

A study guide to improve your Science MCA Test score.

For students: This study guide is intended to help you be successful when taking the science MCA test. The questions in this packet have been generated from each of the actual test specifications science benchmarks put out by the state of Minnesota. Most of the topics on the test have been covered in your science classes through the years, however there will at times be information you are unfamiliar with. It is your responsibility as a student to seek knowledge about this information from your book, teachers or other sources.

General test taking strategies

Essay Questions

- *Make sure to read the entire question.
- *Restate the question into a statement to start your answer.
- *Do not leave an answer blank, show your work and write down your thoughts, even if you don't get the exact answer, partial credit is awarded.
- *Gauge the length of your answers on the character counters, (this counter counts the number of letters you use). The number given would be the ideal amount to correctly answer each question, too long of an answer is just as bad as one that has too little information.

Multiple Choice Questions

- *Read the question before you look at the answer.
- *Come up with the answer in your head before looking at the possible answers, this way the choices given on the test won't throw you off or trick you.
- *Eliminate answers you know aren't right.
- *Read all the choices before choosing your answer.
- *Always take an educated guess and select an answer.
- *Don't keep on changing your answer, usually your first choice is the right one, unless you misread the question.
- *If there is an "All of the above" option and you know that at least two of the choices are correct select the "All of the above" choice

Special Note

On Study Island there are several areas for each strand called "**lesson**", students are encouraged to review each of them to become more familiar with the topic. (See example below after Scientific Investigations) *The word "lesson" will be in blue on Study Island.

2. History and Nature of Science (Strand I)

a. Scientific Investigations - **lesson**

For parents: I am aware of this study guide for my student and agree to assist him/her to better understand this information to the best of my ability.

Parent(s) signature: _____

Strand I (ALL Sub-strands (A/B/C)) Earth and Space Science

Sub-strand A

1. What are the steps of the scientific method?

- A. *Problem* - Identify the problem.
Research - Research the problem.
Hypothesis - Formulate hypothesis to explain the observation.
Collect data - Perform experiments and gather all the data together.
Analyze data - Figure out and examine what is important about it.
Conclude - Tie everything together.

2. What are scientific models and how can they be useful?

- A. When you are trying to learn about something, a model can help you see how the object works. You can model things that you cannot see, or are too large or small. For example, you learn that sound travels in waves. You cannot see sound, but you and a friend can move a rope up and down to create a model of how sound moves. Some other models that you might have done in class are 3D cells, volcanoes, distance in space or atoms.

Sub-strand B

1. What is a variable?

- A. A condition that may influence the outcome of an investigation.

2. What is a controlled variable?

- A. Factors in an experiment that stay the same.

3. What is a changed variable?

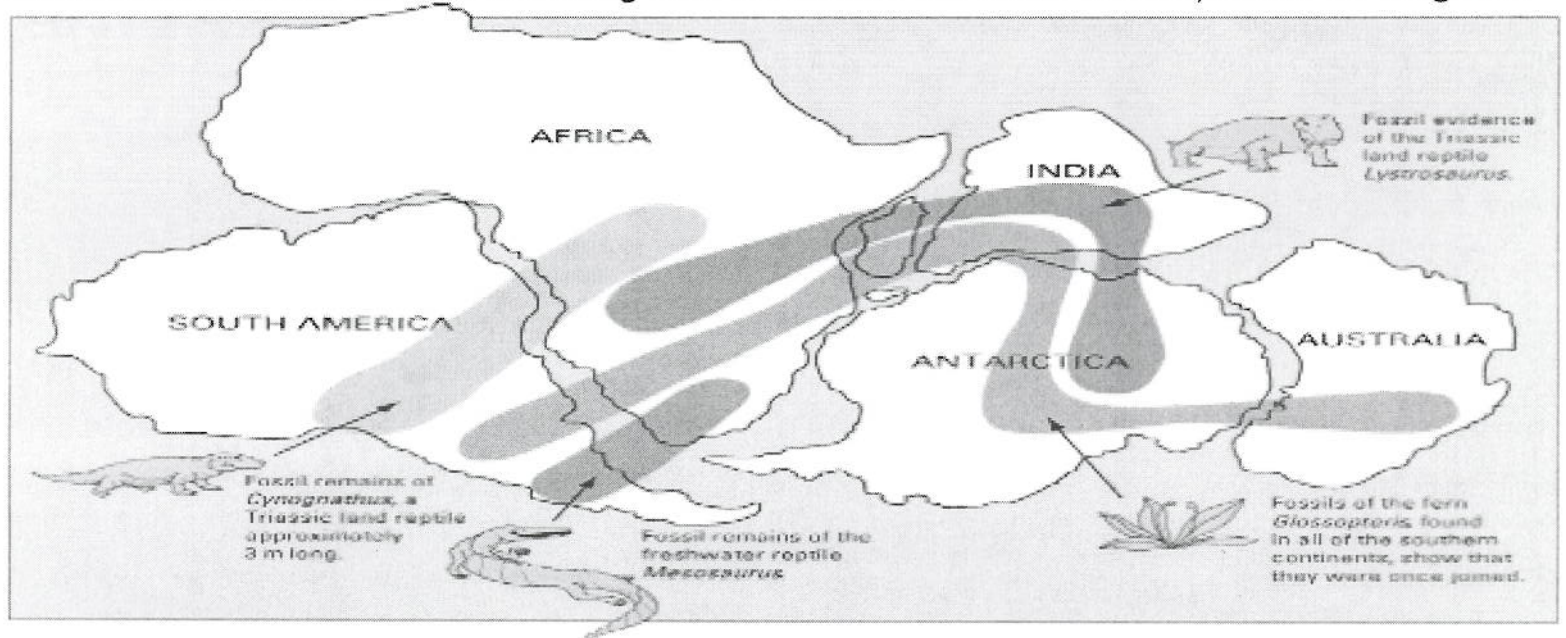
- A. A single factor in an experiment that is purposely changed.

4. Why is it important to change only one variable at a time?

- A. If you test for more than one variable at a time during an experiment, you won't know which variable caused the desired change.

5. How do theories about scientific investigations such as the theory of plate tectonics come about? Remember, theories are well tested explanations.

- A. Through observations, collection of evidence, and logical reasoning. (In the case of plate tectonics this would include matching land forms and the fossil record.) **Refer to diagram.**



Sub-strand C

1. How and why should the credibility and validity of scientific and technological information be checked?

A. Both the qualifications and methods of people who publish scientific information such as authors and researchers should be checked in order to maintain a safe and reliable source.

Strand III (Sub-strand A) Earth and Space Science

1. What is the theory of plate tectonics?

A. The lithosphere (top layer) of the Earth floats on top of the partially molten layer under it (asthenosphere) made molten by heat from the core. The flow of convection currents causes the movement of the lithospheric "plates".

