Sample Instructional Strategies
2010 Mississippi Science Framework
Grades 5, 8, and Biology I

The Center for Educational and Training Technology at Mississippi State University in partnership with Mississippi teachers offers these sample instructional strategies to aid science teachers in 5th, 8th, and Biology I in planning their instructional strategies using the 2010 Mississippi Science Framework. Created by current Mississippi science teachers based on their classroom experience and understanding of the content objectives, these strategies are designed to give science teachers ideas for addressing the framework objectives. They are not meant to supersede your textbook, pacing guides, or other resources nor to be the only strategy or strategies for teaching the objectives. The strategies are available for teachers to adapt or incorporate into units of instruction as needed.

For most content objectives, there are two sample instructional objectives offered to assist teachers in addressing the 2010 Mississippi Science Framework content in more depth. The 2010 Framework includes the Depth of Knowledge (DOK) level for each objective. Therefore when possible, each objective has been written to address the objective at the DOK level of the objective and/or include suggestions for extending the strategy to a higher DOK level. For the most part, strategies addressing Inquiry objectives have been embedded into the strategies for content objectives and are referenced accordingly.

The Center for Educational and Training Technology gratefully acknowledges the efforts of the following outstanding teachers in creating these sample strategies for Mississippi teachers. Using their many years of science classroom experience in Mississippi schools, they have developed strategies that are applicable to your students and your classrooms.

Biology I: Jamie Calvert, Neshoba Central School District; Kristina Darrell, Lowndes County School District
8th Grade: Jim Luke, Philadelphia School District; Kaye Borst, Houston School District
5th Grade: Lori Matzek, Louisville School District; Terry Rose, Stone County School District

Center for Educational and Training Technology
Betty Latimer, Ph.D. Interim Director/ Project Director
Re-C Carter, ATOMS2xp Science Field Coordinator
Sonya Smith, ATOMS2xp Science Field Coordinator

Contact information:
Center for Educational and Training Technology
Bost 309, PO Box 9662
Mississippi State, MS 39762
questions @cett.msstate.edu

Instructional Strategies 8th Grade 2010 Mississippi Science Framework

Comp	Obj.	Inquiry (PLDs: Advanced Proficient Basic)
1		**Draw conclusions from scientific investigations including controlled experiments.** **Blueprint: 8 OBJ/7 ITEMS**
1	1a.	*Design, conduct, and analyze conclusions from an investigation that includes using experimental controls. (DOK 3)* **Advanced** – 1a. Evaluate the design of an investigation, including the design's use of experimental controls and the design's effect on the conclusion. **Proficient** – 1a. Design, conduct, and analyze conclusions from an investigation that includes using experimental controls. **Strategy 1:** See Obj. 2e, Strategy 1 **Strategy 2**: Observe two pumpkins; one will be a whole uncut pumpkin (control). The other will be a freshly carved pumpkin (experimental factor). Place the pumpkins side by side on a plastic tray. Observe the pumpkins for approximately three months. Have students keep a log on the pumpkins. Log should note all changes, organisms and events that occur over the next three months. Each day's entry should be divided into quantitative and qualitative observations. Student should make at least two entries a week. They may enter more entries if they choose to do so. Give students two classroom sessions with microscopes to observe any microscopic structures organisms. In making their observations, they should use as many of their senses as possible. Do not eat or taste the pumpkins. Be sure to include observations such as: mass (weigh pumpkins once a week), height, width, colors, smells, textures, physical state, and temperatures (room, pumpkin and pumpkin fluids). Take pictures of the pumpkins twice a week. Post for the students to see long range change.
1	1b.	*Distinguish between qualitative and quantitative observations and make inferences based on observations. (DOK 3)* **Proficient** – 1b. Distinguish between qualitative and quantitative observations and make inferences based on observations. **Basic** – 1b. Identify an inference as being based on qualitative observations or quantitative observations. **Strategy 1:** See Obj. 2a, Strategy 1 See Obj. 2c, Strategy 1 See Obj. 2e, Strategy 1 See Obj. 4e, Strategy 1 **Strategy 2:** See Obj. 1a, Strategy 2 See Obj. 2c, Strategy 2
1	1c.	*Summarize data to show the cause and effect relationship between qualitative and quantitative observations. (DOK 3)* **Advanced** – 1c. Predict the effect of summarized data. **Proficient** – 1c. Summarize data to show the cause and effect relationship between qualitative and quantitative observations.

		Strategy 1: See Obj. 2e, Strategy 1 See Obj. 3e, Strategy 1 See Obj. 4e, Strategy 1 **Strategy 2:** See Obj. 2b, Strategy 2 See Obj. 4c, Strategy 2 See Obj. 4d, Strategy 2
1	1d.	*Analyze evidence that is used to form explanations and draw conclusions. (DOK 3)* **Proficient** – 1d. Analyze evidence that is used to form explanations and draw conclusions. **Basic** – 1d. Identify evidence that supports an explanation or conclusion. **Strategy 1:** See Obj. 2a, Strategy 1 See Obj. 2b, Strategy 1 See Obj. 2e, Strategy 1 See Obj. 3e, Strategy 1 See Obj. 3f, Strategy 1 See Obj. 3g, Strategy 1 See Obj. 4a, Strategy 1 See Obj. 4b, Strategy 1 See Obj. 4e, Strategy 1 See Obj. 4g, Strategy 1 See Obj. 4h, Strategy 1 **Strategy 2:** See Obj. 2f, Strategy 2 See Obj. 3g, Strategy 2
1	1e.	*Develop a logical argument defending conclusions of an experimental method.(DOK 3)* **Advanced** – 1e. Justify whether an argument defending a conclusion is logical. **Proficient** – 1e. Develop a logical argument defending conclusions of an experimental method. **Strategy 1:** See Obj. 2e, Strategy 1 See Obj. 3f, Strategy 1 See Obj. 3g, Strategy 1 See Obj. 4h **Strategy 2:** See Obj. 3f, Strategy 2
1	1f.	*Develop a logical argument to explain why perfectly designed solutions do not exist.(DOK 3)* **Proficient** – 1f. Develop a logical argument to explain why perfectly designed solutions do not exist. **Strategy 1:** See Obj. 2e, Strategy 1 **Strategy 2:** See Obj. 2c, Strategy 2

