisms that obtain energy indirectly from plants by eating other organisms that have eaten plants. Omnivores are organisms that eat plants and animals. Herbivores are also known as primary consumers. Carnivores are also known as secondary consumers. Carnivores that eat other carnivores may be known as tertiary, or higher, consumers. Decomposers are organisms such as bacteria or fungi that break down dead organisms into basic components.


A close ecological relationship between the individuals of two (or more) different species. Sometimes a symbiotic relationship benefits both species (**mutualism**), sometimes one species benefits at the other's expense (**parasitism**), sometimes one species benefits without harming the other (**commensalism**) and in other cases neither species benefits. The nature of a

<table>
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<tr>
<th>Relationship</th>
<th>Self</th>
<th>Opponent</th>
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<tr>
<td>Amensalism</td>
<td>Neutral</td>
<td>Harm</td>
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<tr>
<td>Commensalism</td>
<td>Benefit</td>
<td>Neutral</td>
</tr>
<tr>
<td>Competition</td>
<td>Harm</td>
<td>Harm</td>
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<tr>
<td>Mutualism</td>
<td>Benefit</td>
<td>Benefit</td>
</tr>
<tr>
<td>Parasitism</td>
<td>Benefit</td>
<td>Harm</td>
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<tr>
<td>Predation</td>
<td>Benefit</td>
<td>Harm</td>
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</table>
symbiotic association depends on the relative "strengths" of the partners ... and the balance of power can change over time.

**BIG IDEA 18: MATTER AND ENERGY TRANSFORMATIONS**
A. Living things all share basic needs for life.
B. Living organisms acquire the energy they need for life processes through various metabolic pathways (photosynthesis and cellular respiration).
C. Matter and energy are recycled through cycles such as the carbon cycle.
### Periodic Table of the Elements

(based on $^{12}\text{C} = 12.0000$)

<table>
<thead>
<tr>
<th>Group</th>
<th>Period</th>
<th>Representative Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Hydrogen, Helium</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Boron, Oxygen, Fluorine</td>
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<tr>
<td>3</td>
<td>3</td>
<td>Lithium, Magnesium</td>
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<tr>
<td>4</td>
<td>4</td>
<td>Sodium, Aluminum</td>
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<tr>
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<td>6</td>
<td>Rubidium, Sulfur</td>
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<td>7</td>
<td>7</td>
<td>Caesium, Barium</td>
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<tr>
<td>8</td>
<td>8</td>
<td>Francium, Actinium</td>
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</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Period</th>
<th>Transition Metals</th>
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<tbody>
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<td>Hydrargyrum, Scandium</td>
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<tr>
<td>2</td>
<td>2</td>
<td>Titanium, Vanadium</td>
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<td>Chromium, Manganese</td>
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<td>Iron, Cobalt, Nickel</td>
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<td>Copper, Zinc</td>
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<tr>
<td>6</td>
<td>6</td>
<td>Gallium, Germanium</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Mercury, Thallium</td>
</tr>
</tbody>
</table>

**Inner Transition Metals**

- Lanthanide series
- Actinide series

**Metals**

- Sodium, Potassium, Calcium, Iron, Copper, Silver, Gold

**Nonmetals**

- Hydrogen, Oxygen, Nitrogen, Fluorine, Chlorine, Bromine, Xenon

**Appendix F:** Periodic Table of the Elements FCAT 2.0 Science Grade 8 End-of-Course Assessment
Nature of Science

1. Pat has two kinds of plant food, “Quickgrow” and “Supergrow.” What would be the best way for Pat to find out which plant food helps a particular type of houseplant grow the most? **SC.8.N.1.1**

   A. Put some Quickgrow on a plant in the living room, put some Supergrow on a plant of the same type in the bedroom, and see which one grows the most.
   B. Find out how much each kind of plant food costs, because the more expensive kind is probably better for growing plants.
   C. Put some Quickgrow on a few plants, put the same amount of Supergrow on a few other plants of the same type, put all the plants in the same place, and see which group of plants grows the most.
   D. Look at the advertisements for Quickgrow, look at the advertisements for Supergrow, and see which one says it helps plants grow the most.

2. Mandy wanted to see if a new, environmentally-friendly pesticide will prevent insect damage to tomato plants. After making her hypothesis, she conducts her experiment.

   She treats five tomato plants with traditional pesticide and five with the new pesticide. Mandy also leaves five plants untreated as a control. She makes careful notes of how she set up her experiment and then records her data about all of the plants.