2. How do earthquakes, volcanoes, sea-floor spreading and mountain building support the plate tectonic theory?

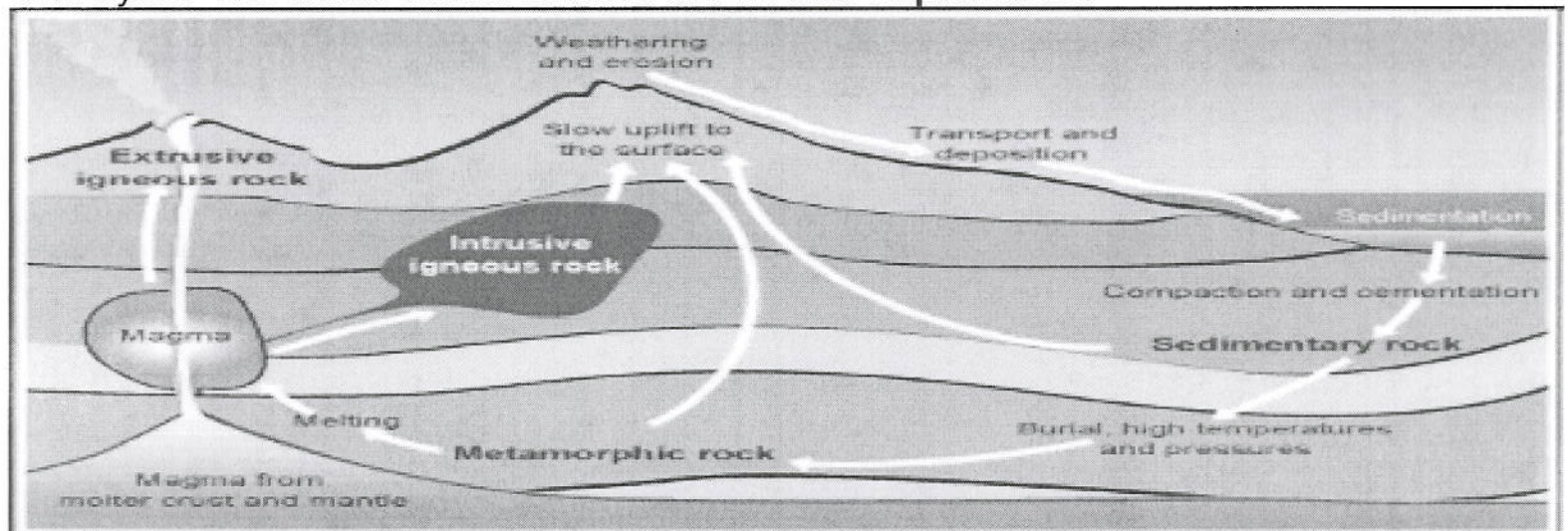
A. The lithosphere is broken up into what are called tectonic plates —there are seven major and many minor plates. The lithospheric plates ride on the asthenosphere. These plates move in relation to one another at one of three types of plate boundaries: **convergent**, or collisional boundaries; **divergent** boundaries, also called spreading centers or sea-floor spreading; and **transform** boundaries (where plates slide past each other). **Earthquakes, volcanic activity, mountain-building, and oceanic trench formation** occur along these plate boundaries.

3. Describe the processes and interactions of the rock cycle.

A. There are three main types of rock:

- **Sedimentary Rock** forms when small bits and pieces of matter (sediments) are carried by wind or rain and then deposited, compacted, and cemented to form layered rock.
- **Igneous Rock** are formed when molten rock (magma) cools and solidifies. (The **slower** the cooling process is, the **larger** the crystal formation of these rocks will be).
- **Metamorphic Rock** have changed in texture or composition as the result of heat and pressure.

Earth's rocks do not stay the same forever. They are continually changing because of processes such as chemical weathering (influenced by water, oxygen, carbon dioxide and acid rain) or physical weathering (rock is broken down by physical forces or processes, including gravity, ice wedging, wind, or human actions) and large earth movements such as plate movement. The rocks are gradually recycled over millions of years. This is called the rock cycle. **The chart below should aid in this explanation.**



4. The diagram below represents a cross-section of the earth's crust showing several marine fossils. Answer the following questions:

4a. What is the relative age of each layer compared to the layers on top of it?

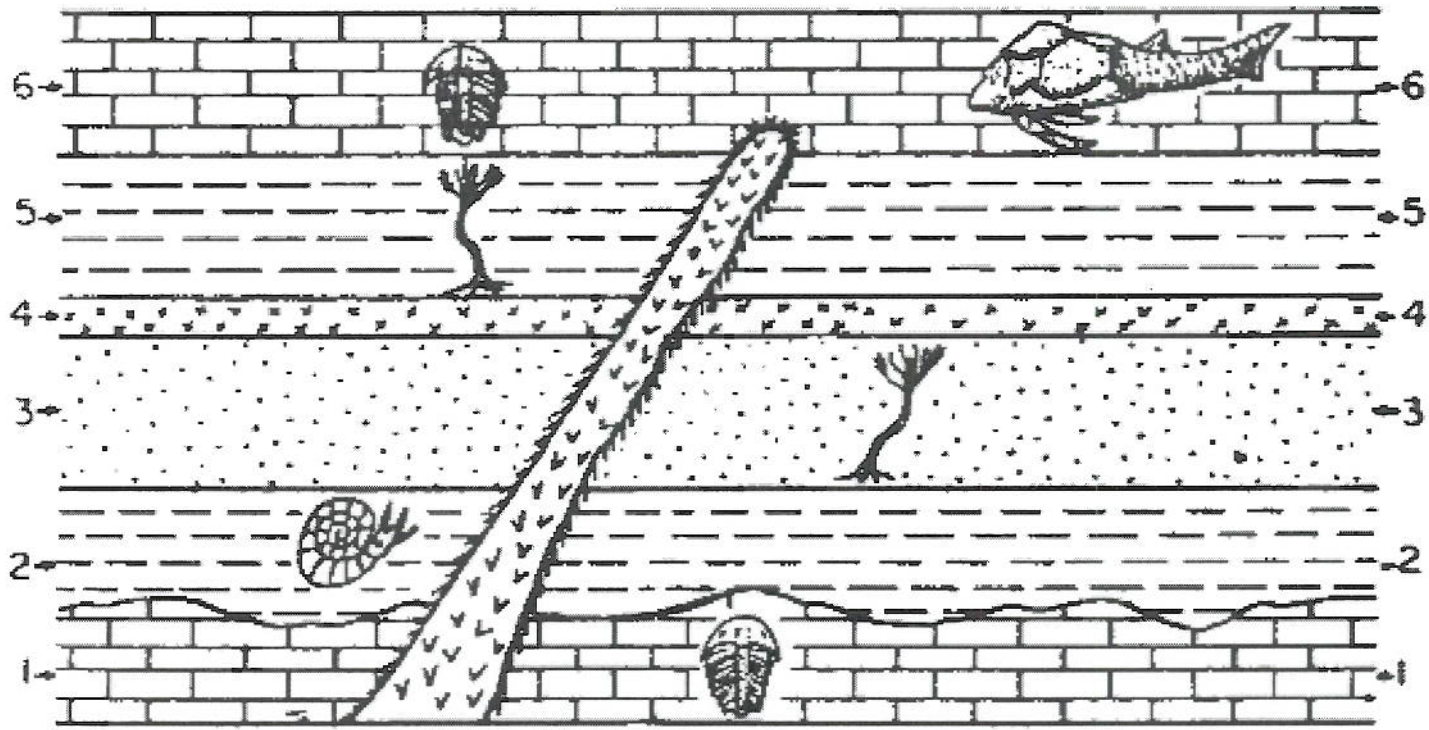
A. Layer 1 or the lower layers tend to be older than the ones on top of them due to the process of superposition (the oldest layer is found on the bottom, and the most recent layer is on top).

4b. What are index fossils?

A. A widespread fossil known to have lived in a short particular geologic age that can be used to date the rock layer in which it is found this is termed relative dating.

4c. Use the diagram to describe cross cutting?

A. Looking at the horizontally positioned layers (1-6) it is clear to see that there is an intrusion through layers 1-5 and part of 6, this being so, this intrusion of rock must have occurred after the formation of these 6 layers.



5. What constructive and destructive Earth processes can affect the evidence of Earth's history (changes to rock layers, land masses and shape/structure of the land)?

A. Movement of tectonic plates, weathering, continental glaciation and volcanic activity.

6. What mineral properties are used to identify minerals, and how are they used?

- A. Color- Least informative physical appearance.
- Hardness-What it can scratch, and what scratches it.
- Cleavage/Fracture- Pattern when mineral is broken.
- Streak-The color left behind when rubbing against a streak plate.
- Luster- How the mineral looks like in the light. (Reflects or absorbs light).
- Density-Mass per unit volume (How heavy it feels). $D = \text{Mass} / \text{Volume}$

7. Be able to describe how humans have had both positive and negative environmental impacts on the Earth.

A. Examples of positive and negative environmental issues and human impacts include global climate change, water quality, energy use, acid rain, ozone, establishment of parks, agricultural practices and forestry.

