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.

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Instructional Strategies 5th Grade 2010 Mississippi Science Framework

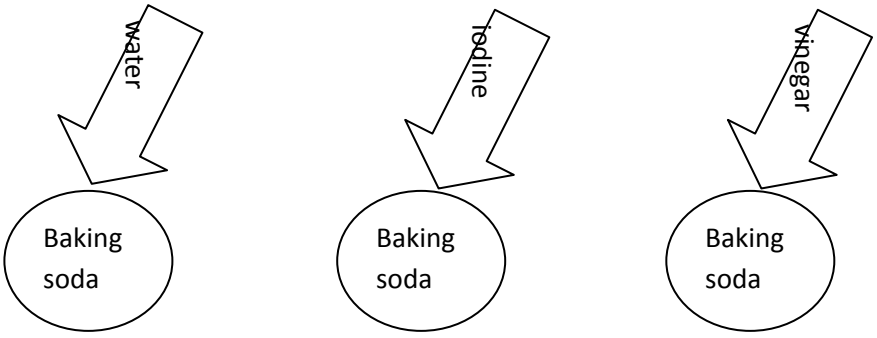
Comp.	Obj.	Inquiry (PLDs: Advanced Proficient Basic)
1		**Develop and demonstrate an understanding of scientific inquiry using process skills. Blueprint: 8 OBJ/7 ITEMS**
1	1a.	*Form a hypothesis, predict outcomes, and conduct a fair investigation that includes manipulating variables and using experimental controls. (DOK3)* **Advanced –** 1a. Design a fair scientific investigation including analyzing the data, forming conclusions, manipulating variables and using experimental controls. **Proficient –** 1a. Form a hypothesis and predict outcomes, based upon a fair investigation that includes manipulating variables and using experimental controls. **Basic –** 1a. Identify the components of a fair investigation (hypothesis, prediction or outcome, manipulating variables, or experimental control). **Strategy 1:** See Obj. 2c, Strategy 1 See Obj. 2f, Strategy 1 See Obj. 3b, Strategy 1 See Obj. 3c, Strategy 1 **Strategy 2:** See Obj. 2b, Strategy 2 See Obj. 2g, Strategy 2 See Obj. 2f, Strategy 2 See Obj. 4d, Strategy 2
1	1b. 3a. 3e.	*Distinguish between observations and inferences. (DOK2)* **Proficient –** 1b. Distinguish between observations and inferences. **Strategy 1:** Examining Skulls Show students photographs of the skulls of mammals (or actual skulls if you can get them). Have them make observations using their senses of the skulls. Then infer, or draw a conclusion, whether the animal was an herbivore, carnivore, or omnivore. For example, if the eye sockets are facing forward, the skull is likely that of a carnivore as forward-facing eyes are needed for hunting. Herbivores have eyes on either side of the head, as they are on the lookout for predators even while they are eating. A long nose indicates a good sense of smell. Teeth are very useful for inferring the diet of the animal. A T-chart may be made with the observation on one side and the inference on the other. See Obj. 2b, Strategy 1 See Obj. 2e, Strategy 1 See Obj. 3c, Strategy 1 **Strategy 2:** See Obj. 2a, Strategy 2

1	1c.	*Use precise measurement in conjunction with simple tools and technology to perform tests and collect data. (DOK1) …* **Proficient –** 1c. Use precise measurement (e.g. "to the nearest millimeter") in conjunction with simple tools and technology to perform tests and collect data. **Basic –** 1c. Identify a simple tool and its associated unit of measurement used to collect data. **Strategy 1:** See Obj. 2a, Strategy 1 See Obj. 2c, Strategy 1 See Obj. 2f, Strategy 1 See Obj. 3b, Strategy 1 See Obj. 4c, Strategy 1 See Obj. 4g, Strategy 1 **Strategy 2:** See Obj. 2b, Strategy 2 See Obj. 2c, Strategy 2 See Obj. 2d, Strategy 2 See Obj. 2e, Strategy 2 See Obj. 2f, Strategy 2 See Obj. 2g, Strategy 2
1	1d.	*Organize and interpret data in tables and graphs to construct explanations and draw conclusions. (DOK 2)* **Advanced –** 1d. Justify a conclusion based upon data **Proficient –** 1d. Organize and interpret data tables and graphs to construct explanations and draw conclusions. **Basic –** 1d. Recognize data patterns **Strategy 1:** See Obj. 2f, Strategy 1 See Obj. 3b, Strategy 1 See Obj. 3e, Strategy 1 See Obj. 4c, Strategy 1 See Obj. 4g, Strategy 1 **Strategy 2:** See Obj. 2d, Strategy 2 See Obj. 2e, Strategy 2 See Obj. 2f, Strategy 2 See Obj. 2g, Strategy 2 See Obj. 3b, Strategy 2 See Obj. 4c, Strategy 2 See Obj. 4d, Strategy 2
1	1e.	*Use drawings, tables, graphs, and written and oral language to describe objects and explain ideas and actions. (DOK 2)* **Proficient –** 1e. Use drawings, tables, graphs, and written and oral language to describe objects and explain ideas and actions.