   Why is it important for Mandy to record her procedures and data accurately? **SC.7.N.1.2**

   A. so that the hypothesis will always be correct
   B. so that she can look intelligent when she presents her data
   C. so that society does not waste money on buying pesticides that do not work
   D. so that other scientists can replicate the experiment and make sure the results are correct

3. Alex and Jennifer conducted an experiment to test reaction times in grabbing a meter stick after it is dropped. They each tested 15 friends. Alex dropped the meter stick for his friends and Jennifer dropped the meter stick for her friends while the other one timed the reactions. Jennifer’s friends reacted, on average, 0.9 seconds faster than Alex’s friends. Jennifer concluded that her friends were faster.

   Which of the following should she do next to check her results? **SC.7.N.1.2**

   A. Try a different reaction time experiment.
   B. Try the experiment again, this time using a ruler instead of a meter stick.
   C. Repeat the experiment as it was done the first time but using only Jennifer’s friends.
   D. Repeat the experiment and have one person drop the meter stick for all the friends tested.
4. Francesca creates a model that shows the movement of the tectonic plates of the Earth’s surface.

If she wants to use the model to understand the concept of how a mountain is formed, how does that model help her? **SC.7.N.1.5**

A. It shows all of the plates in the correct layout.
B. It explains in detail how mountains are formed.
C. It displays details that cannot be seen in a drawing.
D. It speeds up a process that takes millions of years.

5. In science, a theory is different from how we use the term "theory" to apply to everyday ideas. The statement, "It's only a theory" might mean something very different than "theory" when used as a scientific term.

What is the best way to explain the word, "theory," when used in science? **SC.7.N.3.1**

A. In science, there is no difference between a law and a theory.
B. In science, there are few principles that can be considered theories.
C. In science, a theory is well supported by observations and/or experimental data.
D. In science, a theory is a completely accurate and reliable fact about natural events.

6. In what way is a scientific law different from a scientific theory? **SC.7.N.3.1**

A. A law is true in all situations and all circumstances, while a theory is only true in certain instances.
B. A law describes the major ideas of the universe, while theories are based on the smaller ideas of the universe.
C. A law is based on testable facts and data, while a theory is just a combination of one or more hypotheses that have not been tested.
D. A law expresses a relationship between two or more variables, while a theory explains the causal mechanism of how something happens.

7. Colleen waters the plants in her greenhouse once every day. She wants to find out if the plants will grow more leaves if they are watered more often. She counts the number of leaves on each plant before she starts. She then continues to water half of each type of plant once daily, but she waters the other half of each type twice a day.

What is the outcome variable (dependent variable) in Colleen's experiment? **SC.8.N.1.1**

A. the type of plant being grown
B. the number of leaves the plants grow
C. the amount of light the plants receive
D. the number of times the plants are watered
8. Christy wants to find out if the birds that visit the bird feeders in her backyard would rather build nests in birdhouses or in trees. She puts a birdhouse next to the feeder containing sunflower seeds and hangs a feeder containing cracked corn from a tree. She observes the birds' nesting activities over the next two weeks and records her observations. Which of the following would improve Christy’s investigation? **SC.8.N.1.1**

A. putting more food in both bird feeders  
B. setting the feeders up closer to each other  
C. putting the same kind of food in both bird feeders  
D. setting up a third bird feeder containing fruit near a bird bath

9. Susan noticed that hummingbirds in her yard visited all the flowers, but especially seemed to like the red trumpet-shaped ones. She read that they use the nectar in the flowers for food. She assumed that since the parents were eating nectar, they must feed their babies only nectar as well. To her surprise, she saw hummingbirds bringing small spiders and insects to feed the young hummingbirds. How does this new evidence affect her original assumption? **SC.6.N.2.2**

A. She should stick to her assumption that the babies eat nectar since she thought that first.  
B. She should believe what she read in the book and disregard what she witnessed.  
C. She should change her original assumption that they only feed their babies nectar.  
D. She should ask other people what they think and agree with the majority.

10. A paleontologist who is trying to figure out if a meteor impact killed all the dinosaurs would not be able to find an answer by setting up an experiment. Which of the following would be the best way for a paleontologist to approach this problem? **SC.7.N.1.5**

A. search for dinosaur fossils in many places and note where the fossils stop appearing in the rock layers at each location  
B. study the evidence a meteor impact leaves in a rock layer, then look for that evidence in the layers of rock that formed after those layers with dinosaur fossils  
C. wait for a very large meteor to hit Earth again and see which kinds of animals are killed by it  
D. study similar kinds of disasters that result in large animals becoming extinct, like an oil spill

11. A scientist has been studying bullfrogs for many years. She has noticed that these bullfrogs are now laying eggs 8 days earlier than they did 20 years ago when she first began studying them. The trees around the pond have also grown taller and shade the water more than they did 20 years ago. What would be the best thing for the scientist to do next? **SC.6.N.2.2**

A. See if she can determine why they are laying eggs earlier.  
B. Choose a different species of frog to study for the next twenty years.  
C. Conclude that the changed tree heights have affected the frogs.  
D. Assume that the water temperature must have risen so frogs can lay eggs earlier.
12. A swimming team wants to select one of three fabrics for their new swimsuits. Each fabric is made of a different material. The team decides to do the following experiment:

They cut the same size pieces from each fabric and wet each piece with the same amount of water. They hang the pieces in the sunlight and they check every two minutes to see if any of the pieces are dry.