1	1g.	*Justify a scientist's need to revise conclusions after encountering new experimental evidence that does not match existing explanations. (DOK 3)* **Proficient** – 1g. Justify a scientist's need to revise conclusions after encountering new experimental evidence that does not match existing explanations. **Strategy 1:** See Obj. 2e, Strategy 1 See Obj. 3g, Strategy 1
1	1h.	*Analyze different ideas and recognize the skepticism of others as part of the scientific process in considering alternative conclusions. (DOK 3)* **Advanced** – 1h. Evaluate arguments based upon the scientific process for ideas presented as alternative conclusions. **Proficient** – 1h. Analyze different ideas and recognize the skepticism of others as part of the scientific process in considering alternative conclusions. **Basic** – 1h. Recognize appropriate scientific skepticism when reviewing alternative conclusions. **Strategy 1:** See Obj. 2e, Strategy 1 See Obj. 3f, Strategy 1 See Obj. 4h
Comp.	**Obj.**	**Physical Science (PLDs: Advanced Proficient Basic)**
2		**Apply concepts relating to an understanding of chemical and physical changes, interactions involving energy, and forces that affect motion of objects.** **Blueprint: 6 OBJ/10 ITEMS**
2	2a.	*Identify patterns found in chemical symbols, formulas, reactions, and equations that apply to the law of conservation of mass. (DOK 1)* **Advanced** – 2a. Balance chemical equations to illustrate the law of conservation of mass. **Proficient** – 2a. Identify patterns found in chemical symbols, formulas, reactions, and equations that apply to the law of conservation of mass. **Basic** – 2a. Identify the chemical symbols, formulas of common substances, or reactions used in a balanced equation.
1	1b.	**Strategy 1:** After students understand that an apple changing color after being peeled is a chemical reaction, allow them to experimentally see that no mass is gained or lost in the reaction. Using an airtight bag, quarter an apple and place it in the bag, sealing tightly. Do not force any air out of the bag. Place the bag and apple on a balance to calculate the mass. After a few minutes the apple will begin to change colors. Emphasize to the students this is a chemical reaction taking place. Using the same balance, mass the bag and apple again. You should have the same result, showing that no mass was gained or lost during the reaction.
1	1d.	**Strategy 2:** Balancing chemical equations such as photosynthesis and respiration proves the law of conservation. Students should have background knowledge of these equations. • On six pieces of blue construction paper write "C" to represent carbon [six molecules of carbon] • On 12 pieces of red construction paper write "H" to represent hydrogen [12

		molecules of hydrogen] • On 18 pieces of green construction paper write "O" to represent oxygen [18 molecules of oxygen] • Draw a sun on a piece of yellow construction paper to represent energy coming • from the sun • On a piece of white construction paper write a "+" on it • On a piece of white construction paper write an arrow to represent the yields sign in the equation • On a large poster board write the equation for photosynthesis on one side and the equation for respiration on the opposite side • On piece of construction paper write "carbon dioxide" • On piece of construction paper write "water" • On piece of construction paper write "glucose" • On piece of construction paper write "oxygen" Each student is given the role of a molecule of carbon, hydrogen, or oxygen. Depending on the size of your class, some students may need to be assigned the role of two molecules of the same element. For example, you may need to give one student two "H's" instead of one "H." In a large open area, hold up the poster board with the equation for photosynthesis facing the students. First, instruct the students to position themselves so that they represent the reactants of the photosynthesis equation. (Remember to assign a student to the role of "sun," "+" and "yields".) Once students have gotten into the correct positions give each group of molecules the name of the substance that they represent (carbon dioxide or water). Next, have students position themselves so that they represent the products of the photosynthesis equation. Once the students have positioned themselves correctly give each group of molecules the name of the substance they represent (glucose or oxygen). The idea is that students will realize that the very same carbon atoms that make up carbon dioxide make up the backbone for the glucose molecule. Now hold up the respiration equation. First have the students position themselves to represent the reactants for respiration. Again, when they are correctly positioned, give the names of the substances that they represent to the groups of molecules (oxygen and glucose). Next, have students position themselves so that they represent the products of the respiration equation. Once the students have positioned themselves, give the groups of molecules the names of the substances they represent (carbon dioxide and water).
2	2b.	*Predict the properties and interactions of given elements using the periodic table of chemical elements. (DOK 2)* **Proficient** – 2b. Predict the properties and interactions of given elements using the periodic table of the elements. **Basic** – 2b. Use the periodic table to identify the properties of an element or a simple compound.
1	1d.	**Strategy 1:** Understanding the difference between physical and chemical changes can be difficult for many students. This activity will take a few days, but helps to demonstrate the differences. You will need an effervescent cold tablet, table salt and distilled water. Using the label from the cold tablet, determine its chemical makeup. Then have the students find those elements on the periodic table. Ask them what types of elements have combined to make the cold tablet. Do the same for the table salt. Crush an effervescent cold tablet into small pieces. Ask the students if a chemical or physical change has taken place. Explain that it is still the same product and that you have

		only changed its appearance from a disk to a granular form. Use a balance to mass the crushed cold tablet. Add the crushed tablet to as small amount of water as possible to get a full reaction. Add the same amount of salt to the same amount of water and stir until dissolved. Have the students write down whether each was a chemical or physical reaction and give their reasons for their choices. Clearly label each container and allow the water to evaporate. Once all the water has evaporated, scrape each from its container and mass them. Compare to the initial mass. Crush both the cold tablet and salt into a powered form. Add the salt to water and stir. Add the cold tablet to water and stir. Compare to the first time each was added to water. Both should dissolve and there should be little if any reaction this time with the cold tablet. Have the students write their conclusions about what has happened. Salt dissolving in water is simply a physical change. The cold tablet initially was a chemical change and the second time was a physical change.
1	1c.	**Strategy 2:** Soap is produced by the reaction of fatty substances with sodium or potassium hydroxide. The fatty substances are actually fatty acids, while the sodium hydroxide (NaOH) and the potassium hydroxide (KOH) are very strong bases. The reaction of these substances produces a salt: the soap. Usually, soaps have a basic reaction. Particularly in winter, these soaps help to dry the skin of the hands, causing redness and even bleeding. Probably, this is also due to the fact the skin has an acidic pH, around 5.5. The frequent use of soaps tends to decrease the pH of the skin and cause harm. To reduce this problem, neutral and even acid soaps are produced. Check the pH of common soaps. Use about 5 different types of soaps. Put several drops of water on the soap to be tested. With a finger, scrape and mix a little to make a solution with the soap. Wet a litmus paper with the solution. If the soap is basic, the paper becomes blue, if the soap is acid, the paper becomes red. Check also the pH of the detergents you use to hand wash dishes, shampoo, balsams, creams and other toiletries.
2	2c.	*Distinguish the motion of an object by its position, direction of motion, speed, and acceleration and represent resulting data in graphic form in order to make a prediction. (DOK 2)* **Advanced** – 2c. Evaluate the motion of two or more objects to predict the effects of a Collision. **Proficient** – 2c. Distinguish the motion of an object by its position, direction of motion, speed, and acceleration and represent resulting data in graphic form in order to make a prediction.
1 1	1b. 1f.	**Strategy 1:** Give the students the following two sets of data regarding the constant velocity of two objects. The students are to plot the two sets on the same graph. They can then use the formula of the change in **y** divided by the change in **x** to determine the slope of each line, which is the velocity of each line. The students could then predict where each object would be after five seconds.