		Strategy 1: See Obj. 2a, Strategy 1 See Obj. 2d, Strategy 1 See Obj. 3c, Strategy 1 See Obj. 4a, Strategy 1 See Obj. 4e, Strategy 1 See Obj. 4g, Strategy 1 **Strategy 2:** See Obj. 2c, Strategy 2 See Obj. 2d, Strategy 2 See Obj. 2e, Strategy 2 See Obj. 2f, Strategy 2 See Obj. 2g, Strategy 2 See Obj. 3a, Strategy 2 See Obj. 3b, Strategy 2 See Obj. 3c, Strategy 2 See Obj. 3d, Strategy 2 See Obj. 3e, Strategy 2 See Obj. 4c, Strategy 2 See Obj. 4d, Strategy 2 See Obj. 4e, Strategy 2
1	1f. 2g. 4d.	*Make and compare different proposals when designing a solution or product.(DOK 2)* **Proficient –** 1f. Make and compare different proposals when designing a solution or product. **Basic –** 1f. Identify an appropriate design for the solution for a problem. **Strategy 1:** Solar Cooker After discussing the pros and cons of alternative energy sources including wind, water, solar, geothermal, nuclear, and biomass, have students work in groups to design and construct a solar cooker using a recycled pizza box, aluminum foil, newspaper, clear plastic wrap, wooden dowel rods, and tape. Use the solar cookers to heat up food such as a hot dog. Which group's design works the best and why? Marketable applications for thermal conductors (the foil, for example) and insulators (the newspaper) used in the cooker can also be discussed. See Obj. 4c, Strategy 1 See Obj. 4g, Strategy 1 **Strategy 2:** See Obj. 2c, Strategy 2 See Obj. 3b, Strategy 2 See Obj. 4f, Strategy 2 See Obj. 4g, Strategy 2

1	1g.	*Evaluate results of different data (whether trivial or significant). (DOK 2)* **Advanced –** 1g. Justify that data are significant . **Proficient –** 1g. Evaluate whether data results are significant or insignificant. **Strategy 1:** See Obj. 2c, Strategy 1 See Obj. 2f, Strategy 1 See Obj. 3b, Strategy 1 See Obj. 3c, Strategy 1 See Obj. 4d, Strategy 1 See Obj. 4g, Strategy 1 **Strategy 2:** See Obj. 2b, Strategy 2 See Obj. 2d, Strategy 2 See Obj. 2e, Strategy 2 See Obj. 2f, Strategy 2 See Obj. 2g, Strategy 2 See Obj. 3a, Strategy 2 See Obj. 3b, Strategy 2 See Obj. 4a, Strategy 2 See Obj. 4b, Strategy 2 See Obj. 4f, Strategy 2 See Obj. 4g, Strategy 2
1	1h.	*Infer and describe alternate explanations and predictions. (DOK 3)* **Proficient –** 1h. Infer and describe alternate explanations and predictions. **Strategy 1**: See Obj. 2c, Strategy 1 See Obj. 2f, Strategy 1 See Obj. 3c, Strategy 1 See Obj. 4c, Strategy 1 **Strategy 2**: See Obj. 3a, Strategy 2 See Obj. 4c, Strategy 2 See Obj. 4f, Strategy 2 See Obj. 4g, Strategy 2

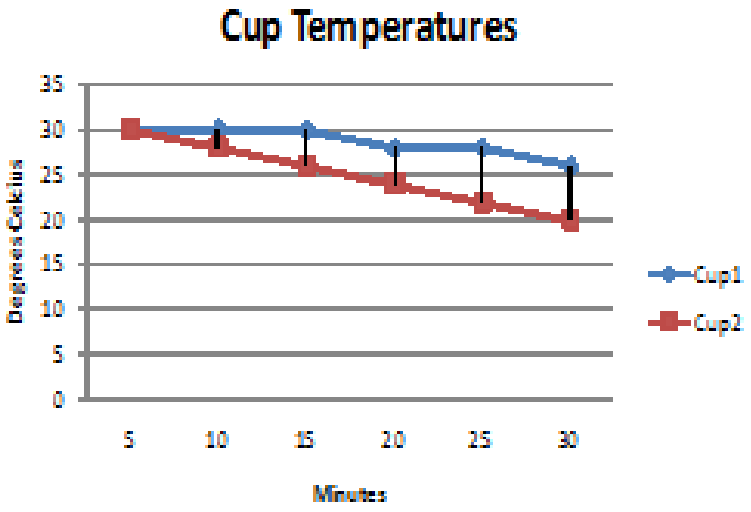
Comp.	Obj.	Physical Science (PLDs: Advanced Proficient Basic)
2		**Understand relationships of the properties of objects and materials, position and motion of objects, and transfer of energy to explain the physical world. Blueprint: 7 OBJ/14 ITEMS**
2	2a. 2f. 1c. 1e. 1b. 1c.	*Determine how the properties of an object affect how it acts and interacts.(DOK 2)* **Advanced –** 2a. Predict how an object will act and interact based on its properties. **Proficient –** 2a. Determine how the properties of an object affect how it acts and interacts. **Strategy 1:** Seven Layer Density Column Explore the density of liquids by forming a seven layer density column. Use some or all of the following liquids: vegetable oil, baby oil, water, honey, isopropyl alcohol, light corn syrup, and dish detergent (Dawn works best). The clear liquids should be colored using a few drops of food coloring for easier discrimination of the layers. Measure an equal volume (25mL) of each liquid, discussing the difference in volume and density. Have students predict whether each liquid will be more or less dense than the water, justifying their predictions. The students will work in groups to slowly pour the liquids one by one into a 250mL graduated cylinder. The honey should be poured first, directly into the center of the container to prevent it from sticking to the sides. The order of the other liquids does not matter, as they will find their "places" in the density column. Measure the layers to see that the volume of each liquid has remained the same. The students should make a sketch of the density column, coloring and labeling each layer. Ask students," In order to measure the density of each liquid, since we know the volume of each is 25mL, what other information would we have to know?" Students should state that the mass of each liquid would also be needed, since density=mass/volume. As an extension, small solid objects may be dropped into the liquids to test their relative densities. **Strategy 2:** Mystery Objects Students will identify the physical properties of hidden objects and try to discover what each mystery object is. The teacher, using several boxes (such as shoe boxes), will hide one item in each box. Items can be found around the classroom such as a marker, block eraser and such. One box could have a balloon filled with air and another should have something iron. The students will examine one box at a time. First the students will determine the weight or mass of an object on a scale. By shaking the box, the students can determine if the object is a solid, liquid or gas. Also, by running a magnet across it, the students can determine if the object has magnetic properties. Using these properties and their own inferences, they are to guess what is in each box. Suggested literature: Seven Blind Mice
2	2b.	*Differentiate between elements, compounds, and mixtures and between chemical and physical changes (e.g., gas evolves, color, and/or temperature changes). (DOK 2)* **Proficient –** 2b. Differentiate between elements, compounds, and mixtures and between chemical and physical changes. **Basic –** 2b. Identify elements, compounds, mixtures, chemical changes or physical changes