What can the team find out about the different fabrics from doing just this experiment? SC.6.N.2.2

A. If the amount of water affects how long it takes the pieces of fabric to dry.
B. If the type of fabric affects how long it takes the pieces of fabric to dry.
C. If the amount of water and the amount of light affect how long it takes the pieces of fabric to dry.
D. If the type of fabric, the amount of water, and the amount of light affect how long it takes the pieces of fabric to dry.

Life Science

13. In the picture of a cell below, which label indicates the part of the cell that contains most of the cell's genetic material? SC.6.L.14.4

A. 1
B. 2
C. 3
D. 4
14. How do molecules from food and molecules of oxygen that enter the body through the mouth and the nose move to cells of the body? **SC.6.L.14.5**

   A. Molecules from food and molecules of oxygen move from the mouth and the nose to cells of the body through a series of blood vessels, including veins, arteries, and microscopically small blood vessels (capillaries), that extend throughout the body.
   B. Molecules from food and molecules of oxygen move from the nose and the mouth to cells of the body through special respiratory and digestive tubes that directly connect the lungs and stomach to the rest of the body.
   C. Molecules from food and molecules of oxygen move from the mouth and the nose to cells of the body through special respiratory and digestive tubes that directly connect the mouth and nose to the rest of the body.
   D. Molecules from food and molecules of oxygen do not move from the mouth and the nose to cells of the body. Oxygen is breathed in and out of the lungs without entering the cells of the body, and molecules from food enter the digestive tract and pass through the body without entering cells of the body.

15. Which of the following statements is TRUE about competition between organisms with the same needs when resources are limited? **SC.7.L.17.2**

   A. Animals are the only organisms that compete for resources.
   B. Plants are the only organisms that compete for resources.
   C. Neither plants nor animals compete for resources.
   D. Both plants and animals compete for resources.

16. Ants burrow into a thorn of the Acacia tree to live and eat sugar secreted by the tree. These ants are a benefit to the Acacia because they attack the tree’s predators. What type of relationship do the ants and these trees share? **SC.7.L.17.2**

   A. commensalism
   B. competition
   C. mutualism
   D. parasitism

17. Where does the food that a plant needs come from? **SC.8.L.18.4**

   A. The food comes in from the soil through the plant’s roots.
   B. The food comes in from the air through the plant’s leaves.
   C. The plant makes its food from carbon dioxide and water.
   D. The plant makes its food from minerals and water.
18. Humans, dogs, and trees are all living things. In which of these organisms would you find DNA molecules? **SC.7.L.16.1**

A. Only in humans  
B. Only in humans and dogs  
C. In humans, dogs, and trees  
D. DNA molecules are not found in any of these organisms

19. Leigh Ann is learning about the differences between inherited traits and learned behaviors in organisms. For example, she knows that being able to read is learned, while having straight or curly hair is inherited. How does a person inherit a trait such as hair texture? **SC.7.L.16.1**

A. through the storage of excess fatty acids in tissues  
B. through DNA that is passed from parents to offspring  
C. through the breakdown of different proteins during birth  
D. through different viruses that are passed from parents to offspring

20. In a human body, which of the following represents the highest level of structural organization? **SC.6.L.14.1**

A. an atom in the lung  
B. lung tissue  
C. the lungs  
D. the respiratory system

21. Which of the following is something that all living organisms have in common? **SC.6.L.14.2**

A. They all contain at least one cell.  
B. They all need a source of oxygen.  
C. They all use other organisms for food.  
D. They all find mates to reproduce.

22. A cell can be seen by looking through a microscope. Seeing which of these organelles would let you know that you are looking at a plant cell? **SC.6.L.14.4**

A. mitochondria  
B. chloroplast  
C. cell membrane  
D. nucleus
23. Sandra measured her heart rate and her breathing rate at rest and again after doing 50 jumping jacks.

What is the main reason that both her heart rate and her breathing rate went up with exercise? **SC.6.L.14.5**

A. They both sped up to supply her working muscles with enough oxygen to remain in homeostasis.
B. Her lungs and heart ran short on oxygen while she was exercising and sped up to maintain homeostasis.
C. Her muscles were out of shape and required extra blood and oxygen in order to maintain her jumping pace.
D. They both increased in order to carry heat away from her working muscles more efficiently.