Strand III (Sub-strand B)-Earth and Space Science

1. What is radiation?

A. Transfer of energy through empty space via waves such as light waves, radio waves and microwaves.

2. What is conduction?

A. Transfer of heat between objects that are in direct contact with each other.

3. What is convection?

A. Transfer of heat by movement of fluid, including air and water.

4. How do radiation, conduction and convection work together to heat the atmosphere?

A. It all has to do with the movement of heat from the sun to our atmosphere, from the sun the heat is transferred via waves since there is nothing for the heat to be in contact with this is **radiation**, when it hits the atmosphere these waves encounter air which then transfers the heat (**convection**), the sun heats the ground and the ground transfers the heat back to the atmosphere (**conduction, and convection**).

5. What forces create currents in the ocean?

A. Wind, temperature and salinity (salt)

6. What forces create currents and layers in the atmosphere?

A. -Unequal heating of surface air. -Causing warm air to rise / cool air to fall. -Causing convection currents in the troposphere (lower layer of the atmosphere where weather occurs)

7. Describe the effect of Earth's rotation on winds and ocean currents.

A. -The rotation of the Earth creates what is known as the Coriolis effect. Since the Earth is rotating beneath the wind, the path it follows becomes a curve. In the Northern Hemisphere, the Earth rotates counterclockwise so the wind is deflected to the right. The Southern Hemisphere rotates clockwise deflecting the wind to the left. Regardless, the Coriolis effect only influences the direction of the wind, not its speed.

8. What weather predictions can be made from the following?

Increased Barometric Pressure

A. Warmer temps, skies clear, air dries.

Decreasing Barometric Pressure

A. Cooler temps, clouds increase, humidity increases.

High and Low Dew Points

A. The higher the dew point, the more water vapor there is for producing rain or snow.

8. (cont.) What weather predictions can be made from the following?

Wind direction -change to the following relative directions

A. *North*- colder, *South*- warmer, *East* -weather to get worse (rain/snow), *West* -fair and warmer.

Temperature

A. *Rises* -Warmer / *Falls*-Cooler. If rapidly changes chance of rain / snow / thunderstorms.

Clouds

A. Thicken and lower (Cumulus)-Weather to get worse.

Get higher and break up (Stratus) -Weather to get fair and warmer.

9. What is the composition and structures of the atmosphere.

A. >The atmosphere is mostly composed of Nitrogen (79%) and Oxygen (20%)

>Most weather takes place in the troposphere (lowest level)

>The ozone layer is located in the upper portion of the stratosphere (the layer above the troposphere).

>Temperature decreases with height in the first and third layers (troposphere and mesosphere) and increases in the second and fourth layers, (stratosphere and thermosphere).

>The jet stream is located at the top of the troposphere.

10. What evidence of climate change is there in Minnesota?

A. In Minnesota there is evidence of past glaciers due to current topography, land forms and rock layering that can be seen.

Strand III (Sub-strand C) Earth and Space Science

1. What is the closest star to the Earth?

A. Our sun

2. About how many galaxies are there?

A. Billions

3. About how many stars in a galaxy?

A. Billions

4. What is the name of our galaxy?

A. The Milky Way

5. Describe our sun?

A. Medium-sized star

6. Why do we use light years to measure distance in space?

A. Due to the vast distances

7. What evidence is there in favor of the Big Bang Theory?

A. Expanding universe

8. Why is space travel limited?

A. Due once again to the vast distances

9. What is the central and largest body in our solar system?

A. Our sun

10. What is the principal energy source for a solar system?

A. The sun

11. Explain the process that causes day and night.

A. Earth rotates on its axis once per day.

12. What is the primary factor that contributes to the change of seasons?

A. The tilt of Earth's axis at a 23.5° angle. See solstice and equinox diagrams and descriptions on the last page of this packet.