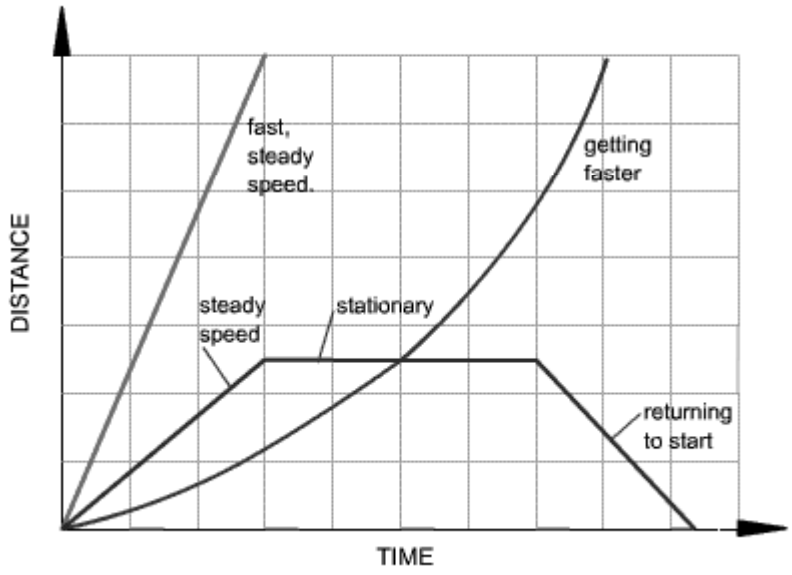
1	1f.	

Time (x-axis)	Position (y-axis)	Time (x-axis)	Position (y-axis)
0s	0m	0s	0m
1s	1m	1s	2m
2s	2m	2s	4m
3s	3m	3s	6m
4s	4m	4s	8m

The slope (speed) of the first object is 1 m/s and the slope of the second object is 2 m/s. The first object would have a displacement of 5 m after five seconds and the second object would have a displacement of 10 m after five seconds.

Strategy 2: Describing the motion of an object is occasionally hard to do with words. Sometimes graphs help make motion easier to picture, and therefore understand.

See Graph:



Give a copy of the graph to each student. Discuss the **x** and **y** axis as distance and time. Have the students label the lines as either constant acceleration, constant velocity, zero velocity, acceleration, or constant deceleration, and the area of distance covered. Discuss that the common terms help describe what is actually happening and that a graph is an excellent way to understand motion.

1 1	1f. 1b.	**Strategy 3:** Divide students into groups of 6, to measure the motion of a toy car. Create a "race track" and position five students with stop watches at various points along the track. Use a 5 meter track with students at 1, 2, 3, 4, and 5 meter positions. One student will release the car onto the track. As the car passes each point, the students should record the time on their data charts. Once three trials are complete, use the data collected to analyze the speed of the vehicle between the various points and overall speed. Students use the data to create graphs (speed, acceleration) Be sure to discuss the reliability of the experiment.
2	2d.	*Relate how electrical energy transfers through electric circuits, generators, and power grids including (but not limited to) contributions from Mississippi companies. (DOK 2)* **Advanced** – 2d. Predict the outcome (positive or negative) of altering one component of the power grid system. **Proficient** – 2d. Relate how electrical energy transfers through electric circuits, generators, and power grids, including the importance of contributions from Mississippi companies.
1	1d.	**Strategy 1:** After working with parallel and series circuits, possibly using hand-held generators, bring in a speaker from your local electric power association to talk with your students about how electricity gets to their homes from its source and what happens when even one part of the grid system has a problem. Have the speaker discuss where the electricity comes from (method of generation) and all the components of the grid system between the generating plant and their homes. In the following days, have the students prepare a simple model based on the information given by the speaker. This could be a simple, straight-line model using thread to represent wire, empty pill bottles to represent transformers, etc. Each part should either be labeled or a key provided with an explanation of the role it plays in bringing electrical power to the home.
1	1d.	**Strategy 2:** Generators work by spinning magnets located between a copper coil to create a steady flow of electrons. Forcing these electrons or electric charges to move through an external circuit that connects to anything that needs power, it produces the energy to make it work. The relation between magnets and electrons shows how a generator functions. By passing electrons through electrical wires, conduction of electricity happens when forced by the magnetic fields produced when mechanical energy converts into electrical energy. Construct a wind powered generator using 4 playing cards, 4 large magnets, very thin (#30) magnetic wire, a nail, glue, ½ volt light bulb, and the "flower" from a foil garden pinwheel. Glue three of the playing cards together to make three sides of a C-shaped box. Insert a nail through the two of the cards. Attach magnets to nail inside the box. Glue fourth playing card to complete the box. Magnets should not touch the box, if so enlarge box, slightly. Wrap the wire about 350 times around the middle of the card box, not restricting the nail's movement. The ends of the wire should be left exposed. Attach the light bulb to the exposed ends of the copper wire. Glue the pinwheel to the end of the nail. As the pinwheel turns the magnets surrounded by the wire will create enough volts to light the bulb, the light will be dim. The faster you spin the magnet, the higher the voltage pump-force becomes, and the brighter the light bulb lights up. The more powerful the magnet, the higher the voltage and the brighter the bulb. And the more circles of wire in the coil, the higher the voltage and the brighter the bulb.

2	2e.	*Contrast various components of the electromagnetic spectrum (e.g., infrared, visible light, ultraviolet) and predict their impacts on living things. (DOK 2)* **Proficient** – 2e. Contrast various components of the electromagnetic spectrum (e.g., infrared, visible light, ultraviolet) and predict their impacts on living things. **Basic** – 2e. Identify components of the electromagnetic spectrum.
1 1 1 1 1 1 1 1	1a. 1b. 1c. 1d. 1e. 1f. 1g. 1h.	**Strategy 1:** For this experiment you will need the following supplies for each group (or this may be done as a whole class): Bean seeds, four boxes with removable lids (the boxes that reams of paper come in are ideal), potting soil, peat pots, ultraviolet light source. Plant three bean seeds in potting soil in four peat pots for each box (16 total). Place the pots into their boxes. One box will be left covered throughout the activity except for the brief moments when it is being checked. One box will not be covered. In one box, place pinprick holes around the sides just below where the lids sits to allow small amounts of light to come in through the sides. The final box should have the ultraviolet light source at one end. You might cut a hole large enough for the light source to shine through or mount the light source inside the box. Be sure to tape or putty around the hole to eliminate any other light. The students should make hypotheses on what they believe will happen in each box and give reasons. After three days, check the plants in each box. Make note of germination and, after germination, the direction of growth of the plants. Measure the length of the plants each day. When several days have passed and data has been collected, the students should analyze the data and draw conclusions based on the observations. They should then revisit their hypotheses and make revisions if necessary. Did anything happen that was unexpected? Can it be explained? What would happen if parts of the experiment were changed? What changes would you make if a follow-up experiment was conducted? The students should prepare a form of communication (write a paper, prepare a power point presentation, etc.) to report findings and defend their conclusions. These should be presented in class and discussion of various findings should take place. **Strategy 2:** The electromagnetic spectrum is arranged in different categories from the longest wavelength to the shortest. In decreasing order of energy or increasing wavelength they are gamma rays, x-rays, ultra-violet rays, visible light, infrared rays, microwaves and television and radio waves. Ask students to identify the waves with the longest and shortest wavelengths. (It may be helpful to draw wavelengths decreasing from left to right above a labeled diagram of the spectrum.) Based on what they have learned about frequency as it relates to wavelength (the longer the wavelength, the lower the frequency), ask students which waves have the lowest frequency and which have the highest frequency. It may be necessary to prompt them with some clues — the longer the wavelength, the lower number waves in a given space; the shorter the wavelength, the more waves there are in a given amount of space. One easy way for students to remember the relationship between frequency and wavelength is to consider that the longer the wavelength, the lower the frequency, emphasizing the 'l' at the beginning of each word. And the shorter the wavelength, the higher the frequency, emphasizing the 'h' in each word. (Again, it may be helpful to reinforce this relationship by labeling lower frequency by the radio waves on the spectrum and higher frequency by the gamma rays.)