24. The infection-fighting cells that are produced by the immune system are manufactured in specific places around the body, for example, in the lymph nodes and the spleen. However, an infection can occur anywhere in the body. How do these infection-fighting cells manage to move around the body and get to the sites of infection? **SC.6.L.14.5**

A. There are lymph nodes every few millimeters all over the body.
B. They are excreted and float freely around the body, hunting infections.
C. They are carried around the body in the circulatory system.
D. They are moved around the body as muscles squeeze against them.

25. Which characteristic is shared by all cells? **SC.6.L.14.2**

A. They need energy.
B. They reproduce sexually.
C. They make their own food.
D. They move from place to place.

26. Which of the following are the three main classification domains? **SC.6.L.15.1**

A. Fungus, Plants, and Animals
B. Bacteria, Archaea, and Eukarya
C. Protist, Fungus, and Plants
D. Bacteria, Virus, and Eukarya
27. According to the modern classification system, which list is written correctly from least specific to most specific? **SC.6.L.15.1**

A. species, genus, family, order  
B. phylum, class, genus, order  
C. class, order, genus, species  
D. phylum, order, species, family

28. Joe has a cat with black fur (BB) and a cat with white fur (bb). What would be the genotype of their offspring? **SC.7.L.15.2**

A. BB  
B. Bb  
C. bb  
D. Bbbb

29. Jenny’s father has blood genotype AA, and her mother’s blood genotype is OO. Jenny wants to find out what her grandparents’ blood genotypes are. Which of the following blood genotypes could the parents of Jenny’s mother have? **SC.7.L.15.2**

A. AA and OO  
B. AO and BO  
C. AB and OO  
D. AB and AO
Refer to the diagram below, showing a food web. The arrows show the direction of energy flow. Each arrow points from the organism that is consumed to the organism that consumes it. Use the information in the food web to answer the questions that follow.

**FOOD WEB**

30. Which statement best explains why decomposers are an important part of this food web?  
**SC.7.L.17.2**

A. They use sunlight to make their own food.  
B. They give off oxygen for animals to breathe.  
C. They provide camouflage for small animals.  
D. They make nutrients available to plants.
31. Which of the following living things in the pond system uses the energy from sunlight to make its own food? **SC.8.L.18.4**

A. Insect  
B. Frog  
C. Water lily  
D. Small fish

32. Andrea is training to run in a marathon—a 26.2-mile race. For one of her training runs, she will be running for several hours. She plans to eat several energy bars during the run. Why is it important for Andrea to eat during her run? **SC.8.L.18.4**

A. The protein in the energy bars will help her to build stronger muscles.  
B. The energy bars will replace the sugars her body is breaking down for energy.  
C. The energy bars will deliver important vitamins her body needs during the run.  
D. The carbohydrates in the energy bars will replace the oxygen her cells use in the run.

33. Which of the following is NOT a way carbon dioxide returns to the atmosphere? **SC.8.L.18.4**

A. decay of organisms  
B. emissions by factories  
C. photosynthesis  
D. respiration

34. If air pollution causes the rain that falls on this pond to become much more acidic, after two years how will this acidity affect the living things in this pond? **SC.7.L.15.2**

A. There will be more plants and animals because the acid is a source of food.  
B. There will be fewer plants and animals because the acid will dissolve many of them.  
C. There will be fewer plants and animals because many of them cannot survive in water with high acidity.  
D. There will be more plants and animals because the acid will kill most of the disease-causing microorganisms.
35. Male crickets chirp to attract a mate. Chirping is dangerous because it can attract predators of the crickets like birds or bats. Sometimes, other male crickets will wait quietly and intercept the female on her way to a chirping male. How is the cricket that intercepts the female cricket at an advantage? **SC.7.L.15.2**

A. The male will be more attractive to females and predators.
B. The female is more attracted to the male and the predator.
C. The female is less likely to get eaten and less likely to reproduce.
D. The male will be less likely to attract predators and more likely to reproduce.

Questions 36 - 37 refer to the following investigation.

Some students were studying the life cycle of mosquitoes. They learned that mosquito larvae and pupae spend part of their time at the surface of water.

The students wanted to find out how a larva and pupa behaved when the jars they were in were disturbed. They put one larva and one pupa in identical tall jars of water at 20°C as shown below.

**JARS WITH LARVA AND PUPA**

The students tapped on the jars when the larva and pupa were at the surface of the water. The larva and pupa dove down into the jars, and then slowly came to the surface.

The students measured the depth each larva and pupa reached and the amount of time each stayed underwater. The students repeated this step five times and calculated the average of each of their measurements.

Their results are summarized in the table below.
36. Larvae have a breathing tube and must come to the surface of the water to breathe. **SC.7.L.15.2**

If a layer of an oily substance completely covers the surface of the water for several days, what will most likely happen to the larva?