13. What 3 factors allow life to flourish on Earth?

A. Distance from the sun, composition of the atmosphere, presence of liquid water.

14. What is the name of our hemisphere?

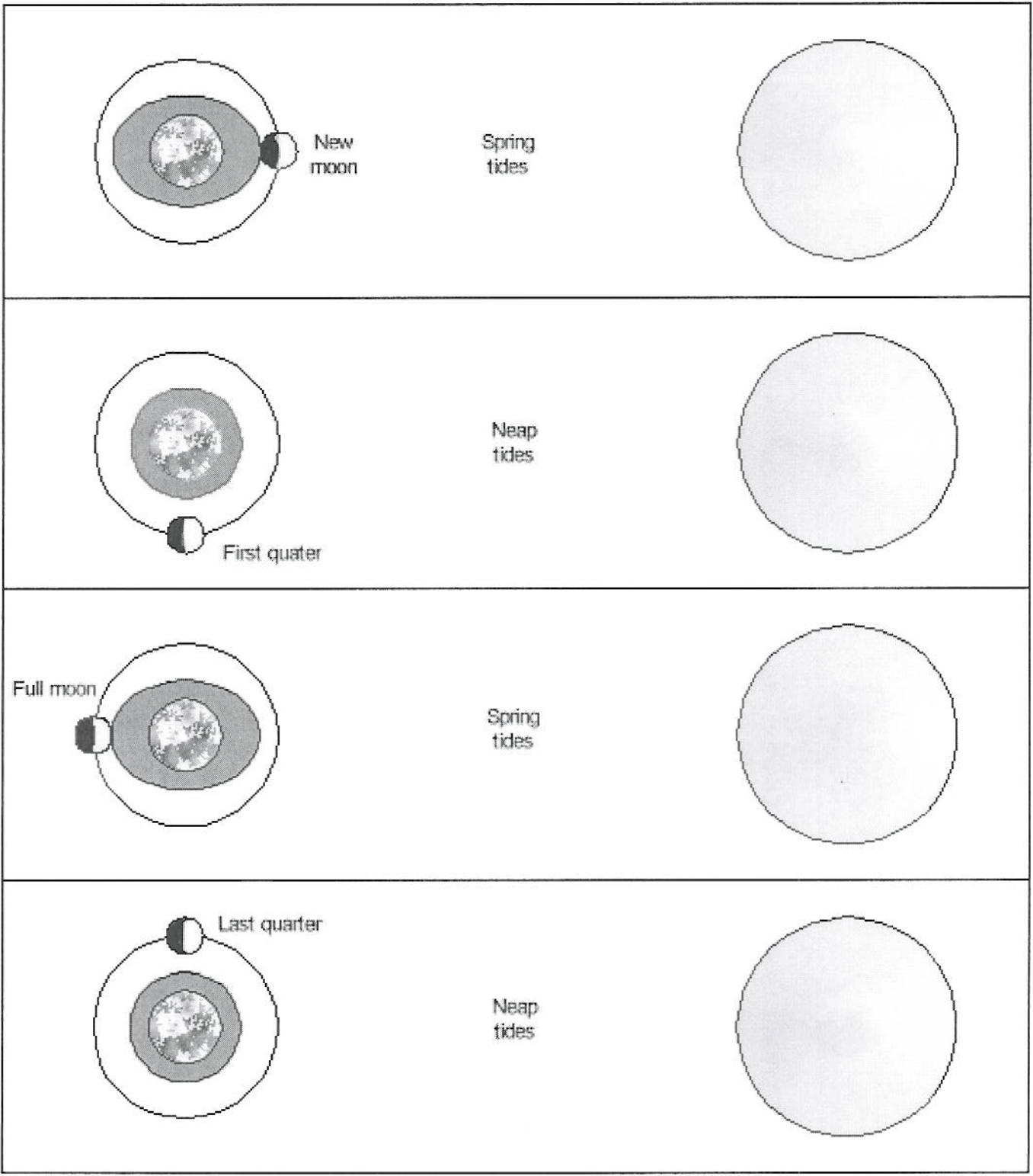
A. Northern

15. How is energy from the sun transferred to the Earth (what type of energy)?

A. Radiation

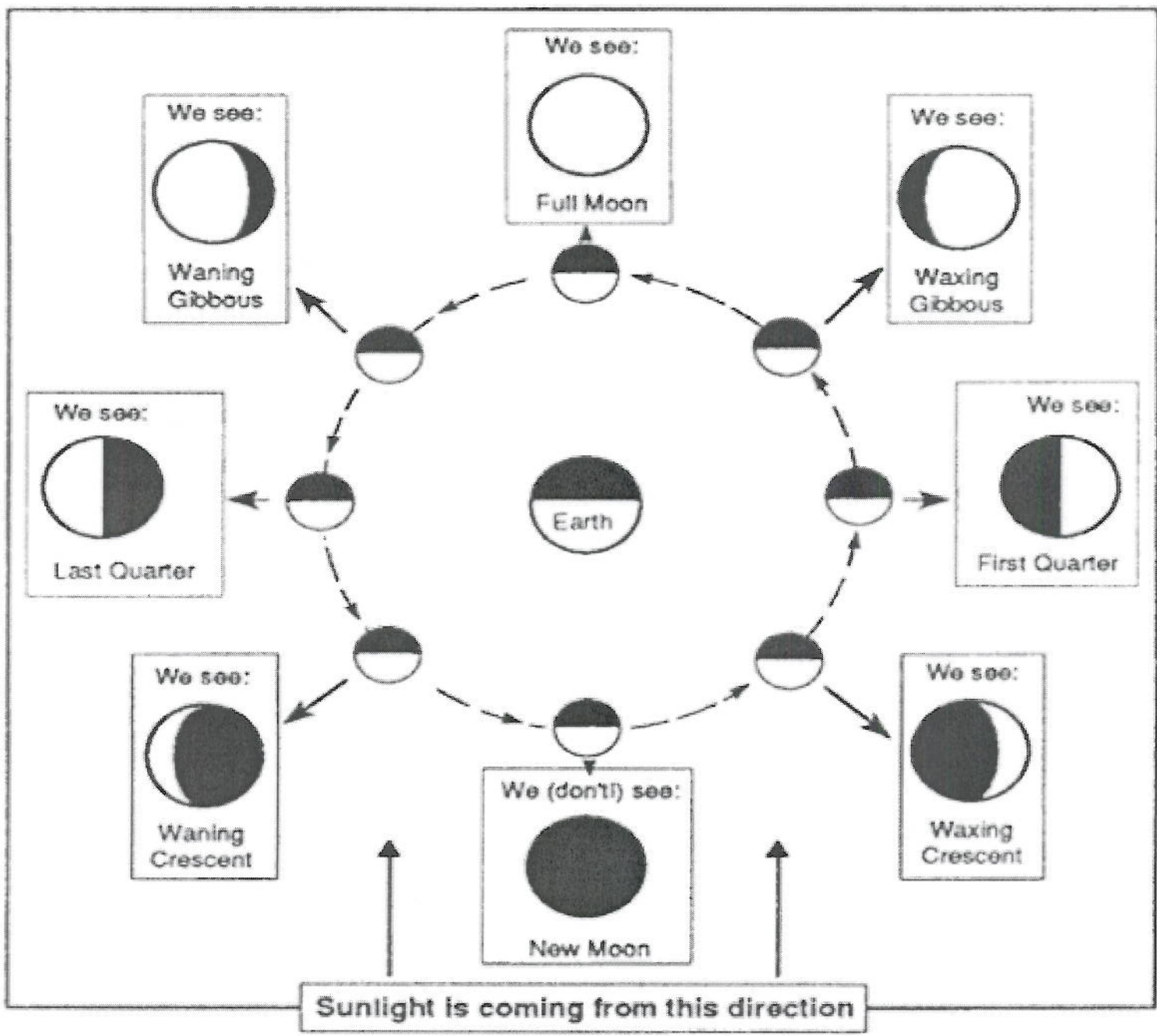
16. How do the Moon and Sun influence tides on Earth.

A. Tides are caused by Gravity pulling on the bodies of water on the earth and upon the Earth itself. There are 2 gravitational bodies that affect the tides. The sun and the moon. The Moon is much closer to the Earth so it has a much greater influence upon the tides. When the Earth, Moon, and Sun are all in a line (Full and New Moon Phases) the high tides are MUCH higher than at other times. These are called **SPRING TIDES**. Also, when the Moon and Sun are at right angles to each other the high tides are lower than at other times. These are called **NEAP TIDES**. During both the **FULL MOON** and the **NEW MOON** phases the high tides will be higher than the average high tide for the month. These are called **SPRING TIDES**. **The diagram below may help explain.**