2	2f.	*Recognize Newton's three laws of motion and identify situations that illustrate each law (e.g., inertia, acceleration, action and reactions forces). (DOK 2)* **Proficient** – 2f. Recognize Newton's Three Laws of Motion and identify situations that illustrate each law (e.g., inertia, acceleration, action, reaction forces). **Basic** – 2f. Identify Newton's Three Laws of Motion. Strategy 1: The students are to create model (illustration, working model, etc.) to demonstrate each of Newton's three laws of motion. Examples: Newton's First Law of Motion states any object will continue in its current state of motion, either at rest or in motion in a straight line, unless acted on by an outside net force. The students could have a ball at rest on a table and poke it to make it move or make a drawing showing the Moon moving about the Earth and the gravitational attraction between the two bodies keeping the Moon in orbit instead of moving out into space. Newton's Second Law of Motion states the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to the mass. The students could have two balls, one with twice the mass of the other, sitting at rest on a table. They could apply the same force to each and measure the distance each travels on the table. Newton's Third Law of Motion states that when two objects act upon each other, the force is the same for each or "for every action there is an equal but opposite reaction." The students could attach a string to two spring scales that measure newtons and gently pull on one of them. The result should be the same on both spring scales. Strategy 2: Newton's First Law describes motion produced by balanced forces. An object at rest will remain at rest, and a moving object will remain at a constant velocity unless unbalanced forces act on it. Newton was first to use the term inertia to describe the tendency of objects to remain in motion or stay at rest. Inertia comes from the Latin word *iners*, which means "lazy". Newton's Second Law describes motion produced by unbalanced forces. This law is best stated using the equation: Force = mass X acceleration. Acceleration is always in the direction of the unbalanced force. The units of force are "Newtons", 1 N = 1 kg X 1 m/s/s. Newton's Third Law explains why forces act in pairs. For every action, there is an equal and opposite reaction. Forces always act in pairs. Have each student to bring a picture from a newspaper. On the board construct a graph with three columns, one for each of the three laws. Label the columns as Law 1, Law 2, and Law 3. Have the students glue the picture onto the top of a sheet of plain paper. On the bottom of the paper, below the picture write which law the picture is illustrating, and a brief reason why. As a group, discuss each student's picture and explanation. Hang the sheet in the column of the correlating law.

Comp.	Obj.	Life Science (PLDs: Advanced Proficient Basic)
3		**Compare and contrast the structure and functions of the cell, levels of organization of living things, basis of heredity, and adaptations that explain variations in population. Blueprint: 8 OBJ/18 ITEMS**
3	3a.	*Analyze how adaptations to a particular environment (e.g., desert, aquatic, high altitude) can increase an organism's survival and reproduction and relate organisms and their ecological niches to evolutionary change and extinction. (DOK 3)* **Proficient** – 3a. Analyze how adaptations to a particular environment can increase an organism's survival and reproduction and relate organisms and their ecological niches to evolutionary change and extinction. **Strategy 1:** The students are to select an organism from a list prepared by the teacher and research, using multiple sources and source types (internet, books, etc.), the adaptations the organism has that makes it successful in its environment. When this is complete, the teacher will assign each organism a new and very different environment (for example, move a polar bear to the tropical rain forest). The student would then identify adaptations the organism would have to make in order to be successful in the new environment and tell what would happen over time (evolution) if the organism was able to adapt or if unable to adapt (extinction). **Strategy 2:** All animals live in habitats. Habitats provide food, water, and shelter which animals need to survive, but there is more to survival than just the habitat. Animals also depend on their physical features to help them obtain food, keep safe, build homes, withstand weather, and attract mates. These physical features are called physical adaptations. Physical adaptations do not develop during an animal's life but over many generations. The shape of a bird's beak, the number of fingers, color of fur, the thickness or thinness of the fur, the shape of the nose or ears are all examples of physical adaptations which help different animals to survive. Bird's beak is an adaptation. The type of food the bird eats determines the type of beak the bird will need to survive. Each group of students needs scissors, plastic spoons, tweezers, large binder clips, large paper clips, large rubber bands, a box of toothpicks, a cup of macaroni. Each student needs a clear plastic cup and graph paper. Have students select a spoon, tweezers, binder clip or pair of scissors, and a plastic cup. Explain to them that they are now birds, very hungry birds. They can only eat with the implement they have selected and they can only use that implement for eating. The cup represents their stomach. They must hold their beak in one hand and their stomach in the other. They can only place food in their stomachs with their beaks. Explain to them that food items have been placed in the feeding area. When you say "go" they are to collect as much food and place it in their stomachs as possible until you say "stop." Say "go" and allow birds to feed for 1–2 minutes or until all of the food is gone. Once you have said "stop" have students empty their stomachs count the contents and record them. Have them return all food items. Repeat this activity using a different type of beak. By the end of the activity, each of the students should create bar graphs that represent the total for each of the beak and food types. Tally up the class totals for each of the beak types in a grid on the board. Pause for a class discussion and examine the data. (Adapted from ATOMS^{2XP} workshop activities.)
1 1	1a. 1b.	

3	3b.	*Compare and contrast the major components and functions of different types of cells. (DOK 2)* **Proficient** – 3b. Compare and contrast the major components and functions of different types of cells. **Basic** – 3b. Identify different cell types and their structures. **Strategy 1:** Using prepared slides and microscopes or detailed pictures of various cell types (bone, blood, muscle, nervous, etc.) the students are to give similarities and differences in the various cell types. They are to relate how the structure of each cell type is related to the function of the cell and give reasons that all cell types are not the same. (Why are red blood cells not elongated as nerve cells are?) Ex: power point, poster, journal **Strategy 2:** After reviewing the parts and functions of a plant and animal cell, have students construct a venn diagram. A venn diagram compares and contrasts two things. The outside areas list only the parts that are in that cell. The overlapping middle lists the parts of a cell that is in both a plant and animal cell. Have students on their paper draw a venn diagram. Label one circle plant and the other animal. On the board list the parts of each cell. Have the students fill the diagram plugging in the correct part in each section of the diagram. Discuss parts in common (most), then the parts that are special only to that type of cell.
3	3c.	*Describe how viruses, bacteria, fungi, and parasites may infect the human body and interfere with normal body functions. (DOK 1)* **Proficient** – 3c. Describe how viruses, bacteria, fungi, and parasites may infect the human body and interfere with normal body functions. **Strategy 1:** Each student will select from the teacher a prepared list of conditions caused by one of the pathogens listed. The students will research the condition using internet, library book, encyclopedia or other approved resource and prepare a presentation for the class. The presentation could be a poster, power point, written report, or other teacher-approved method of presentation. The information provided by the student should include the name of the pathogen, including scientific name; how humans are introduced to the pathogen; the way it affects the human body; treatments; preventions; and other information the teacher deems necessary. **Strategy 2:** Viruses, bacteria, fungi, and parasites infect the human body differently. Have the students pick one and research how it infects the human body. Then have the students create a “comic strip” explaining the process, using five to ten boxes. Talking bubbles can be used to help clarify. Post the strips by category.
3	3d.	*Describe heredity as the passage of instructions from one generation to another and recognize that hereditary information is contained in genes, located in the chromosomes of each cell. (DOK 2)* **Advanced** – 3d. Analyze a pedigree diagram to predict the inheritance for a particular trait for a family member. **Proficient** – 3d. Describe heredity as the passage of instructions from one generation to another and recognize that hereditary information is contained in genes, located in the chromosomes of each cell.