	1b.	**Strategy 1:** Bag Blow Up Provide each student with a resealable plastic sandwich bag containing one tablespoon of baking soda and a snack sized bag containing 25mL vinegar. Instruct students to place the bag containing vinegar inside the larger bag and seal, then carefully mix the contents of both bags. Have students record observations. What can they infer from these observations? They should note that the bag inflates (carbon dioxide gas) and gets colder (endothermic reaction). Point out that gas formation and temperature change are evidence that a chemical reaction has occurred. The chemical equation for this reaction ($NaHCO_3 + HC_2H_3O_2 \rightarrow H_2O + CO_2 + NaC_2H_3O_2$) may be used to discuss reactants and products and the law of conservation of mass. Discuss other signs of a chemical change, including color change and formation of a precipitate. The teacher should then form a solution of baking soda and water and have the students compare and contrast the physical change (dissolving) and chemical change. **Strategy 2:** Elements & Compounds After learning about the periodic table of elements, students will investigate the chemical properties of several different compounds (combinations of elements). The students will combine several solids (powders) with different liquids. The students will be able to tell that the elements are rearranging into different compounds when a chemical reaction occurs. Some powders that may be used are baking soda, baking powder, cornstarch, or salt. Liquids that could be used are water, iodine and vinegar. Arrange three small containers (clear plastic cups work well), with one tablespoon each, of one type of powder (e.g. baking soda) for each group of students. Have students use droppers to add water to the first container and note any changes to the contents of the container. In the second container, add iodine and observe. Do the same in the third container using vinegar. Repeat these steps for each of the other powders you have chosen to investigate. The students will note chemical changes such as color change and bubbling with certain combinations. Discuss these chemical changes and what they mean (changes in compounds) with the students. 
	1a. 1c. 1g.	

2	2c.	*Investigate the motion of an object in terms of its position, direction of motion, and speed. (DOK 2)* **Advanced –** 2c. Predict the motion of an object based on position, direction of motion and speed. **Proficient –** 2c. Investigate the motion of an object in terms of its position, direction of motion, and speed.
	1a. 1c. 1g. 1h.	**Strategy 1:** Measuring Force Measure and graph the force required to move a toy car up inclines of different heights. Demonstrate use of a spring scale to find the weight of the car by lifting the toy car straight up. Make sure students know weight is a measure of the force of gravity acting on an object and can be recorded in newtons (N). Make an incline using a textbook and a piece of wood as a ramp. Measure both the height of the textbook (in mm) with a ruler and the force (N) required to move the car up the ramp using the spring scale. Increase the height of the incline by adding another textbook and measure the force again. Repeat this procedure several times with inclines of increasing heights. Have students graph the data collected and interpret the results to determine that more force is needed the move an object to a greater height. Have students redesign the experiment to test ramps of different lengths, while leaving the height of the incline the same. How did this change the results of the experiment?
	1c. 1e. 1f.	**Strategy 2:** Balloon Cars To examine the properties of speed, direction and friction, the students will design their own cars in groups of 4 or so to be powered by jet propulsion (balloons). Each car will be entered in class competition to see which goes the farthest and which goes the fastest. If possible, the winners in each class could compete with the winners in other classes. The teacher and students could brainstorm materials to be used in class. These could include bottle caps, straws and craft dough for the axel and wheels, and cardboard or construction paper for the body of the cars. Using these materials, the students will plan the design of their cars and cooperatively make and test their products before a set date in which each groups' car will be tested in front of the whole class in a competition setting. Suggested literature: The Big Balloon Race
2	2d.	*Categorize examples of potential energy as gravitational (e.g., boulder on a hill, child on a slide), elastic (e.g., compressed spring, slingshot, rubber band), or chemical (e.g., unlit match, food). (DOK 2)* **Proficient –** 2d. Categorize examples of potential energy as gravitational, elastic, chemical.
	1e.	**Strategy 1:** Potential Energy Scavenger Hunt After showing examples of each type of potential energy (gravitational, chemical, and elastic) in the classroom, send students on a scavenger hunt around the school to find other examples of potential energy. Gravitational potential energy could be shown by books on library shelves or a child swinging on the