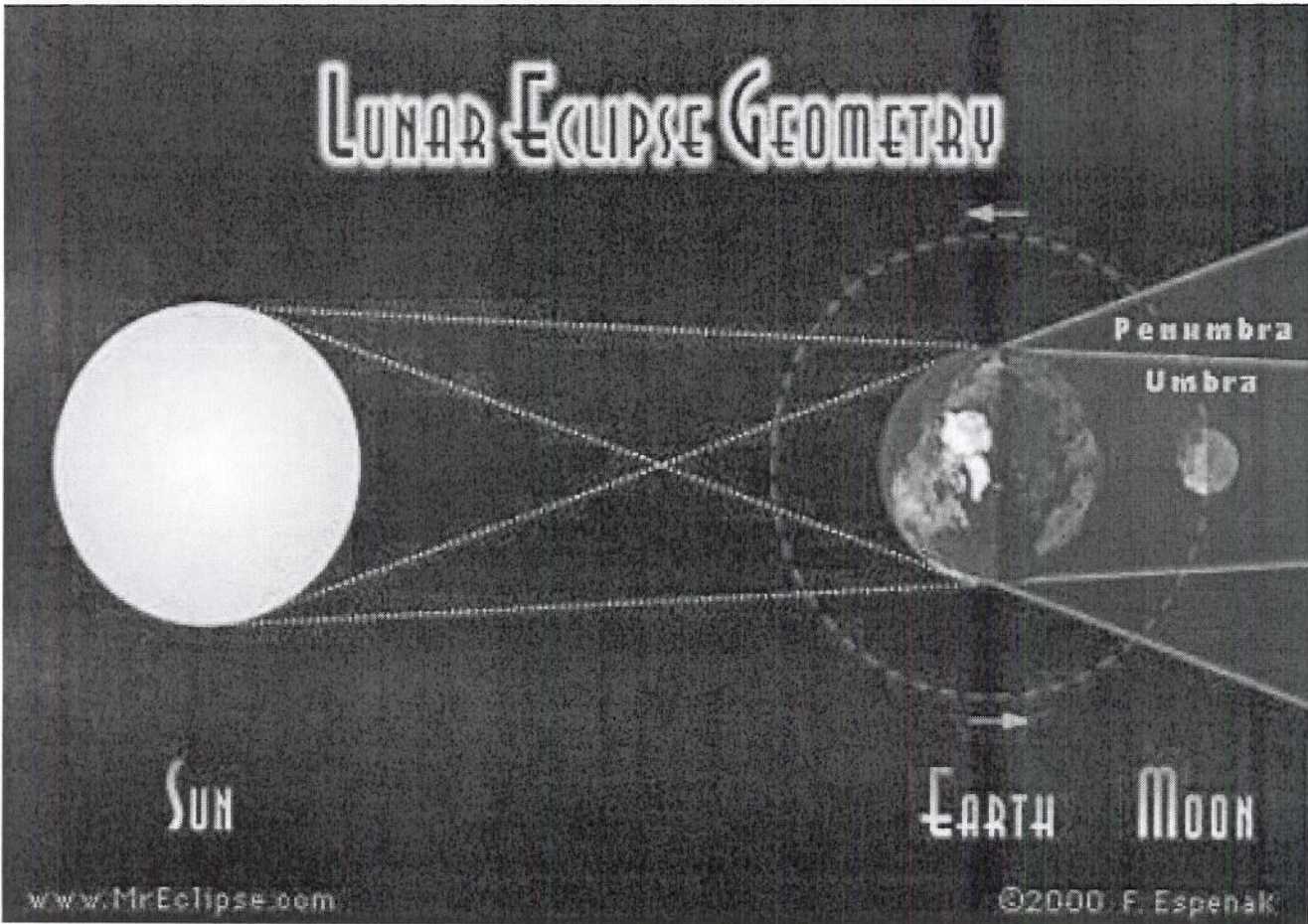
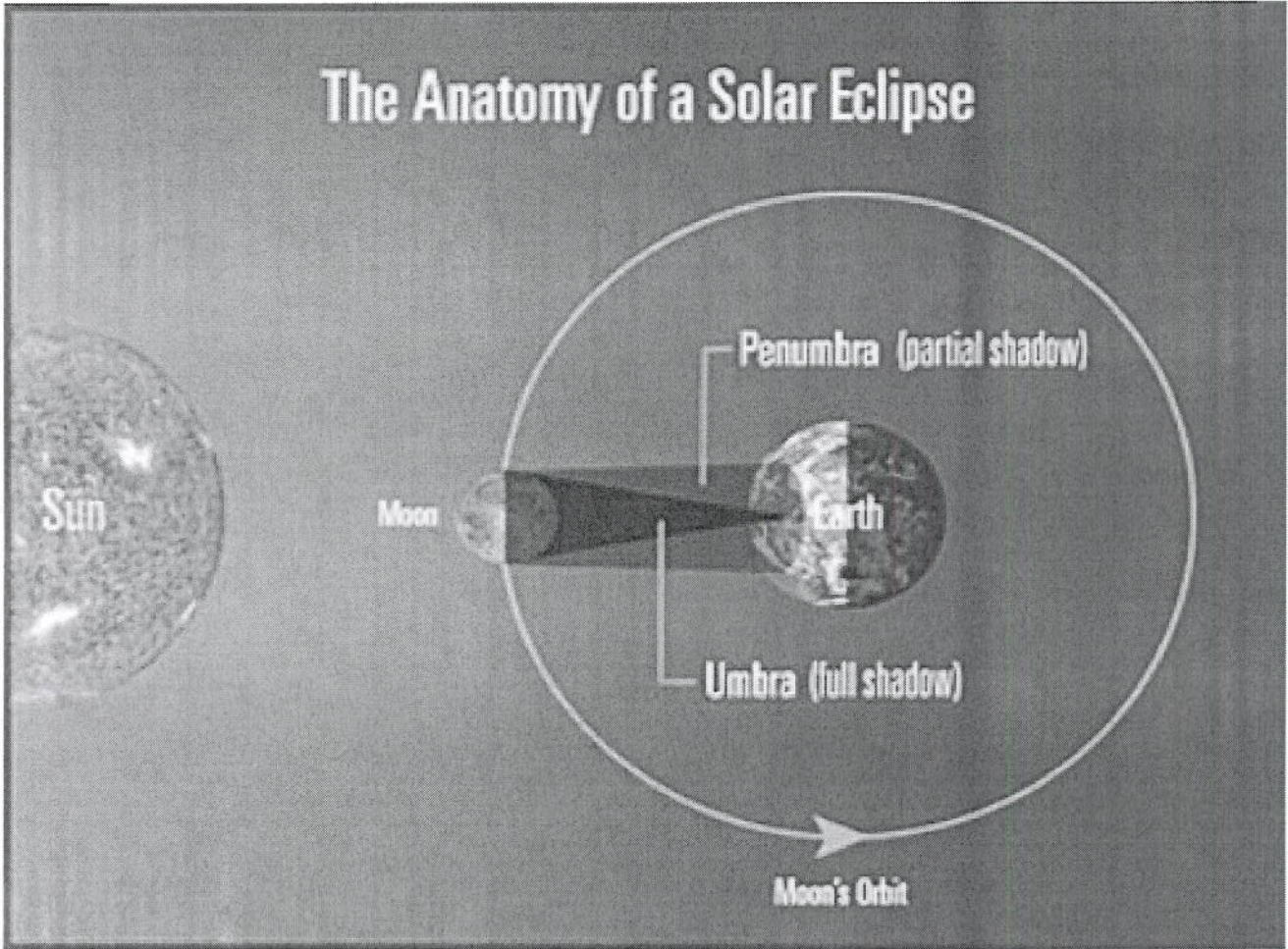


17. What are the names and phases of the moon?

A. See diagram.

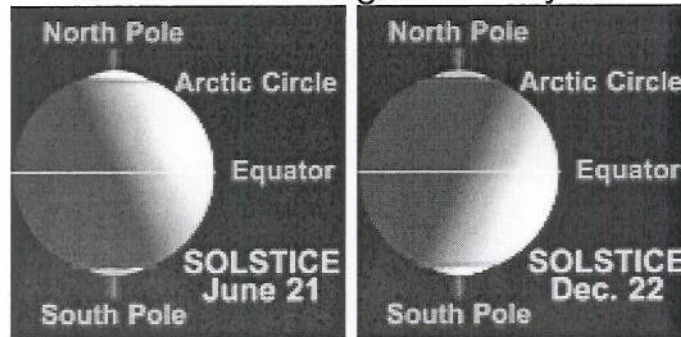


18. Be familiar with both a solar and lunar eclipse along with solstice and equinox. See diagrams.



SOLSTICE

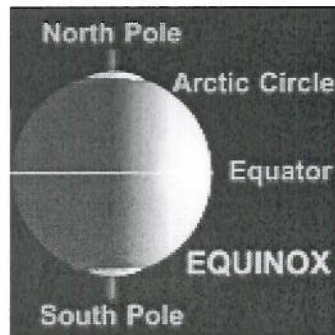
SUMMER SOLSTICE: The first day of the Season of Summer. On this day (JUNE 21 in the northern hemisphere*) the Sun is farthest north and the length of time between Sunrise and Sunset is the longest of the year.



WINTER SOLSTICE: The first day of the Season of Winter. On this day (DECEMBER 22 in the northern hemisphere*) the Sun is farthest south and the length of time between Sunrise and Sunset is the shortest of the year.

** In the southern hemisphere, winter and summer solstices are exchanged. Summer: December 22. Winter: June 21.*

EQUINOX



Two times of the year when night and day are about the same length. The Sun is crossing the Equator (an imaginary line around the middle of the Earth) and it is an equal distance from the North Pole and the South Pole.

SPRING EQUINOX: The first day of the Season of Spring - and the beginning of a long period of sunlight at the Pole. In the northern hemisphere: MARCH 20 (the Sun crosses the Equator moving northward). In the southern hemisphere: SEPTEMBER 22 (the Sun crosses the Equator moving southward).

AUTUMN EQUINOX: The first day of the Season of Autumn - and the beginning of a long period of darkness at the Pole. In the northern hemisphere: SEPTEMBER 22 (the Sun crosses the Equator moving southward). In the southern hemisphere: MARCH 20 (the Sun crosses the Equator moving northward).

Life Science Standard: Study Guide

Strand IV: Life Science

Sub-strand A: Cells

1. What is the smallest unit of all living things?

The cell

2. Name the parts that make up an animal cell.

Cell membrane, nucleus, mitochondria, endoplasmic reticulum, golgi body, lysosome, vacuole, and ribosomes.