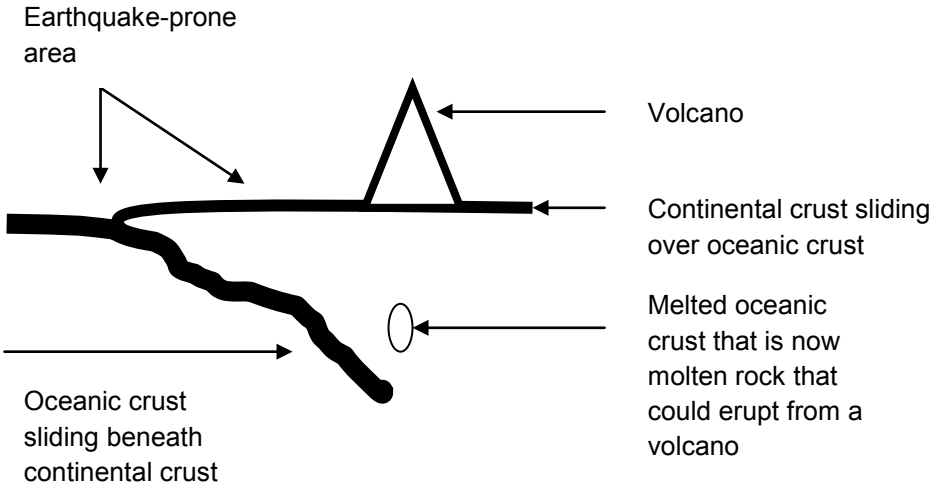
		Strategy 1: Students will work in pairs to work through a demonstration on how genetic information from parent generation is passed along to the offspring. Each student should be given two coins (pennies will do) and a sheet to complete with "their" genetic information. Heads of the coin will represent dominant alleles and tails will represent recessive alleles. The students will flip the two coins to determine randomly their genotype for each trait. After both students in each pair have completed their own information sheet, they are now ready to determine which alleles will be passed along to the offspring. If they are homozygous for a trait, then they will automatically pass along the only allele type possible for the trait. In a heterozygous situation, they will flip a coin to determine which allele will be passed along, again heads for dominant and tails for recessive. While the following does not necessarily represent what actually occurs with human genetics, the students should be able to see how genetic information is passed from one generation to the next. Head shape: Oval shape – dominant, Round shape – recessive Ears: Lobes free – dominant, Lobes connected – recessive Ear shape: Rounded – dominant, Pointed – recessive, Saw-toothed – heterozygous Eyebrows: Thin – dominant, Bushy – recessive, Unibrow – heterozygous Eye Color: Brown – dominant, Blue – recessive, Green – heterozygous Eye shape: Round – dominant, Pointed – recessive Nose shape: Flared nostrils – dominant, Small nostrils – recessive Mouth shape: Full lips – dominant, Thin lips – recessive, Medium lips – heterozygous Chin: Rounded – dominant, Cleft – recessive Hair Shape: Curly – dominant, Straight – recessive Hair Color: Black – dominant, Blonde – recessive, Brown – heterozygous Other traits may be easily added to this or the above traits could be changed or deleted. As an added bonus, you could have the students draw their offspring based on the results to present to the class. **Strategy 2:** A Punnett Square is used to predict the genotype of an offspring of a particular set of parents. After lessons on how traits are passed through genes and dominate and recessive genes, have students calculate probability of an offspring's genotype using a Punnett square. Have students draw a Punnett square on their paper (can be laminated for multiple use). Give each pair of students a small bag filled with black-eyed peas and pinto beans. On the board label black-eyed peas as recessive and pinto beans as dominate. Each student will be a parent, so each student pulls two from the bag. Determine if the "genes" are heterozygous. homozygous dominate, or homozygous recessive. Write one parent's combination along the top of the Punnett square and the other parent's down the side. Use letters to represent the genes (Tt, Aa,or Bb). Fill in the square by bringing down and across each letter to each box. Calculate the percentage of the offspring to have the trait. Discuss the pattern of percentages by crossing heterozygous, homozygous dominate, and homozygous recessive.
3	3e.	*Explain energy flow in a specified ecosystem. (DOK 2)* **Advanced** – 3e. Analyze the food web of an ecosystem in which the population of an organism has been altered to explain how this change may affect another member of the food web ecosystem. **Proficient** – 3e. Explain energy flow in a specified ecosystem.

1 1	1c. 1d.	**Strategy 1:** In this activity, the students play the roles of bead bears and yellow rabbits. Bead bears can feed upon any color bead while yellow rabbits can only "eat" yellow beads. Each color bead represents a certain level of food energy for our bears and rabbits. Bead bears must have a total of 100 points of energy each day, while yellow rabbits only require 10. If an organism goes two days in a row without meeting its energy point requirement, it will starve to death. Neither is capable of storing energy and cannot eat an excess of energy points in a day. If an organism finds it has too many energy points, the excess must be returned to the food web immediately so than another organism can use the points. Green beads count 25 points Red beads count 15 points Blue and orange beads count 10 points Yellow beads count 1 point All other colors count 5 points After each day, energy points are tallied for each organism and the beads are returned to the environment for the next day's feeding. Any organism that does not meet its energy requirement is removed from the community. The students whose organism did not survive become the pool for reproduction in either the bead bears or yellow rabbits. After two of the two-day feeding cycles, yellow rabbits reproduce at a rate of three offspring per pair. Bead bears reproduce at a rate of one offspring per pair after three of the two-day feeding cycles. Track the level of each population after each feeding cycle and have the students graph both populations on the same graph after several feeding cycles. The students should then draw conclusions about how the availability of food energy affects the populations of each and possibly see a connection between the two populations. Class size may dictate that a third (predator) species be introduced to the system if you have a large number of students in a class. This will ensure that there are available students for the reproduction pool and help keep the populations under control. The predator should target yellow rabbits, needing two per two-day feeding cycles in order to survive. Predators reproduce at a rate of one per pair after two of the two-day feeding cycles. If there are too few students in the reproduction pool, predators will get first priority, yellow rabbits second and any left would be available for bead bears. If predators are used, this population should also be included on the graph. **Strategy 2:** Food chains cycle nutrients within an ecosystem and provide the mechanism for energy to flow through the ecosystem. These food chains have many alternate routes through which energy can flow, creating integrated, complex food webs. An ecosystem consists of species in a biological community (the living component) interacting with each other and with factors that make up their environment (the nonliving component). An ecosystem can be as small and obscure as a blade of grass, a pond, or rotting log. It can also be as large and magnificent as the Florida Everglades or the Amazon rain forest. Choose a biome, allow students to choose an ecosystem in that particular biome (students can work in groups). Have the students construct a web showing the flow of energy in their ecosystem. They may draw the animals or cut them from magazines. Have students display and explain the web.