		playground. Chemical potential energy might be represented by showing the batteries in a clock or food in the cafeteria. Elastic potential energy may be found in rubber bands in the school office or the spring in a stapler. If digital cameras are available, students may take photographs and create a multimedia presentation. If cameras cannot be used, students may create a potential energy collage using pictures from magazines. **Strategy 2:** Poppers There are two types of poppers that are both great examples of elastic potential energy. The rubber, bubble-shaped poppers require the child to turn them inside-out for them to "pop". The spring-loaded poppers require the child to compress the spring and wait for the toy to pop. As a class, chant the word potential several times after preparing the toy and the second it begins to pop, yell "kinetic!" After doing this a few times, break into groups and give each group one of each type of popper and a stopwatch. Have each group create a table with their findings about which type of popper holds onto its potential energy the longest. Suggested literature: Sheep in a Jeep
	1c. 1d. 1e. 1g.	
2	2e.	*Differentiate between the properties of light as reflection, refraction, and absorption. (DOK 1)* **Proficient –** 2e. Differentiate between the properties of light as reflection, refraction, and absorption. **Basic –** 2e. Recognize the effect of prisms, lenses, mirrors, and eyeglasses on the characteristics of light. **Strategy 1:** Experimenting with Light Provide a variety of optical tools such as prisms, mirrors, magnifying glasses, convex and concave lenses, old eyeglasses, etc. for students to use as they explore the properties of light. Prepare a flashlight to emit a small beam of light by covering its end with a circle of cardstock into which a narrow slit has been cut. Explain that the ray model of light describes light waves as moving away from their source in straight lines. When these rays hit a surface, the rays may be absorbed or reflected back. Some materials reflect light better than others. Shiny, smooth surfaces like mirrors reflect light well, while dark, rough surfaces do not. Demonstrate the *law of reflection* by shining the light from the prepared flashlight onto a mirror in a darkened room. Position the mirror so students can see both the incoming and reflected beams. Note that the angles formed from both beams are the same. Next, explain that light waves travel at different speeds in different substances (mediums). This causes refraction, or the bending of light waves as they leave one medium and enter another, as when it moves through air into water. Show how a beam of light is refracted using the same prepared flashlight and a glass of water. Darken the room and hold the flashlight at an angle to the surface of the water. A piece of paper placed on the floor below will help students see how the beam of light refracts. A Venn diagram may be constructed to compare and contrast what students learn about reflection, refraction, and absorption. Some great experiments involving the properties of light can be found on the Exploratorium's website at www.exploratorium.edu.
	1b.	

	1c. 1d. 1e. 1g.	**Strategy 2:** What to wear on a hot day? Different color fabrics reflect and absorb different amounts of energy from the sun's light. Arrange different color fabrics (felt squares and even construction paper work well) on a table outside on a sunny day. Have the children make predictions about which color they think will be the hottest and coldest and explain why they think so. Record the temperature for each color at 10 minute intervals for about an hour. Make a table of the information and discuss your findings and compare them to the children's original predictions.
2	2f.	*Describe physical properties of matter (e.g., mass, density, boiling point, freezing point) including mixtures and solutions. (DOK 1)* **Proficient –** 2f. Describe physical properties of matter including mixtures and solutions. **Basic –** 2f. Define mass, density, boiling point, freezing point and other physical properties of matter.
	1a. 1c. 1d. 1g. 1h.	**Strategy 1:** How Does Temperature Affect Solubility? Students have probably made hot chocolate, but have they ever made cold chocolate? Why not? Discover the effects of temperature changes on the solubility of substances by dissolving instant cocoa mix into water at three different temperatures. Provide each group of students 3 clear cups containing equal amounts of hot, cold, and room temperature water, thermometers, tablespoons, cocoa mix, and a stopwatch. Have them use a thermometer to measure and record the temperature of each cup of water. Beginning with the hot water and stirring constantly, record the time it takes to completely dissolve one tablespoon cocoa into the water. Repeat process for the cold water, followed by the water at room temperature. The data collected may be graphed to show the relationship between the temperature of the solvent and the solubility of the solute. For more independent inquiry, students may be provided with materials and asked to develop their own procedure for testing. Emphasize that the experiment's independent variable, or the variable that is manipulated, is the temperature of the water. The dependent variable will be the time it takes for the solute to dissolve. The amounts of water and cocoa mix, as well as the stirring method and tool must all remain the same. These are the controls. Different procedures should be compared to see if the same results are obtained.
	1a. 1c. 1d. 1e. 1g.	**Strategy 2:** Evaporation Rate Different liquids evaporate at different rates. Choose some clear liquids and have the children guess which is alcohol, water and vinegar (from a distance). They all look the same, but have different properties. Have the children predict which they think will evaporate the fastest. Put each in the same kind of container and mark the level at the top of each liquid (start with the same amount of each). Each day, mark the level in each container and discuss what is happening. Make a chart of the amount of each liquid, in each cup, each day. At the end of a week compare your findings to the children's predictions.

2	2g.	*Categorize materials as conductors or insulators and discuss their real life applications (e.g., building construction, clothing, animal covering). (DOK 2)* **Advanced –** 2g. Evaluate a marketable application of conductors and/or insulators. **Proficient –** 2g. Categorize materials as conductors or insulators and discuss their real life applications. Strategy 1: Conductors & Insulators Make a simple electrical circuit with a size D battery, flashlight bulb, socket, and insulated wire. Have students collect a variety of objects to test, such a penny, pencil, paper clip, rubber band, etc. Make sure to include both metals and nonmetals. Have students make predictions whether the objects will be conductors or insulators. Test the objects by touching both open ends of the wire to the objects. Have students classify the objects as conductors or insulators, rating the conductors by how brightly the bulb is lit. Ask students which materials made the best conductors? Where are electrical conductors and insulators used? How are electrical and thermal conductivity related? Strategy 2: Hot Cups Have the children suppose that their uncle just opened a coffee shop in town and wants to keep expenses down. He needs to find a cup for the coffee that will keep the coffee hot but he is also concerned at how much each cup will cost him. Have the children brainstorm different types of cups and how they can determine which cup works the best. Pour hot water (not too hot) into each type of cup and take the temperature of each cup at 5 minute intervals for about 30 minutes. Make a line graph comparing the temperatures for each cup and how long they stay at a warmer temperature (see below). Compare results and discuss which cup would be the best insulator for their uncle to use. 
	1a. 1c. 1d. 1e. 1g.	