3. Explain the difference between one-celled organisms and many-celled organisms.

A unicellular (one-celled) organism performs all life functions itself. The cells in a multicellular (many-celled) organism do not work alone but depend in some way on other cells. Multicellular organism cells also are specialized to do certain jobs.

4. Explain the difference between prokaryotic and eukaryotic cells.

A prokaryotic cell does not have a nucleus or other membrane-bound organelles.

5. What are some examples of a multi-celled organism?

Plants, animals, fungi some algae, etc.

6. What are some examples of single-celled organisms?

Diatoms, amoeba, paramecium, bacteria etc.

7. Name three organelles that plant cells have that animal cells do not.

Chloroplasts, cell wall and central vacuole

8. How does a multi-celled organism grow?

By increasing the number of cells

9. Using the terms: energy, food, oxygen, carbon dioxide and water, explain the basic process of cellular respiration.

Food (sugar) + Oxygen → Carbon dioxide + Water + ENERGY

Strand IV: Life Science
Sub-strand B: Diversity of Organisms

1. Put the following terms in order from the most simple to the most complex:
organ system, tissue, organ, and cells.

Cells, tissues, organ, organ system, organism

2. An organism's ability to maintain a steady condition is called _____.
a. biogenesis c. osmosis
***b. homeostasis d. respiration**

3. What are some ways an organism maintains homeostasis?

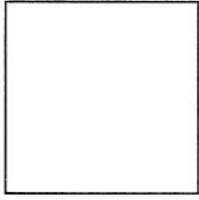
Sweating, goose bumps, some animals sit in the sun to maintain body temperature.

4. Explain the difference between an endothermic and exothermic organism?

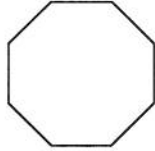
An endothermic organism can maintain its own internal body temperature and exothermic cannot. It must use an outside source. Example: a lizard sitting on a warm rock.

5. Dichotomous key: Use the dichotomous key to find the silly name for each of these shapes:

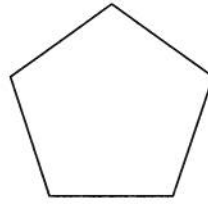
1.



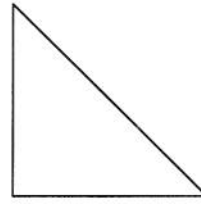
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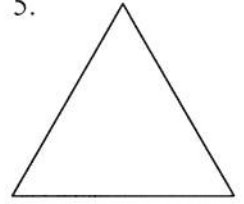
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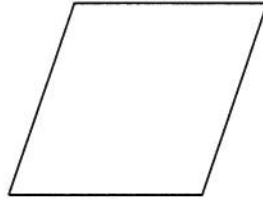
4.



5.



6.



- | | |
|-------------------------------------------------|-------------------|
| 1. a. The shape is a triangle | Go to 2 |
| b. The shape is not a triangle | Go to 3 |
| 2. a. The shape is a right triangle | Trius rightus |
| b. All angles are equal and all sides are equal | Isoculusis |
| 3. a. There are four sides | Go to 4 |
| b. There are more than four sides | Go to 5 |
| 4. a. There are four sides with right angles | Squarus maximus |
| b. There are four sides with no right angles | Parallel strangis |
| 5. a. The shape has five sides | Pentabus regulus |
| b. The shape has eight sides | Octogonus regulus |

- ANSWERS:**
1. Squarus maximus
 2. Octogonus reculus
 3. Pentabus regulus
 4. Trius rightus
 5. Isoculusis
 6. Parallel strangis

5. What are the five main kingdoms of living organisms? Give an example of each.
Plants, Animals, Protists, Fungi and Monerans

Strand IV: Life Science

Sub-strand C: Interdependence of Life

1. What are the two types of factors involved in ecosystems?
Living (biotic) and non-living (abiotic)
2. Make a food chain that shows the flow of energy between the following organisms: eagle, snake, mouse, and clover.
Clover-→ Mouse-→ Snake-→Eagle
3. What are some factors that limit the number of organisms in an ecosystem?
Competition for resources such as food, shelter and finding a mate
4. Name some organisms that live in a temperate (MN) forest.
Deer, bear, squirrel, pine tree, oak tree, spiders, owl, mouse, etc...

Strand IV: Life Science

Sub-strand D: Heredity

1. What is a trait?
A characteristic passed on from parent to offspring
2. How are traits controlled?
Traits are controlled by genes carried on chromosomes.
3. Compare and contrast the following terms: DNA, chromosomes, gene, and trait.
Traits are characteristics that are passed from parent to offspring. A gene is a segment of DNA that codes for a specific trait. DNA is the nucleic acid that contains all our traits. Chromosomes are DNA molecules that are tightly coiled which form just before mitosis begins.
4. Explain the difference between dominant and recessive traits.
A dominant trait is seen over a recessive trait. Sometimes it is said it is the “stronger” trait. You must have two recessive genes for a recessive trait to be expressed.

5. How many chromosomes are contained in human cells? How does the number differ in sex cells?

Human cells contain 46 total chromosomes (23 pair) Sex cells contain half the number of total chromosomes which in humans is 23. Therefore when egg and sperm come together during fertilization the organism has a complete set of chromosomes, half from each parent.

Directions: Complete the Punnett square by writing the parental genotypes in the correct places and determining the possible genotypes of the offspring.

Dominant gene: curly hair (H)
Recessive gene: straight hair (h)
Parents: Hh × hh

6. What are the genotypes and phenotypes of the all offspring?

**Half of the offspring are Hh, curly hair
Half of the offspring are hh straight hair**

7. What affect does mutation have on inheritance?

Mutations are a source of genetic variation a species needs in order to adapt to changing conditions and thus evolve over time.

8. Why is genetic diversity in a population of organisms important?

It plays an important role for the survival and adaptation of a species within a population. A species that has a large degree of genetic diversity among its population will have more variations from which to choose the most fit alleles.

9. Describe the role of sexual and asexual reproduction on diversity of a population of organism.

Sexual reproduction increases the diversity of a population. Asexual reproduction does not as it produces clone organisms. Sexual reproduction encourages diversity.

Strand IV: Live Science

Sub-strand E: Biological Populations Change Over Time

1. Why is the fossil record an important piece of evolutionary history?

The fossil record shows extinction as a common event. The fossil record also shows examples of organisms that lived during various times which can show scientists how organisms have changed. Scientific evidence can be used to infer common ancestry among organisms.

2. How did Darwin explain the evolution of beak size of finches on the Galapagos Islands?

Darwin observed that all of the species of finches closely resembled one species of South American finch. All of the species were similar, but each was specialized to catch food in different ways. Some had thick, sturdy bills for cracking open tough seeds. Others had slender beaks for catching insects. Darwin hypothesized that the beaks changed over time to adapt to feeding conditions. Natural selection is the process of evolution- changes in characteristics lead to survival. Diversity of species develops through gradual processes over generations (finches)

3. What are some environmental pressures that can affect evolution?

Environmental pressures include food sources, changes in climate and isolation of populations.