3	3f.	*Develop a logical argument for or against research conducted in selective breeding and genetic engineering including (but not limited to) research conducted in Mississippi. (DOK 3)* **Proficient** – 3f. Develop a logical argument for or against research conducted in selective breeding and genetic engineering, including research conducted in Mississippi. **Basic –** 3f. Identify examples of selective breeding or genetic engineering.
1 1 1	1d. 1e. 1h.	**Strategy 1:** The students are to gather information on a research project by a company or institution doing selective breeding and/or genetic engineering. This can be done through internet research, email and or letter writing. After putting the information together, the students are to conduct further research into the pros and cons related to the project. Using all the gathered information, the students will prepare a presentation to give the class with a conclusion either for or against the project based upon the information gathered. The presentations should present both sides of the issue with the conclusion based upon the evidence. The better presentations will admit to the validity of some points of the opposing viewpoint, but give logical reasons for the conclusion drawn by the student. This can be done individually, in pairs or in groups. If group work is allowed, the research and presentation should be significantly more in depth than would be expected for individual work.
1	1e.	**Strategy 2:** Genetic engineering is the alteration of genetic code by artificial means, and is therefore different from traditional selective breeding. Genetic engineering works because there is one language of life: genes. Human genes work in bacteria, monkey genes work in mice and earthworms, tree genes work in bananas and frog genes work in rice. There is no limit in theory to the potential of genetic engineering. Genetic engineering has given us the power to alter the very basis of life on earth. Divide class into two sections, pro and con genetic engineering. Allow students time to research their assigned point of view. (Internet has the most current information.) Have the students create a commercial educating and persuading the audience about their point of view on genetic engineering. (You can team with the reading teacher on this project, objectives will overlap.)
3	3g.	*Research and draw conclusions about the use of single-celled organisms in industry, in the production of food and impacts on life. (DOK 3)* **Proficient** – 3g. Research and draw conclusions about the use of single-celled organisms in industry and in the production of food and about their impact on life. **Basic –** 3g. Identify examples of single-celled organisms that are used in industry or food production or that impact life.
1 1 1	1d. 1e. 1g.	**Strategy 1:** In this research project students will use the internet, library books, encyclopedias and other sources approved by the teacher to look at methods where single-celled organisms are being used or are proposed to be used. Examples would include research into using algae in biofuel production, bacteria with recombinant DNA used in the production of human growth hormone or insulin, or how single-celled organisms are being used to increase food production or the quality of a particular food, how the chosen path has or would have an impact on life on this planet, human or otherwise. After gathering information on the chosen or assigned topic, the student should use this information to prepare a presentation such as power point, written and/or oral. Presentations should present the pros and cons of the research and the use of single-celled organisms.

1	1d.	**Strategy 2:** Antibiotics are produced by a number of micro organisms and inhibit the growth of other micro organisms even at very low concentrations. As such, the antibiotics have found wide application in chemotherapy, plant pathology, food preservation, veterinary medicine and as research tools in biochemistry and molecular biology. At present about 7000 antibiotics are known and about 100 of these are produced commercially by microbial fermentation process. Fungi, bacteria and actinomycetes are important antibiotic producing organisms. Most species of *Streptomyces* are quite active in the production of a variety of antibiotics. Micro organisms especially single-celled organisms are used everyday by us and by industry to produce things we use everyday. Using internet, media center, or other resource, have students research commonly used single-celled organisms in industry and the products produced by these industries. The students then present these findings as a class presentation. May be graded using a rubric.
3	3h.	*Describe how organisms get energy from oxidizing their food and release some of their energy as heat. (DOK 1)* **Advanced** – 3h. Explain the process of cellular respiration to the survival of the cell and its components. **Proficient** – 3h. Describe how an organism gets energy form oxidizing its food and releasing some of its energy as heat. **Basic –** 3h. Identify the reactants and products involved in cellular respiration. **Strategy 1:** The students will use information and drawings from their textbooks or as provided by the teacher to create a model showing the production of adenosine triphosphate (ATP). The students should indicate how the reactants (simple sugar and oxygen) in cellular respiration get into the system and what happens with the products (carbon dioxide, water and energy) as they model the chemical formula for the reaction. **Strategy 2:** At each level of the food chain, about 90% of the energy is lost in the form of heat. The total energy passed from one level to the next is only about one-tenth of the energy received from the previous organism. Therefore, as you move up the food chain, there is less energy available. Animals located at the top of the food chain need a lot more food to meet their energy needs. You can demonstrate the loss of energy to heat using a one liter coke and 4 graduated cylinders. The coke represents the energy from the sun. The graduated cylinders will represent the organisms in a food chain: a plant, a mouse, a hawk, and decomposers. The sun has a liter of energy to give, but the plants only get one-tenth. Pour 100 milliliters into the cylinder labeled plant. The mouse eats the plant but only gets one-tenth of the energy. Pour 10 milliliters into the cylinder labeled mouse. The hawk eats the mouse but only gets one-tenth of the energy. Pour 1 milliliter into the cylinder labeled hawk. The hawk dies and decomposes but they only get one-tenth of the energy, one-tenth of a milliliter. The coke left represents the 90% of energy lost to the environment as heat. Pour the liter coke into the sink or bucket to really show the loss of energy.