Comp.	Obj.	Life Science (PLDs: Advanced Proficient Basic)
3		**Predict characteristics, structures, life cycles, environments, evolution, and diversity of organisms. Blueprint: 5 OBJ/10 ITEMS**
3	3a.	*Compare and contrast the diversity of organisms due to adaptations to show how organisms have evolved as a result of environmental changes. (DOK 2)* **Advanced –** 3a. Predict how structural or behavioral adaptations of an organism will allow that organisms to continue living in a changing environment. **Proficient –** 3a. Compare and contrast the diversity of organisms due to adaptations to show how organisms have evolved as a result of environmental changes. **Basic –** 3a. Identify the adaptation that allows an organism to live in their particular environment. **Strategy 1:** Animal Classification Play "Mystery Animal" game. Collect a variety of animal photographs from magazines, books, or the internet. Include at least one animal from each of the major phyla and classes studied. Attach a picture to the back of a student and have the student try and determine the animal's identity by asking classmates only dichotomous questions. These are questions that have only two possible answers, for example, "Does the animal have a backbone?" Encourage the students to ask questions related to animal classification such as body structure and symmetry, body temperature, reproduction, etc. The student who guesses the mystery animal using the fewest questions wins. **Strategy 2:** Habitat Match Let each group choose a different biome. As a group, the children are to make a poster depicting this habitat. As an individual, each child in the group is to choose a living organism from their biome (plant or animal) and make one that will fit on their group poster. They are also to teach the other members of their group about their organism. When all are finished, hang the posters around the room and hold up the organisms one at a time. The children will have to identify the habitat poster the individual belongs to and what adaptations of that organism make them think so. The group that made the organism will be in charge of telling the others whether or not they are correct and why. They may even find that some organisms have adaptations that enable them to live in more than one habitat. Suggested literature: The Great Kapok Tree or Nature's Green Umbrella
	1e. 1g. 1h.	
3	3b.	*Research and classify the organization of living things. (DOK 2)* **Proficient –** 3b. Research and classify the organization of living things. **Basic –** 3b. Identify the components (e.g., cells, organs, organ systems) within an organized, living system.

	1a. 1c. 1d. 1g.	**Strategy 1:** Are Body Surface Area and Lung Capacity Related? After studying the parts and functions of the respiratory system, have students hypothesize whether a person's lung capacity is related to body surface area (BSA). Perform an experiment to test their hypotheses. Divide students into pairs to measure each other's weight in kilograms and height in centimeters using a scale and measuring tape. Enter the measurements into an online body surface area calculator, such as www.medcalc.com/body.html, that will convert the data into square meters. Lung capacity is measured by having students inflate a round balloon with a normal breath (tidal lung volume) to the fullest capacity possible, carefully tying off the balloon so that no air escapes. Students use the measuring tape to find the circumference of their balloons at the widest part (use cm). The circumference is used to find the radius ($C = 2\pi r$), which is then used to calculate the volume of the spherical balloon ($V = \frac{4}{3}\pi r^3$) in cubic centimeters. Graph the BSA and lung capacity measurements using Excel or another program. Have students analyze the graphs to determine if the data supports their hypothesis. Answers may vary, but research has shown that the capacity of a human's lungs is proportional to the surface area of his/her body. Discuss variables that might affect the outcome of the experiment. What factors besides body surface area affect lung capacity? Point out that aerobic activities increase lung capacity, thus athletes and musicians will have greater lung capacity than average people. In general, males have greater lung capacity than females and lung capacity tends to decrease with age. Smoking and lung diseases, including asthma and cystic fibrosis, also lead to decreased lung capacity. **Strategy 2:**
	1d. 1e. 1f. 1g.	Shoe Tree Scientists have to find similarities in order to group animals into their different groups and differences in order to separate them. The children will do the same thing using their own shoes. You may want to bring a few "different" kinds of shoes to make things interesting. The children place all their shoes on the table, and as a group, they have to decide what the shoes have in common and put them into categories. Anything they come up with as long as they can justify it is acceptable. An example might be boy shoes and girl shoes. They must keep dividing the shoes into groups until there are only one or two shoes in each category. When they have agreed on their groups, they draw their groups as a diagram (see below) on chart paper to share with the class. 
3	3c.	*Research and cite evidence of the work of scientists (e.g., Pasteur, Fleming, 2010 Mississippi Science Framework Approved July 25, 2008 39 Salk) as it contributed to the discovery and prevention of disease. (DOK 3)* **Proficient –** 3c. Research and cite evidence of the work of scientists as it contributed to the discovery and prevention of disease.

	3b. 1a. 1b. 1e. 1g. 1h.	**Strategy 1:** Testing for Microbes Read and discuss biographies of scientists recognized for their work in the field of microbiology: Fleming, Jenner, Koch, Leeuwenhoek, Lister, and Pasteur. Emphasize their roles in the discovery and prevention of disease. Perform an experiment where students test to see which objects in the classroom contain the most microorganisms, as well as the affect alcohol has on these microbes. Emphasize that microbes are unicellular, cannot be seen unaided, and may include both bacteria and fungi. Before beginning the activity, ask students probing questions such as, "How do people contract disease?" "What conditions are needed for microbe growth?" "Should you wash your hands even if they don't look dirty?" "What products are used to kill germs?" Have students form hypotheses as to what objects they think are the dirtiest. Choose five or six of the objects to test. A group of students will test for the presence of microbes on each of these objects. Each group will need three petri dishes prepared with nutrient agar, cotton swabs, water, and alcohol pads. Instruct students to use the cotton swab to rub the chosen object and carefully streak the petri dish. The petri dish will be sealed with tape and labeled. Next, clean half the object with water and use another cotton swab to streak a second petri dish. Seal this dish and label it CONTROL. Use the alcohol pad to disinfect the other half of the same object, swab, and streak the third plate as before. Seal and label. The dishes will be placed in a warm, dark area such as a closet and will be observed daily. Construct a table that compares the plates before and after cleaning. What can be inferred from these observations? Have the groups compare the results from each object and evaluate their hypotheses.
	1e.	**Strategy 2:** Science Most Wanted Have each group of students choose a famous scientist. The group must research this scientist and share their information with each other. When they have done their research, the group will make a "Wanted" poster of their scientist using the facts they have learned to create it. Hang these around the room and have each group share their findings with the class. Suggested literature: Scientists Through the Ages (Janice Van Cleave)
3	3d.	Distinguish between asexual and sexual reproduction. (DOK 1) **Proficient –** 3d. Distinguish between asexual and sexual reproduction. **Basic –** 3d. Identify reproduction as asexual or sexual. **Strategy 1:** Asexual Reproduction Make sure students understand that asexual reproduction uses only one cell, while sexual reproduction requires two cells. There are many different types of asexual reproduction. Show students examples or photographs to discuss some of the most common: fission (bacteria), budding (yeast), fragmentation (flatworms), spores (mushrooms), and vegetative propagation (strawberry runners). Students should know that some organisms, including many plants, can reproduce both sexually and asexually. Environmental conditions often determine which type of reproduction the organism uses. Ask students to name