A. It will not survive because of lack of fresh food sources.
B. It will not survive because of lack of oxygen.
C. It will skip the pupa stage and hatch immediately to break out of the water.
D. It will hold its breath until the oily substance naturally breaks down in the water.

**Physical Science**

37. Larvae and pupae normally float. They must use their muscles in order to dive down through water. What type of energy is used by the muscles? **SC.7.P.11.2**

A. Sound energy from the air
B. Thermal energy from the water
C. Chemical potential energy from their cells
D. Gravitational potential energy from Earth

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### DATA TABLE

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<thead>
<tr>
<th>Number of Trials</th>
<th>Larva</th>
<th>Pupa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Depth Reached (centimeters)</td>
<td>Average Length of Time Underwater (seconds)</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>90</td>
</tr>
</tbody>
</table>
Physical Science

38. Look at the two pictures below. They show what happened when two solid blocks were each put in a jar containing a liquid. Based just on what you can see in the pictures, what can you say about the blocks and the jars? SC.8.P.8.4

A. The liquid in the jars must be water.
B. The block in jar 1 weighs more than the block in jar 2.
C. The block in jar 1 is floating lower in its liquid than is the block in jar 2.
D. The block in jar 1 must be made of metal and the block in jar 2 must be made of wood.

39. Which of the following is NOT made up of atoms? SC.8.P.8.5

A. Heat
B. A gas
C. A cell
D. A solid
40. Based on its location on the partial periodic table shown below, which element would you predict has chemical properties that are most similar to argon (Ar)? **SC.8.P.8.5**

![Partial Periodic Table]

A. Chlorine (Cl)
B. Helium (He)
C. Nitrogen (N)
D. Zinc (Zn)

41. What atoms combine to make up a molecule of water (H₂O)? **SC.8.P.8.5**

A. 1 hydrogen, 1 oxygen
B. 1 hydrogen, 2 oxygen
C. 2 hydrogen, 1 oxygen
D. 2 hydrogen, 2 oxygen
42. All of the following would be helpful in separating a mixture of sand and salt EXCEPT \textbf{SC.8.P.8.5} \\
A. a magnet \\
B. a glass cup \\
C. a filter paper and funnel \\
D. water \\

43. The chart below shows part of the electromagnetic spectrum. Which statement is true regarding this part of the spectrum? \textbf{SC.7.P.10.1} \\

![Visible Light Region of the Electromagnetic Spectrum]

A. Violet has the longest wavelength. \\
B. Violet has the highest frequency. \\
C. Violet has the lowest energy levels. \\
D. Violet is not able to be seen by humans. \\

44. Francesca is drawing a picture of the electromagnetic spectrum. She needs to order the types of electromagnetic radiation from the lowest to highest frequency. Which of the following shows the correct order of the electromagnetic spectrum, from lowest to highest frequency? \textbf{SC.7.P.10.1} \\
A. visible, UV, infrared, X-ray, microwave, radio, gamma \\
B. radio, visible, microwave, infrared, UV, X-ray, gamma \\
C. gamma, UV, microwave, infrared, radio, X-ray, visible \\
D. radio, microwave, infrared, visible, UV, X-ray, gamma \\

45. Warren is tuning his guitar. He notices that as he tightens the string, the pitch of the string increases. Which best explains why tightening the string raises the pitch? \textbf{SC.7.P.10.3} \\
A. It makes the string more flexible. \\
B. It improves the string’s ability to make sounds. \\
C. It increases the frequency of the string’s vibration. \\
D. It allows sound waves to move along the string more easily.
46. Arianna is experimenting with different materials to see which one will transmit sound the fastest.

Through which of the following materials will sound waves travel the fastest? **SC.7.P.10.3**

A. air  
B. concrete  
C. oil  
D. water

47. On a sunny day, Heidi and some of her classmates are playing kickball during PE. She kicks the ball past second base, and it rolls uphill to a stop. She runs to first base, but before she gets any farther, the bell rings and everyone has to go back inside. **SC.7.P.11.2**

Which of these is an example of kinetic energy changing to potential energy?

A. the ball rolling uphill to a stop  
B. the bell ringing inside the school  
C. the Sun warming the playground  
D. the players running from base to base

48. Vinnie places his cold drink on the roof of a hot car. Which of the following correctly describes what happens next? **SC.7.P.11.4**

A. The temperature of the drink increases as it sends cold into the hot metal of the car.  
B. Heat is transferred from the car into the drink and increases the temperature of the drink.  
C. Cold is transferred from the drink into the metal of the car, decreasing the temperature of the roof.  
D. The temperature of the area under the drink decreases until it is the same temperature as the cold drink.
49. Two boys wearing in-line skates are standing on a smooth surface with the palms of their hands touching and their arms bent, as shown above. If Boy X pushes by straightening his arms out while Boy Y holds his arms in the original position, what is the motion of the two boys? **SC.6.P.13.1**

A. Boy X does not move and Boy Y moves backward.
B. Boy Y does not move and Boy X moves backward.
C. Boy X and Boy Y both move backward.
D. The motion depends on how hard Boy X pushes.
Meg designs an experiment to see which of three types of sneakers provides the most friction. She uses the equipment listed below.