Comp.	Obj.	Earth and Space Science (PLDs: Advanced Proficient Basic)
4		**Describe the Earth's System in terms of its position to objects in the universe, structure and composition, climate, and renewable and nonrenewable resources.** **Blueprint: 8 OBJ/15 ITEMS**
4	4a.	*Compare and contrast the lithosphere and the asthenosphere. (DOK 1)* **Advanced** – 4a. Explain how the composition of the lithosphere and asthenosphere affects plate movement. **Proficient** – 4a. Compare and contrast the lithosphere and the asthenosphere. **Basic** – 4a. Identify the composition, physical nature, or location of the lithosphere or the asthenosphere.
1	1b.	**Strategy 1:** To demonstrate how the lithosphere, being less dense, floats and moves on the asthenosphere use a pan of oatmeal heated on a hot plate to the point it is bubbling and three graham crackers small enough to fit in the pan with two touching in the middle with a third to the side. Tell the students that the bubbling oatmeal represents the fluid-like, heated asthenosphere and the graham crackers represent the lithosphere, or upper portion of the Earth's crust. As the oatmeal bubbles, the hotter portions are rising from the bottom of the pan to the top. As more rises, it pushes the oatmeal at the top to the side. When the oatmeal moves away from the hot spots, it cools and sinks, setting up convection currents similar to those found in the asthenosphere. This rising, pushing to the side, cooling, and sinking action will move the pieces of graham cracker around on the surface of the oatmeal similar to the way continental and oceanic plates that make of the lithosphere move about on the asthenosphere. With a little luck, the two pieces touching each other in the center will move away from each other in a fashion that mimics the movement of plates along the mid-Atlantic ridge. When one of them comes into contact with the cracker placed at the side of the pan several things can happen. The two crackers could begin to rise as would happen when two continental plates collide such as where the Indian subcontinent is colliding with the Asian continent, forming the Himalayan Mountain range. One could begin to slide beneath the other, representing where oceanic crust is colliding with continental crust and creating a subduction zone. The two crackers could also slide along each other creating a representation of where plates are moving along side each other and give a model of a strike-slip fault. Repeated attempts at this could give you a different result each time. Take care not to let the oatmeal go overlong without being stirred or it could stick to the bottom of the pan and burn. The lower the heat you are able to use and still get the bubbling action, the longer you can let this run without stirring. **Strategy 2:** Lithosphere is the solid, rocky crust covering the entire planet. The crust is inorganic and composed of minerals. Asthenosphere is the layer of the Earth that lies beneath the lithosphere. It is the least rigid portion of the mantle. It is susceptible to the slow convection currents of the core, therefore moving the lithosphere. Have students create a venn diagram comparing and contrasting the lithosphere and the asthenosphere. Have students research the layer's composition, density, depth, and texture. Have each student draw two large circles overlapping on their paper. Label one circle lithosphere and the other asthensphere. Properties that have in common is written in the middle (overlapping). Outer areas of the circles are filled in with exclusive properties to that layer.

4	4b.	*Describe the cause and effect relationships between the composition of and movement within the Earth's lithosphere. (DOK 1)* **Advanced** – 4b. Predict geologic phenomena based on the composition and movement of interacting plates. **Proficient** – 4b. Describe the cause and effect relationship between the composition of and movement within the Earth's lithosphere. **Basic** – 4b. Identify plate boundaries based on lithospheric movement.
1	1d.	**Strategy 1:** Lead a discussion on the plates that make up the lithosphere that explains to the students that oceanic crust is denser than continental crust and will sink beneath the continental crust when plates involving the two are moving toward each other. Use a diagram (such as one similar to the one included) to show students what happens as the oceanic crust slides beneath the continental crust. Because of the friction involved as the two plates slide along each other, earthquakes frequently occur in these regions. Also, as the oceanic crust is pushed deeper and deeper underneath the continental crust, it begins to melt and rise through the asthenosphere as molten rock. The areas in the continental crust above these areas are prone to volcanic activity. **See Graphic next page:**  The students are to take a map of the world that shows plate boundaries and the direction of movement of the plates and identify the continental and oceanic plates on the map. Using the information they have learned, they are to mark in red areas on the map where they would predict volcanoes are likely to be present. When they have completed marking the map they are to be given a map that shows the volcanoes of the world or be given access to a computer to go to the United State Geological Survey website (www.usgs.gov) to see how well they have predicted volcano-prone areas of the world.

1	1d.	**Strategy 2:** Seismic investigations are made to be able to describe geological structures in the bedrock. At sea, sonar signals are transmitted from the ocean surface (pings), and the echoes are captured by special measurement instruments. The seismograph records ground movements caused by earthquakes, explosions, or other Earth-shaking phenomena. Have students observe live current seismic data and make predictions. Have students go to the website: http://aslwww.cr.usgs.gov/Seismic_Data and view live seismic readings from different locations around the world.
4 1 1 1 1	4c. 1c. 1d. 1c. 1d.	*Examine weather forecasting and describe how meteorologists use atmospheric features and technology to predict the weather. (DOK 2)* **Advanced** – 4c. Predict a change in weather based on differences in pressure, heat, air movement, and humidity. **Proficient** – 4c. Examine weather forecasting and describe how meteorologists use atmospheric features and technology to predict the weather. **Strategy 1:** The students are to watch local weather forecasts and check internet sources such as The Weather Channel for one week. They are to record forecasts and any reasons given by the forecasters for the forecasts. They should also make note of any technology use such as satellites and computer models cited by the forecasters. Each day they are to record what actually occurred. After one week of recording forecasts and actual weather, the students are to compare forecasts and results. Suggested items to record are predicted high and low temperatures, rainfall, where highs and lows will be located and the position of any fronts (especially those that are local). Questions that can be asked at the conclusion of the activity include (but are not limited to): Were forecasters accurate with temperature predictions? How close to actual temperatures should they be to be considered accurate? Does a 20 % chance of rain mean it is going to rain? **Strategy 2:** Barometric pressure is the measure of weight of the atmosphere above us. A barometer measures with weight of the atmosphere per square inch and compares it to the weight of a column of mercury. Barometric pressure varies with altitude. A higher elevation will have less atmosphere, therefore less pressure. Readings at elevations other than sea level will require a correction factor. Barometric pressure changes as the weather systems over us changes. High pressure areas are generally areas of good clear weather. Low pressure areas are generally areas with bad wet weather. Barometric pressure has been used by weathermen (and fishermen) since the beginning of meteorology to predict the weather. Have students track the local Barometric pressure and type of the weather. Each day for at least of month, have students check the barometric pressure. Have students log the pressure and type of weather in a log book. At the end of the month, discuss data. Results should show when pressure was high the weather was dry and clear, when pressure was low the weather was damp and cloudy.
4	4d.	*Research the importance of the conservation of renewable and nonrenewable resources including (but not limited to) Mississippi, and justify methods that might be useful in decreasing the human impact on global warming. (DOK 3)* **Proficient** – 4d. Research the importance of the conservation of renewable and nonrenewable resources, including Mississippi, and justify methods that might be useful in decreasing the human impact on global warming. **Basic** – 4d. Identify renewable or nonrenewable resources.