		advantages and disadvantages of asexual reproduction. Asexual reproduction does not require a mate and may produce many offspring quickly, but these offspring will be exact copies of the parent, offering no genetic variation. Demonstrate vegetative propagation (the production of a new organism from a nonsexual part of one parent) in plants by using toothpicks to suspend a sweet potato, pointed side down, in a jar of water. Observe for several weeks as the sweet potato's eyes develop into new plants. Have students answer questions, "What are the eyes?" "Do they all develop into new plants?" "How might this type of asexual reproduction be beneficial?" "Can a potato also reproduce sexually?"
	1e.	**Strategy 2:** Sexual Reproduction in Plants Using a visual of the reproductive parts of plants such as a large diagram on the smart board, discuss and identify each of the parts using the correct vocabulary. Make sure to make a point of distinguishing the male and female parts. Some children may not realize this is how seeds are made. The children will then dissect their own plant and identify each of the parts. Then the children will draw their own diagram of the reproductive parts of their flowering plant. Plants that work well for this are gladiolas and irises. Suggested literature: From Seed to Plant or The Reason for a Flower
3	3e.	*Give examples of how consumers and producers (carnivores, herbivores, omnivores, and decomposers) are related in food chains and food webs.(DOK 1)* **Advanced –** 3e. Predict how possible changes in the food web or environment will affect the flow of energy. **Proficient –** 3e. Give examples of how consumers and producers are related in food chains and food webs. **Basic –** 3e. Identify the levels of organization in a food chain or food web (e.g., producers, consumers, herbivores, carnivores, omnivores).
	1d.	**Strategy 1:** Predator-Prey Simulation Model the relationship between predator and prey by simulating owl and mice populations in a meadow ecosystem over several generations. Use small plastic beads to represent the mice, a spoon for the owl, and a bowl for the meadow. Pair students and assign each a role. Begin by placing five beads (mice) in the bowl (meadow). Drag the spoon (owl) through the bowl. Any beads in the spoon represent prey captured by the owl. An owl must capture at least five mice to survive and reproduce. Any mice not captured survive and reproduce by doubling their numbers. No more than 100 mice may be present in the meadow at any time (the land's carrying capacity). Make a data table to record numbers of initial prey and predators, surviving prey and predators, and total numbers after reproduction. Continue the simulation for at least fifteen generations. Construct a double-line graph to show the numbers of initial prey and predators from the data table. Ask questions that help students interpret the information on the graph, for example, "Which population first showed an increase in numbers?" "What happened once the mice population neared 100?" Have students describe

		events that might occur to change the pattern of population growth. One example: "If a forest fire destroys all the meadow grass, how would both populations be affected and how might the graph show this?" Additionally, an energy pyramid may be constructed to show the flow of energy from the grass (the producer), to the mouse (primary consumer or herbivore), to the owl (secondary consumer or carnivore). Note how less energy is available as the level of the pyramid gets higher. How does this relate to the graph? The population of mice was always greater than the population of owls.
	1e.	**Strategy 2:** Square Meter Food Web Mark off enough square meters on the school grounds for each group in your class using string and wooden dowels. Before going outside, discuss with the students the types of living things they think will be in their square meter and what kind of interactions they might see. You might want to go over some rules such as no killing bugs and if they move something, they have to put it right back (they could be disturbing someone's home). Have the children bring drawing paper and something to write on so they can draw their square meter. The children will be amazed at the variety of living things they find as well as the different ways organisms depend on each other. When returning to class, have the children share their drawings, discuss their findings and compare them to their predictions. Suggested literature: Butternut Hollow Pond
Comp.	**Obj.**	**Earth and Space Science (PLDs: Advanced Proficient Basic)**
4		**Develop an understanding of the properties of Earth materials, objects in the sky, and changes in Earth and sky. Blueprint: 7 OBJ/14 ITEMS**
4	4a.	*Categorize Earth's materials. (DOK 1)* **Proficient –** 4a. Categorize Earth's materials. **Basic –** 4a. Identify Earth's materials.
	1e.	**Strategy 1:** Layers of the Atmosphere Create a flap booklet to illustrate the layers of the atmosphere. Stagger three sheets of paper, fold in the middle, and staple at the top. Label the layers of the atmosphere on each flap-troposphere, stratosphere (including the ozone layer), mesosphere, thermosphere, and exosphere as they increase in altitude from the Earth's surface. As each layer is discussed, have students lift its flap to record information. Booklets may also be made illustrating the hydrosphere and lithosphere.
	1g.	**Strategy 2:** Test Rock Samples Different minerals have unique properties that help geologists identify them. Choose rock samples such as limestone, magnetite, sandstone, mica, calcite, pumice or obsidian. These are some of Earth's minerals that have remarkable properties making them interesting to identify. Limestone will bubble when drops of vinegar are added; magnetite is magnetic; sandstone can be scratched to release tiny grains of sand; mica separates into thin sheets; calcite is chalk and can write on the board; pumice is very light and obsidian looks like black glass. Lead the children in a discovery of these minerals by letting them identify their samples.