1. Sneaker 1
2. Sneaker 2
3. Sneaker 3
4. Spring scale

She uses the setup illustrated below and pulls the spring scale to the left.


A. To the left
B. To the right
C. Upward
D. Downward

51. Gordon is making a list of forces for his science class. Which of the following should Gordon NOT list as a force? **SC.6.P.13.1**

A. gravity
B. friction
C. a push or pull
D. mass

52. Ignoring mass and weight contributed by fuel, what happens when the space shuttle takes off and moves away from Earth? **SC.6.P.13.1**

A. Its mass decreases and weight increases.
B. Its mass increases and weight decreases.
C. Its mass remains constant and weight decreases.
D. Its mass remains constant and weight increases.
53. Gravity is a force that every mass exerts on every other mass. When you jump up in the air, not only does the Earth exert a gravitational force on you, but you also exert a gravitational force on the Earth. You, of course, fall back down to the Earth. Which of the following explains why the Earth is not moving toward you when you jump up in the air? **SC.6.P.13.1**

A. Earth exerts a gravitational force on itself.  
B. You don't weigh enough to affect Earth's surface.  
C. Your mass is very small compared to Earth's mass.  
D. Earth's fixed orbit around the Sun keeps it from moving.

54. An object travels at constant speed, and its distance and time are shown in the graph. What is the average constant speed of the object between 3 and 5 seconds? **SC.6.P.13.3**

![Distance-Time Graph]

A. 25 m/s  
B. 50 m/s  
C. 150 m/s  
D. 300 m/s

55. An object travels at constant speed, and its distance and time are shown in the graph. What is the average constant speed of the object between 2 and 5 seconds? **SC.6.P.13.3**

A. 25 m/s  
B. 50 m/s  
C. 150 m/s  
D. 300 m/s
56. What happens when the forces applied to an object at rest produce a net force of zero?

SC.6.P.13.3

A. The object will move at constant speed.
B. The object will have positive acceleration.
C. The object will have negative acceleration.
D. The object will not move at all.

57. Jacob went down to the lake on a very still day. The water's surface was completely smooth and he could see a tree reflected perfectly in the water. A breeze came up and disturbed the surface of the water and the reflection of the tree disappeared. Why could he see the tree's reflection when the water was still, but not when it was disturbed? SC.7.P.10.3

A. The disturbed surface made the light waves reflect in many directions, breaking up the image.
B. The disturbed surface allowed some of the light waves to penetrate into the water, making gaps in the image.
C. The disturbed surface kept the light waves from reflecting, making it impossible to see an image.
D. The disturbed surface changed the light waves' wavelengths, changing the reflected image.

58. Andrea held her hand up in front of a light and a shadow in the shape of her hand appeared on the opposite wall. What property of light explains why the shadow appeared?

SC.7.P.10.3

A. Light passes through all objects.
B. Light travels in a straight line.
C. Light bends around objects in its path.
D. Light waves are refracted by solid objects.

59. When Charlie came home from school, he turned on a garden hose that had been sitting in the sun all day. The water that came out of the hose was so hot, he could hardly touch it. What happened to the water molecules that made the water feel so hot? SC.7.P.11.2

A. The solar energy hitting the hose made the water molecules move faster.
B. The individual water molecules got larger as they absorbed the solar energy.
C. The warmth of the soil around the hose made the water molecules move slower.
D. The heat energy from the Sun was stored as chemical energy in the water molecules.
60. Hilary put some ice cubes in a glass of water, and the ice cubes melted. What is the best evidence she can use to show that the melting of the ice is a purely physical change and not a chemical change? **SC.8.P.9.2**

A. Even though the ice and the liquid water look different, they can be shown to be made of the same molecules.
B. When liquid water is put into the freezer and cooled long enough, it will change into a solid form.
C. She did not need to add any extra heat in order to get the ice to melt in the glass of water.
D. Although ice is more difficult to see through than liquid water, it does not change color when it melts.

61. Andy stirred 100 grams of salt (sodium chloride, NaCl) into a pot of water until he could no longer see any grains of salt. If he allows all the liquid to evaporate, how much salt will he find in the pot? **SC.8.P.8.9**

A. 0 grams
B. 50 grams
C. 100 grams
D. 200 grams

62. The flashlight shown below has no batteries. It is operated by squeezing and letting go of the handle. Inside the body of the flashlight are gears, which are shown below.