1	1d.	**Strategy 1:** Prior to conducting this activity, students should have an understanding of the factors many scientists believe contribute to global warming. After a class discussion on renewable and nonrenewable resources, have the students brainstorm resources in each category that are found in Mississippi. Write the results of the brainstorm session on the board. At this point the teacher will assign topics or allow the students to choose from the list on the board for research into the wise use of these resources. They are then to come up with ways that the conservation of their resource would reduce human impact on global warming. Examples of this would be the "clean" coal power plant that is being proposed for Kemper County, the use of biofuels for energy or the harvesting and replanting of pine trees.
1 1	1c. 1d.	**Strategy 2:** The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO_2). In other words, when you drive a car, the engine burns fuel which creates a certain amount of CO_2, depending on its fuel consumption and the driving distance. When you heat your house with oil, gas or coal, then you also generate CO_2. Even if you heat your house with electricity, the generation of the electrical power may also have emitted a certain amount of CO_2. When you buy food and goods, the production of the food and goods also emitted some quantities of CO_2. Have students calculate their carbon footprint, and find ways to decrease their impact on the environment. Websites such as www.carbonfootprint.com will calculate each student's footprint and gives suggestions on how to reduce ones carbon footprint.
4	4e.	*Explain how the tilt of Earth's axis and the position of the Earth in relation to the Sun determine climatic zones, seasons, and length of days. (DOK 2)* **Advanced** – 4e. Explain how a change in the angle of Earth's axis affects climate and seasons. **Proficient** – 4e. Explain how the tilt of Earth's axis and the position of the Earth in relation to the sun determine climatic zones, season, and length of the days. **Basic –** 4e. Identify the effect of Earth's tilt on its axis or the position of Earth in relation to the Sun on seasons and climate.
1 1 1	1b. 1c. 1d.	**Strategy 1:** This is an ongoing activity that will take several weeks for the students to be able to see what is happening. The lead-in demonstration will have the teacher use a flashlight to demonstrate that as angles change light is spread over different areas. Stand up a short stick (a pen with a flat end works well for this) and shine the flashlight directly down on the stick so that there is no or very little shadow. Slowly change the angle of the light, keeping the center of the beam aimed at the bottom of the stick. Make note of the changing shadow made by the stick. Also make note of the change in the amount of area covered by the light. (Be very careful to keep the light at a very similar distance to the bottom of the pen even though we know that the distance between the Earth and the Sun does vary throughout the year.) As an added mathematical connection to this demonstration you could have the students measure the area being covered by the light to put numbers to the idea that as the angle decreases from 90 degrees than a greater area is being covered by the same amount of light energy. They can also measure the length of the shadow caused by the stick to see that it is increasing as the angle of the light source is being changed.

		This shows that as the Sun's angle decreases after the summer solstice in the northern hemisphere that the amount of light energy received on Earth is spread over an increasing area. Add to that the fact that the length of time that sunlight is received over a given area in the northern hemisphere is also decreasing. Find a flagpole or building shadow that could easily be measured by the students. Every day for at least three weeks (longer if feasible), have the students measure the length of the shadow at the exact same time each day. This information should be plotted on a graph each day. If cloud cover or other reasons prevent measuring the shadow on certain days, you could have the students predict what the length of the shadow would have been based on other data collected. Use the information from the demonstration and the data collected to make a connection on what is happening on Earth in relation to light energy from the Sun to explain the changing seasons. **Strategy 2:** If the Earth did not tilt, then Earth would not have seasons. Using a globe and a flashlight demonstrate how the angle of the sun's rays create the seasons. Have student hold the flashlight on the globe. The flashlight should not move. Holding the globe straight up and down, discuss the amount of sun that reaches the Northern Hemisphere, especially the North Pole. With the axis straight (no angle) the Northern Hemisphere is either in spring or fall. Tilt the North Pole away from the light, discuss how little to no light reaches the North Pole, and the low angle of the light on the Northern Hemisphere, this is winter. Tilt the North Pole to the light, discuss how much light the North Pole is receiving, and the direct rays of the sun on the Northern Hemisphere, this is summer.
4 1	4f. 1d.	*Describe the hierarchical structure (stars, clusters, galaxies, galactic clusters) of the universe and examine the expanding universe to include its age and history, and the modern techniques (e.g., radio, infrared, ultraviolet, and X-ray astronomy) used to measure distances in the universe. (DOK 2)* **Advanced** – 4f. Explain techniques used to determine distances between objects in the universe or used to determine the age of the universe. **Proficient** – 4f. Describe the hierarchal structure (stars, clusters, galaxies, galactic clusters) of the universe and examine the expanding universe to include its age and history and the modern techniques used to measure object and distances in the universe. **Strategy 1:** While scientists do not completely agree on an exact age of the universe, there are a number of methods and tools they are using in an attempt to answer the question of the age of the universe. The National Aeronautics and Space Administration (NASA) has a number of tools and scientists working on answering the question. Students may access articles published by NASA by following the link below. After reading an assigned number of articles (or the teacher may assign particular articles), the students are to write a description of the methods used by NASA to try to determine the age of the universe along with the results of the research to date. http://search.nasa.gov/search/search.jsp?nasaInclude=age+of+universe **Strategy 2:** The Rainwater Observatory and Planetarium at French Camp, MS, is the largest observatory in the state. The planetarium and museum houses an extensive collection of astronomy education materials, meteorite collection and library. Contact them at www.rainwaterobservatory.org and have Dr. Jim Hill come to your school and present or take a field trip to the observatory. There is a lot to see and learn at the observatory even during the day. Join "*The Rainwater Observer*", a bi-monthly newsletter and keep informed of activities and astronomy news updates.

4	4g.	*Justify the importance of continued research and use of new technology in the development and commercialization of potentially useful natural products, including, but not limited to research efforts in Mississippi. (DOK 3)* **Proficient** – 4g. Justify the importance of continued research and use of new technology in the development and commercialization of potentially useful natural products, including, but not limited to research efforts in Mississippi.
1 1	1d. 1h.	**Strategy 1:** Students are to be assigned to research the research efforts taking place at the Thad Cochran National Center for Natural Products, the Jamie Whitten Delta States Research Center or the Mississippi Polymer Institute relating to the use of natural products and the commercial applications that may come from this research. The main focus of their research should be on the ways the research and application of the research could have a positive impact on the lives of the people of Mississippi in terms of jobs, increased revenue and development in the state. Thad Cochran National Center for Natural Products - http://www.pharmacy.olemiss.edu/ncnpr/site/index.html Jamie Whitten Delta States Research Center – http://www.ars.usda.gov/main/site_main.htm?modecode=64-02-00-00 Mississippi Polymer Institute – http://www.usm.edu/mpi/index.html
4	4h.	*Justify why an imaginary hurricane might or might not hit a particular area, using important technological resources including (but not limited to) the following: (DOK 2)* • *John C. Stennis Space Center Applied Research and Technology Project Office* • *National Oceanic and Atmospheric Administration (NOAA)* • *The National Weather Service* **Proficient** – 4h. Justify why an imaginary hurricane might or might not hit a particular area, using important technological resources.
1 1	1c. 1d.	**Strategy 1:** Hurricanes are powerful spiraling storms that begin over a warm sea, near the equator. When a hurricane hits land, it can cause catastrophic damage. Preparedness is the best defense for natural disasters. Knowing when and where a hurricane will hit can save lives and minimize property damage. After studying the tracks of past hurricanes, the students will be given the track of an imaginary hurricane. This imaginary hurricane will still be well away from land and the students are to predict where they believe the hurricane will make landfall, if it will make landfall and give reasons for their predictions. The teacher can download a hurricane tracking chart from the National Hurricane Center at the following website: http://www.nhc.noaa.gov/pdf/tracking_chart_atlantic.pdf Copies of the chart can be made and distributed to the students to plot the courses of historical hurricanes using the same chart to plot the various hurricanes. A map of hurricanes from the 2005 Hurricane Season can be found at http://www.nhc.noaa.gov/tracks/2005atl.gif. The teacher can choose from these and give coordinates to the students for each hurricane chosen. After the students have plotted the given hurricanes and marked each hurricane's landfall. The teacher will give the students a set of plots from the imaginary hurricane that is still well at sea. They will then proceed with making their predictions. Additional information on hurricanes can be found at www.nhc.noaa.gov.