4	4b.	*Explain how surface features caused by constructive processes (e.g., depositions, volcanic eruptions, earthquakes) differ from destructive processes (e.g., erosion, weathering, impact of organisms). (DOK 2)* **Advanced –** 4b. Explain how constructive processes combine with destructive processes to create certain land features. **Proficient –** 4b. Explain how surface features caused by constructive processes differ from destructive processes. **Basic –** 4b. Identify surface features formed from constructive or destructive processes.
	1e.	**Strategy 1:** Constructive Forces Use interactive animations to introduce the theory of plate tectonics. The U.S. Geological Survey provides visualizations at www.nature.nps.gov. Guide students in outlining the boundaries of the Earth's major plates on a world map. Have them cut apart and reassemble the "puzzle pieces." Model constructive forces that occur along these plate boundaries using Milky Way™ candy bars. The chocolate covering represents the lithosphere, while the caramel underneath shows the asthenosphere. First, pull the candy bar slowly apart from each end. The chocolate crust will crack and some of the caramel (magma) may emerge. This models a divergent boundary, as two plates move away from each other. Tell students this is how mid-ocean ridges form. Next, model a convergent boundary by slowly pushing the candy bar back together. The chocolate pieces may crumple together like fold mountains, such as the Himalayas and Appalachians, are formed. Also at convergent boundaries, one plate may sink, or subduct, under the other. Subduction is the process that creates most volcanoes. Finally, take a second candy bar, cut it in half, and slide one half past the other. When two plates slide past each other, a transform fault is formed, the San Andreas Fault in California, for example. Earthquake activity is common along transform faults. Have students write a description of the constructive forces that were modeled with the candy bars. Suggested literature: Grand Canyon
	1g.	**Strategy 2:** Erosion Table If you do not have an "official" erosion table, you can use the slide on the playground. Cover the table (or slide) with dirt. Using buckets of water, pour slowly over the dirt and watch what happens. Use different mixes of soil and rocks and compare which move more easily. Raise one end of the table or pour the water more quickly and note the differences. Have the students change the variables and discover how powerful erosion is. Suggested literature: Erosion or The Sun, the Wind, the Rain

4	4c.	*Summarize how weather changes. (DOK 2)* **Advanced –** 4c. Predict weather based on the season and collected data. **Proficient –** 4c. Summarize how weather changes. **Basic –** 4c. Identify tools used for collecting weather data.
	2f. 1c. 1d. 1f. 1g. 1h.	**Strategy 1:** Predicting the Weather Emphasize that air is matter and therefore has mass and exerts force. This force is called air pressure and is affected by temperature, volume, altitude, and humidity. Air pressure is a major factor used by meteorologists to predict the weather. Areas of high pressure generally indicate fair weather with little or no precipitation, while low pressure often means clouds and precipitation, even storms. Make a homemade barometer to measure changes in air pressure. Stretch a large balloon over a coffee can and secure with a rubber band forming an airtight seal. Tape a plastic straw horizontally on top with about one-third sticking off the side. To this side of the coffee can, tape a lined index card. When air pressure increases, the surrounding air will push down on the balloon, making the straw rise. When air pressure decreases, the balloon will not be as stretched and the straw will go down. The lines on the index card can be used as a guide to see if the air pressure has increased, decreased, or remained the same. Over a period of two weeks, students will check their barometer for air pressure changes at least twice a day and use that information to make a prediction for the next day's weather. Use an Internet weather site or daily newspaper to see find actual barometric readings. Record the meteorologists' forecasts for the weather in a table. Compare those to the students' predictions and discuss reasons for any differences that might occur. Set up a classroom weather station. See www.fi.edu/weather for instructions on how to make other homemade weather instruments, including a rain gauge, a hygrometer, and an anemometer. Analyze measurements taken from the instruments to look for patterns in the weather.
	1a. 1d. 1e. 1h.	**Strategy 2:** Smart Board Report Using the smart board, watch the weather report each day and help the children notice how weather moves from the west to the east. Noticing the weather in Louisiana usually comes into our state helps meteorologists make predictions. In groups, using theses graphics, have the children make predictions about the weather in their area and if they feel confident enough, make weather reports for the class. You may even use hurricane reports the same way noting that they move opposite from "normal" weather. Suggested literature: Cloudy with a Chance of Meatballs or The Cloud Book