Which sequence best identifies the energy transfers that take place within the flashlight to produce light? **SC.7.P.11.2**

A. Kinetic → electrical → light
B. Kinetic → chemical → light
C. Chemical → kinetic → light
D. Chemical → electrical → light
Earth and Space Science

63. Jason thinks that global climate change is not happening because a city in Northern Florida received snow one day in January. Which statement explains what is wrong with Jason's reasoning? SC.6.E.7.4

A. Northern Florida would need to get snow for at least a week for this to be true.
B. Jason has confused the weather for one day with the climate of a region.
C. Jason does not realize that Southern Florida would also need to receive snow to make this true.
D. The climate of Northern Florida would be unaffected since it's already warm in Florida.

64. When a warm air mass and cold air mass come together, like a warm front and cold front, a typical outcome is rain. What explains why rain forms in this situation? SC.6.E.7.4

A. The cold air causes the moisture in the warm air to condense and precipitate as rain.
B. The cold air is moving faster than the warm air, which causes rain.
C. Because the cold air is denser, it causes rain.
D. The two air masses neutralize each other, which results in clouds that produce rain.

65. Convection currents in the atmosphere influence many weather patterns. What property of the air has the most influence on convection currents? SC.6.E.7.4

A. the direction of the wind
B. the velocity of the wind
C. the temperature of the air
D. the mass of the air

66. If you visit the beach on a hot summer day you will probably feel a sea breeze coming off the water onto the land. Which of the following causes this sea breeze? SC.6.E.7.5

A. During the day, solar radiation warms the land more than the water.
B. The water is warmer than the land during the day.
C. Earth is tilted toward the Sun, causing air to move inland from the water.
D. Hurricanes that form in the oceans blow air into the shore.

67. If you walk barefoot on hot asphalt, energy is transferred by which process? SC.6.E.7.5

A. convection
B. radiation
C. conduction
D. reflection
68. Both Ocala, Florida, and Lexington, Kentucky, are good places to raise racehorses, in part because of the limestone near the surface in both places. Calcium from the limestone helps make a horse's leg bones stronger and better able to withstand the pounding stress of running. Knowing that the Bluegrass Region around Lexington also sits on top of limestone, what other land features are also likely to be found there? **SC.7.E.6.2**

   A. sand dunes, lakes, and springs  
   B. prairies, swamps, and marshes  
   C. sinkholes, caves, and aquifers  
   D. shallow rivers, flat land, and quartz sand

69. What must happen in order for a metamorphic rock to be transformed into an igneous rock? **SC.7.E.6.2**

   A. It must be compressed by high temperatures and pressure within Earth's crust.  
   B. It must be soaked in water until it dissolves and reforms in a different shape.  
   C. It must be pulled under Earth's crust, melted, and forced out above the crust to cool.  
   D. It must be weathered into sand grains and compressed into multiple layers.

70. Water evaporates and falls back to Earth as rain or snow. What is the primary energy source that drives this cycle? **SC.6.E.7.5**

   A. The wind  
   B. The Sun  
   C. Air pressure  
   D. Ocean currents

71. Which of the following is true about wind and water changing the size of mountains over many millions of years? **SC.7.E.6.2**

   A. The continuous movement of wind and water changes the size of mountains over many millions of years  
   B. Nothing can change the size of mountains over many millions of years, not even the continuous movement of wind and water.  
   C. The continuous movement of wind and water changes the size of some mountains, but not all mountains.  
   D. Even though mountains change in size over many millions of years, the changes are not due to the continuous movement of wind and water.
72. The diagram below shows the collision of two tectonic plates in Asia.

![Diagram of tectonic plate collision]

What is a result of this collision? **SC.7.E.6.5**

A. Volcanoes erupt periodically.
B. The Tibetan Plateau slowly sinks.
C. The Himalayas increase in height each year.
D. Glaciers on the Tibetan Plateau melt.

73. Which of the following is TRUE about how environmental conditions have changed since the time life began on earth? **SC.7.E.6.4**

A. Conditions have remained about the same everywhere on earth, with only minor changes from year to year.
B. Conditions have remained the same in the oceans but have changed on land.
C. Conditions have remained the same except for a few sudden changes in certain locations due to disasters, such as a meteorite striking the earth.
D. Conditions have changed in significant ways everywhere on earth, with some of these changes happening suddenly and others more gradually.

74. An unusual type of fossil clam is found in rock layers high in the Swiss Alps. The same type of fossil clam is also found in the Rocky Mountains of North America. From this, scientists conclude that **SC.7.E.6.4**

A. glaciers carried the fossils up the mountains
B. the Rocky Mountains and the Swiss Alps are both volcanic in origin
C. clams once lived in mountains, but have since evolved into sea-dwelling creatures
D. the layers of rocks in which the fossils were found are from the same geologic age
75. Thomasine has a sample of materials and needs to determine its age. She can determine its relative-age by comparing the rock layer the sample came from to another rock layer.