4. How is biological evolution defined?

Biological evolution is defined as change in a population over time

Strand IV Life Science

Sub-strand F: Flow of Matter and Energy

1. What is photosynthesis?

The process by which plants (producers) use light energy to make sugars (food)

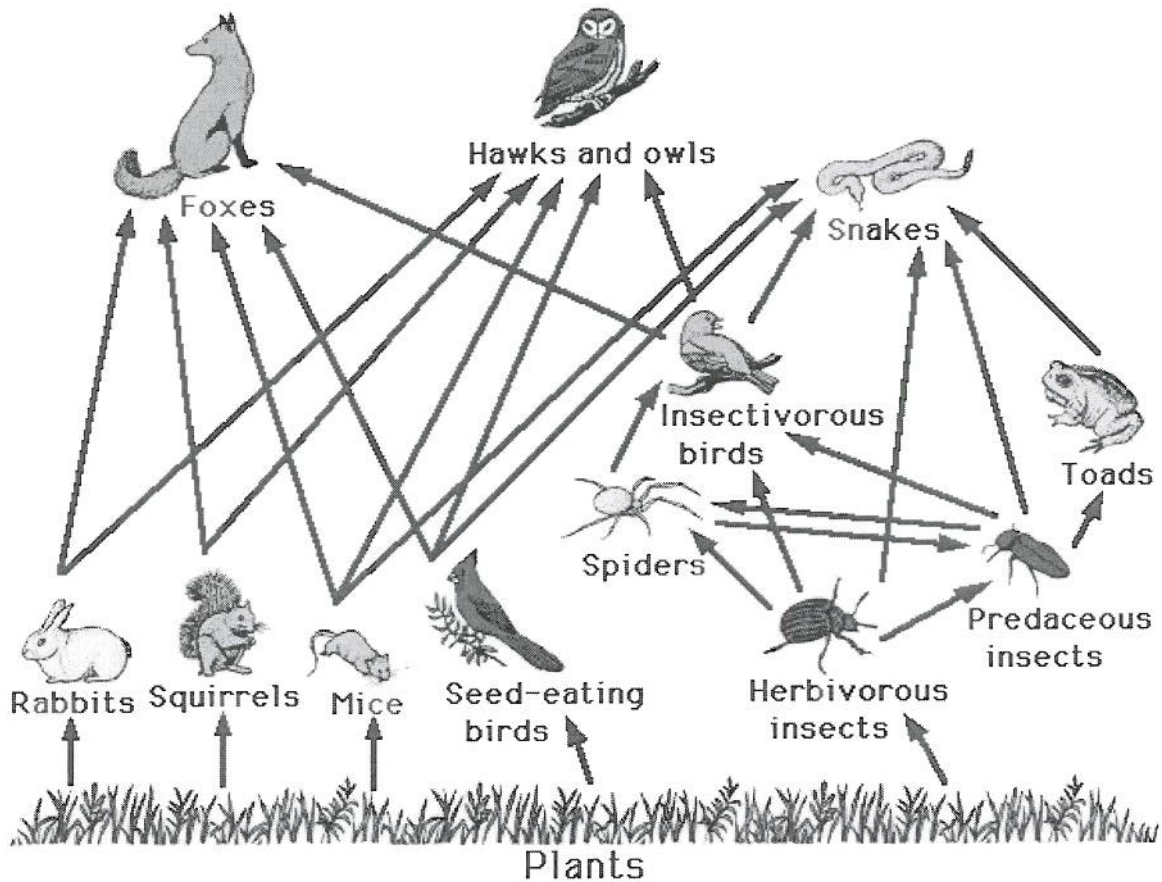
2. Explain the process of photosynthesis using the terms: energy, food, sunlight, water, oxygen, carbon dioxide.

Carbon dioxide + Water + Energy from sunlight → Food (sugar) + Oxygen

- Put the following terms in order starting with the organism whose energy source is closest to the sun: secondary consumer, primary consumer, decomposer, tertiary consumer, and producer.

Producer--primary consumer-- secondary consumer--tertiary consumer--decomposer

- Create a food chain using the following terms: mouse, clover, owl, snake, bacteria



- Is the diagram above a food chain or a food web? How do you know?

Food Web. Food chains show the transfer of energy from one organism to another. A food web is made up of many different food chains.

Strand IV Life Science

Sub-strand G: Human Organism

1. What is the basic structure of a virus?
A virus is DNA or RNA in a protein coat. It is NOT a cell.
2. How are bacteria different from a virus?
Bacteria are prokaryotes (cells without a nucleus). Since they are cells they are living things. Viruses are not considered living. Both can cause illness.
3. What are the basic body systems we have studied? How do they play a role in keeping your body healthy?
Circulatory, digestive, nervous, skeletal, endocrine, muscular, respiratory, and excretory.
The different organ systems work together and depend upon one another to keep your body healthy. All systems work together to maintain homeostasis.

Scientific Method and Measurement

A _____ is a prediction that can be tested.
a. **hypothesis** b. scientific law c. theory d. variable

A(n) _____ is a unifying explanation of a broad range of hypotheses based on many observations and tested over time.
a. control b. experiment c. hypothesis d. **theory**

The SI unit of mass is the _____.
a. cubic meter b. **kilogram** c. liter d. meter

All of the following **EXCEPT** _____ are SI units.
a. kilometer b. **inch** c. gram d. tonne

Redi's Experiment

Francesco Redi was born in Italy in 1626. At age 21, he received a medical degree from the University of Pisa, Italy. From then on, he worked as a doctor. Most of the people of Redi's time thought living things came spontaneously from mud or decaying meat. A few scientists, including Redi, thought that idea was probably not true. He decided to try to find out how maggots appeared in decaying meat. Many thought the maggots came from the meat, but Redi thought that flies laid their eggs on the meat and the maggots hatched from those eggs. To test his theory, Redi prepared eight containers. Into each he placed a piece of meat or fish. He then sealed four of the containers and left four uncovered. Drawn by the smell of the meat, flies buzzed around the containers. After a few days, maggots appeared on the meat in the four uncovered containers. The meat in the four covered containers had decayed, but there were no maggots. Next, Redi prepared eight more containers for a second experiment. Into each, he placed a piece of meat or fish. He then covered four of the containers with gauze, which allowed air to move freely in and out of the containers. He again left four containers uncovered. As before, flies buzzed around the containers, attracted by the smell of the meat. After a few days the results were the same—maggots could be found only on the meat in the uncovered containers.

1. Before the 1700s, some people believed that life came from mud or decaying meat. What is this theory called?
2. What theory did Redi prove?
3. In the first experiment, what did Redi prove?
4. What did Redi do differently in the second experiment?
5. What did Redi prove in the second experiment that he had not already proved in the first?

The Early Cell Explorers

It's hard to believe, but there was a time when we didn't know anything about cell structure. In fact, the word cell (from the Latin word for chamber, *cello*) wasn't used as a biological term until 1665. That's when Robert Hooke, an English-born scientist, looked at a thin slice of a cork plant under a compound microscope he had built himself. Hooke noticed small holes surrounded by walls and named these tiny pores *cells*. After that, scientists believed cells were found only in plants. But in 1839, Matthias Schleiden and Theodor Schwann, both German scientists, shared their scientific findings with one another. Schleiden had been studying plant cells and Schwann had been studying animal structures. Together, they compared plant and animal structures and found that the structures were very similar—too similar to be accidental. They concluded that cells are the basic building blocks for both plants

and animals. In 1858, Rudolf Virchow took Schleiden's and Schwann's theory and stated it simply: all cells come from other cells. This remains known as the cell theory.

Throughout the mid-1800s and into the 1900s, scientists continued to discover more and more about cells thanks in part to Gregor Mendel's study of genetics, Friedrich Miescher's discovery of nuclein (which later became known as DNA), and James Watson's findings about DNA's structure. Although many amazing discoveries have happened in recent years, including genetic engineering and gene therapy, all of it is because of the work of those early cell explorers.

1. How important was Hooke's homemade microscope to the discovery of the plant cell? Explain.
2. Restate the cell theory in your own words.
3. Why do you think it took almost 200 years for scientists to formulate the cell theory?

Physical Science Study Guide

Strand 2 Physical Science Substrand 1--Matter

What is density?

Density is the amount of mass that fits in a given volume. It is found by dividing the object's mass by its volume.

What is dissolving?

Dissolving is the process where by a substance is absorbed by another substance. In a familiar type of solution, a solid is dissolved into a liquid such as powdered drink mix dissolved in water.

What is compression?

Compression is a change in the pressure of a substance when particles get closer together. This could cause a change in state --i.e. gas to a liquid.

What is diffusion?

Diffusion is the process whereby particle spread out from high to low concentrations.

What is thermal expansion?