4	4d.	*Describe changes caused by humans on the environment and natural resources and cite evidence from research of ways to conserve natural resources in the United States, including (but not limited to) Mississippi. Examples of Mississippi efforts include the following: (DOK 2)* **Advanced –** 4d. Critique ways to conserve natural resources. **Proficient –** 4d. Describe changes caused by humans on the environment and natural resources and cite evidence from research of ways to conserve natural resources in the United States, including Mississippi. **Strategy 1:** Conservation Field Trips Plan appropriate field trips and/or guest speakers to highlight conservation efforts in the state of Mississippi. Possible field trips include the Noxubee Refuge, Plymouth Bluff Environmental Center, the Mississippi Museum of Natural Science, J.L. Scott Marine Education Center, and the North MS Fish Hatchery. The Mississippi State Extension Service and the Mississippi Soil and Water Conservation Commission will provide guest speakers and materials on a variety of topics. **Strategy 2:** Acid Rain Pollution in the atmosphere has increased levels of acid in rain in certain areas. The effect is most obviously seen on plant leaves. Have the children plant three separate pots of bean plants (they grow quickly). Water them normally until leaves have emerged. Prepare three different bottles to water the plants and mark both the bottles and the pots with corresponding numbers 1, 2, and 3. Use bottle #1 as a control and just use plain water. In bottle #2 add 20% vinegar (acid) and in bottle #3 add 40% vinegar. Have the children predict which plant will grow the most. Water the pots with their corresponding number water bottles about every other day and measure their growth. Chart the progress of each plant and discuss with the children what is happening. Compare their results to their predictions. Suggested literature: Dinosaurs to the Rescue! A Guide to Protecting Our Planet or Michael Bird Boy
	1a. 1d. 1e.	
4	4e.	*Predict the movement patterns of the sun, moon, and Earth over a specified time period. (DOK 1)* **Advanced –** 4e. Compare the movement patterns of the moon around the Earth to the movement pattern of the Earth around the sun over a specific time period. **Proficient –** 4e. Predict the movement patterns of the sun, moon, and Earth over a specified time period. **Basic –** 4e. Identify the location of the sun, moon, or Earth at a specific time period. **Strategy 1:** Moon Observations Provide each student with 30 index cards on which to make nightly moon observations for one month. A circular object will be traced in the same location
	1e.	

		on each card. Students will shade in areas of the moon that do not appear lightened each night. Have a volunteer report on the previous night's observations in the classroom each day. Label each phase of the moon-new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, last quarter, waning crescent. State that this is known as a lunar cycle. At the end of the month, staple the index cards together, creating a booklet that when flipped will animate the moon's phases. Ask questions related to the movement pattern of the moon over a specified time period. How long is a lunar cycle? (29.5 days) How long is each of the eight phases of the moon? (3.6 days) How many lunar cycles have there been since you were born?
	1e.	**Strategy 2:** Act it Out Each group of 4 students chooses the roll of Earth, moon, sun or director. Have them make signs or costumes identifying which they are. The director is in charge of making sure the other three are behaving (rotating and revolving) properly. The sun simply stays in the middle rotating on its axis. The Earth has to rotate as it revolves very slowly around the sun. As the Earth is doing this, the moon has to rotate as it quickly revolves around the Earth. After a few practice runs, have the children switch rolls and play their new parts.
4	4f.	*Compare and contrast the physical characteristics of the planets (e.g., mass, surface gravity, distance from the sun, surface characteristics, moons). (DOK 2)* **Proficient –** 4f. Compare and contrast the physical characteristics of the planets. **Basic –** 4f. Identify physical characteristics (e.g. mass, surface gravity, moons) of a planet.
	1e.	**Strategy 1:** Planetary Travel Brochure Divide the class into groups to "travel" to each planet in the solar system. Provide textbooks, library books, encyclopedias, Internet, and other resources to have the "astronauts" research and create an illustrated travel brochure on their assigned planets. The brochures should show information including distance from the sun, mass, gravity, surface characteristics, moons, and special features of the planet. As these reports are shared with the class, a chart will be made to compile information from each group.
	1f. 1g. 1h.	**Strategy 2:** Design an Alien The other planets in our solar system have very different habitats than our planet. After discussing the types of atmospheres and gravity on the other planets, have the children choose a planet to create an alien that could survive there. You might encourage them to use recycled household product containers to make their aliens. They must identify at least three adaptations their alien possesses in order to survive on their planet when making their presentation to the class. Suggested literature: Dr. Xargle's Book of Earthlets

4	4g.	*Conclude that the supply of many Earth resources (e.g., fuels, metals, fresh water, farmland) is limited and critique a plan to extend the use of Earth's resources (e.g., recycling, reuse, renewal). (DOK 3)* **Proficient –** 4g.Conclude that the supply of many Earth resources is limited and critique a plan to extend the use of Earth's resources.
	1c. 1d. 1f. 1g.	**Strategy 1:** Water Conservation Emphasize fresh water as a limited resource that must be conserved by showing students a 1000mL graduated cylinder that represents all the water on Earth. Pour 971mL of the water into another container and add salt to it to show the 97.1% that is ocean water. 22mL will be poured into a container and frozen as the 2.2% water in polar ice caps. The remaining 7mL is all the freshwater (less than 1%) that is left. Not all of this water is usable, however. Some of it is too deep underground or found in a remote location, some of it is water vapor in the atmosphere, and an increasing amount of it is too polluted to use. The water that we do have available for everyday use can be symbolized by one drop from a dropper. The class will monitor water usage in the home for one week by checking their water meter readings each day at the same time. Have students research ways to conserve water and design a plan that includes at least three things they will do to reduce the amount of water used in their homes. The conservation methods might include turning off water while brushing teeth, showering rather than bathing, washing only full loads of clothing, etc. Then have students record their water usage for another week, while carrying out their conservation plans. Construct a double-bar graph comparing the two weeks' water usage. Evaluate each others' plans to see which was most successful for saving water.
	1f. 1g. 1h.	**Strategy 2:** Oil Clean-up With the latest oil accident in the Gulf (summer of 2010), this activity will mean a lot to the children in coastal Mississippi. Fill several large aluminum pans (one for each group) with water and pour oil into it. Brainstorm with the children about ways to clean up oil that is in the water. Collect suggested materials such as cotton balls, paper towels, and whatever else the children come up with. While the children are working on this problem, encourage them to come up with additions to their solutions or other ways that might work. Discuss problems this is causing to wild life in the Gulf and human life as well. Suggested literature: <u>Oil Spill</u>! or <u>Prince William</u>