Why is it sometimes difficult to determine the age of materials in this way? **SC.7.E.6.4**

A. The oldest layers of rock are too close to the Earth's liquid mantle.
B. The youngest layers of rocks do not contain enough materials to evaluate.
C. The sequence of rock layers can be disturbed by erosion and earthquakes.
D. The rock layers have too many different types of rocks to determine their age.

76. Scientists hypothesize that 66 million years ago an enormous asteroid hit Earth, sending out a cloud of dust into the Earth's atmosphere. Which of the following would be evidence to support this hypothesis? **SC.7.E.6.4**

A. Fossils show that all plant and animal life became extinct.
B. The fossils of ancient trees show very little growth during this time.
C. A large portion of the asteroid is still embedded in the Earth's crust.
D. An identical layer of sediment can be seen in different parts of the world.

77. All of the following are examples of erosion **EXCEPT** **SC.6.E.6.1**:  

A. The wind in the desert blows sand against a rock.
B. A glacier picks up boulders as it moves.
C. A flood washes over a riverbank, and the water carries small soil particles downstream.
D. An icy winter causes the pavement in a road to crack.

78. Which layer of Earth is divided into plates? **SC.7.E.6.1**

A. Mantle
B. Crust
C. Inner core
D. Outer core

79. Convection currents occur in which of Earth's layers? **SC.7.E.6.5**

A. crust
B. lithosphere
C. mantle
D. solid core
80. What causes the phases of the Moon? **SC.8.E.5.9**

A. the tilt of Earth on its axis
B. Earth’s shadow being cast on the Moon
C. the relative positions of the Sun, Moon, and Earth
D. the elliptical orbit that Earth travels around the Sun

81. Earth revolves around the Sun, and the Moon revolves around Earth. The Moon’s orbital path is sometimes above and sometimes below the plane of Earth’s orbit, as shown in the diagram below.

![Diagram of Sun, Earth, and Moon along plane of Earth’s orbit]

What would happen if Earth’s orbit and the Moon’s orbit were in the same plane? **SC.8.E.5.9**

A. Eclipses would occur every month.
B. The Moon would not have phases.
C. All sides of the Moon would be visible from Earth.
D. The same side of the Moon would always face the Sun.

82. Which statement is true regarding measuring distances in space? **SC.8.E.5.3**

A. An astronomical unit (AU) is larger than a light year.
B. The time taken for light to travel through our Solar System is longer than that for light to travel through the Milky Way.
C. The Earth is one astronomical unit (AU) from the Sun.
D. All of the terrestrial planets are more than one astronomical unit (AU) from the Sun.

83. Jill is creating a scale model of the Solar System. She uses a basketball to represent the Sun. Which of the following should she use to most accurately represent the size of Earth? **SC.8.E.5.3**

A. tennis ball
B. ping pong ball
C. marble
D. grain of sand
84. The Sun's energy and composition is provided by which of the following? SC.8.E.5.5
   A. the burning of fossil fuels within the Sun
   B. solar power that produces electricity in the Sun
   C. the Sun's magnetic field
   D. the fusion of hydrogen into helium

85. Which of the following is the most violent of all solar disturbances? SC.8.E.5.5
   A. solar winds
   B. sunspots
   C. prominences
   D. solar flares

86. There are many objects that are part of our Solar System including planets, moons, asteroids, and the Sun. Which of those objects has the greatest gravitational force? SC.8.E.5.7
   A. asteroids
   B. the Sun
   C. moons
   D. planets

87. Saturn is 9.5 astronomical units (AU) from the Sun and Mars is only 1.5 AU from the Sun. Saturn is also much larger than Mars. Based on this information, how does the average surface temperature on Mars compare to the average surface temperature on Saturn? SC.8.E.5.7
   A. Since Mars is closer to the Sun than Saturn, it has a higher average surface temperature.
   B. Saturn is larger than Mars and absorbs more light, so it has a higher average surface temperature.
   C. Since both planets are more than 1 AU from the Sun, their average surface temperatures are equal.
   D. Even though Saturn is further away, Saturn's rings cause it to have a lower average surface temperature.

88. The current model of our Solar System is called the heliocentric model, which means the Sun is at the center. Before scientists developed the current model, which is best supported by the evidence, what was believed to be the center of our solar system? SC.8.E.5.7
   A. The Solar System had no center because all the planets' orbits were random.
   B. A star other than the Sun was the center of the Solar System.
   C. A black hole was the center of the Solar System.
   D. Earth was the center of the Solar System.