Heat energy causes particles to speed up and spread farther apart. Examples include expansion joints in bridges and railroad tracks or when heated air expands in a balloon.

What is evidence of a physical change?

When a substance goes through a physical change, some of its physical properties may change, but it does not become a different substance. Examples of physical changes include changing the size, shape, phase (solid, liquid, gas), or the number of pieces of a substance. It may also include a substance dissolving in another substance. The physical properties of a substance determine it uses and the physical changes it can undergo.

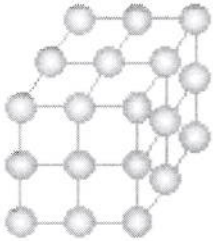
What is the Law of Conservation of Mass?

A law that states that the total amount of mass in a system is always the same, and that mass cannot be created or destroyed.

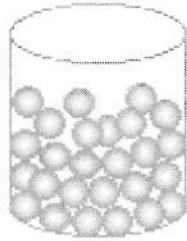
Example-The mass of an ice cube does not change when it melts even though it has gone through a physical change.

How are the particles of solids, liquids, and gases arranged differently?

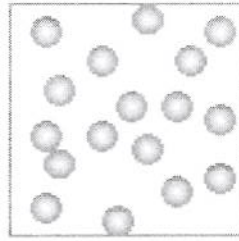
States of Matter



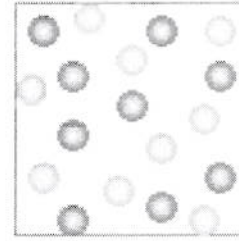
SOLID



LIQUID



GAS



PLASMA



Strand 1--Physical Science Substrand 2 Motion

How can you calculate the speed of an object traveling in a straight line?

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Average speed} = \frac{\text{total distance traveled}}{\text{total elapsed time}}$$

Strand 2 Substrand 2--Motion

What are balanced forces?

Balanced forces acting on an object are equal in size but opposite in direction.

What are unbalanced forces?

Unbalanced forces acting on an object are forces that are not equal in size, but are still opposite in direction.

How do forces acting on object affect motion?

Balanced forces seem to cancel each other out. The result of balanced forces acting on an object is the object either does not move or continues its motion at constant velocity (speed and direction).

The result of unbalanced forces acting on an object is that they cause a change in velocity, making the object slow down, speed up, or change direction.

How does the sum of the forces working on an object affect its motion?

The greater the force that acts on an object, the greater the change in motion.

What are some forces that can act on an object from a distance?

Some forces that can affect motion from a distance are magnetic, electrical, and gravitational forces.

Strand 2 Physical Science

Substrand 3--Energy

What is the speed of a wave?

The speed of a wave is how far a specific point on the wave traveled in a given time.

What is the wavelength of a wave?

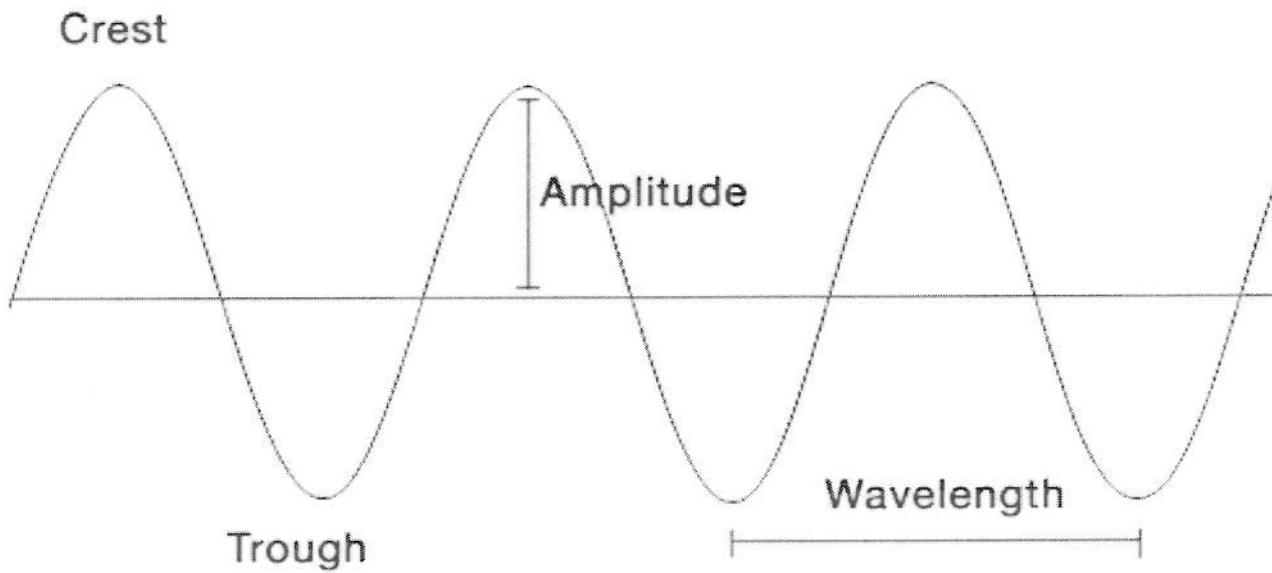
Wavelength is the length of the wave-the distance between any two consecutive identical points on a wave - crest to crest or trough to trough.

What is the frequency of a wave?

The frequency is the number of vibrations the wave has in a given time. It can be measured by counting the number of crests or compressions that pass a point in a certain period of time.

What is the amplitude of a wave?

The amplitude is the distance any point on a wave is moved from its resting point.



How is energy transferred through sound waves?

Sounds are produced by vibrations of objects. The vibrations cause the molecules of the material around the object to vibrate. This forms a wave that travels through the material.

What is reflection?

Reflection is the bouncing of light waves off a surface.

What is refraction?

Refraction is the bending of a light wave when it passes from one medium to another.

What is the color spectrum?

The color spectrum is the colors into which white light can be separated. This is done when a beam of white light passes through a prism. The prism will bend the different colors of white light at different amounts depending on their wavelength. This makes the different colors visible.

What is potential energy?

Potential energy is energy that is due to the position or condition of an object. An object set high on a hill has more potential energy than one on the ground.

What is kinetic energy?

Kinetic energy is energy of motion and it has the ability to exert a force on matter that comes in contact with it. The faster something moves, the more kinetic energy it has.

When would potential energy become kinetic energy and vice versa?

Potential energy becomes kinetic energy when an object that was at rest begins moving. Kinetic energy becomes potential energy when a moving object stops moving.

An example of this energy transfer is when a ball is thrown into the air. The speed of the ball that is tossed decreases as it gets higher. Its kinetic energy decreases. The potential energy is increasing because of the position of the ball. The higher up it is, the more potential it has to fall back down. At the point where the ball stops moving, its potential energy is the greatest and it has no kinetic energy. As the ball comes down, the potential energy decreases and the kinetic energy increases.

What is thermal energy?

Thermal energy is the kinetic energy of moving particles of a substance. The more the particles move, the more thermal energy a substance has, and the warmer it gets.

What is electrical energy?

Electrical energy is the flow of electrons from one place to another. This is what runs electrical devices.

What is chemical energy?

Chemical energy is a form of potential energy stored in reactants. Chemical energy usually changes to heat or light energy when it is given off.

What is mechanical energy?

Mechanical energy is the total energy of an object. It is the sum of kinetic (motion) + potential energy. Mechanical energy turns the wheels on a car or moves your body.

What is nuclear energy?

Nuclear energy is the splitting apart of nucleus of an atom into smaller nuclei.

Energy transfers

What is conduction?

Conduction is the heat that results from particles colliding. Objects have to touch for conduction to take place.

What is convection?

Convection is thermal energy that is transferred through fluids (liquids and gases) in the form of currents.

What is radiation?

Radiation is the transfer of thermal energy as waves. This is the only way for thermal energy to transfer through a vacuum.

