RESOURCE GUIDE

This resource guide is designed to be used in conjunction with the live performance of Bill Blagg's *The Science of Magic* show. Utilizing the resources in this guide will help you explore the wonders of magic with students. You will be able to further your students' understanding of the art of magic and the scientific principles/processes displayed in Bill Blagg's *The Science of Magic* show. The goal of this guide is to further promote students to think "outside the box" and spawn their curiosity about how science is used to create the impossible!

The Man Behind the Magic

To say that Bill Blagg has had a magical life would be no exaggeration. From the moment he received his first magic kit in 1985, his world was never the same. Bill professionally launched his magic performing career in 1996, at the ripe age of sixteen. Bill became a stand-out in the magic community, due in part to his off-the-cuff personality and his high-energy performance style.

After graduating college with honors, Bill hit the road to perform magic full-time. Today, Bill has one of the largest touring theatrical magic and illusion shows in the country.

Having a love for both magic and science, Bill combined the two to create his one-of-a-kind, educational show *The Science of Magic.* The show takes students on a rare, exciting, never-before-seen journey behind the scenes of the magic world. Students discover first-hand how magicians utilize science to create the impossible.

Bill lives in Milwaukee, WI, with his wife Kristin. When he's not performing he can be found at his magic workshop, working with his dad to create new illusions to thrill his audiences with.

Magic & Science

Both magic tricks and science experiments can leave people scratching their heads in amazement. Sometimes it seems there's not much difference between magic and science. What are magic tricks anyway? Magic tricks are really just illusions. The magician knows the secret of how to do the trick. However, to the audience the trick looks like magic because they don't understand how the trick was done.

Many magic tricks are really just simple science experiments. The magician adds a few magic words and makes you believe that something supernatural and mysterious is happening. Magicians are master showmen and work very hard to fool audiences by using misdirection and manipulating their senses. In the end, there's a scientific explanation for how the trick works that has nothing to do with magic or magic words.

Examining Magic

The fascination with tricks and illusions is universal and timeless. Before you can examine magic in detail, it is helpful to let children discover the broadness of the topic. As you are introducing magic to the group, brainstorm all the different types of activities that might fall under the category of magic.

Making things disappear, appear and change form is described as magic. Seeming to defy the "natural" order of the world (i.e. defying gravity, walking through walls) is called magic. Moreover, amazing feats that stun or surprise us are deemed "magical." You may soon find your list of magic acts getting quite lengthy!

Next it is helpful to look at some synonyms for magic. Illusions, tricks, stunts, and deceptions are all used to describe magic acts. Discuss with the children why something might be called a stunt, whereas something else is an illusion. Decide how broadly you would like to define the category of magic. Work with the children to create a working definition for the topic of magic.

Pre-Show Discussion Topics

(Florida Standards Connections: LAFS.2.W.3.8, LAFS.2.SL.1.1, LAFS.3.W.3.8, LAFS.3.SL.1.1, LAFS.4.W.3.8, LAFS.4.SL.1.1, LAFS.5.W.3.8, LAFS.5.SL.2.4, LAFS.6.W.3.8, LAFS.6.SL.2.4, LAFS.7.W.3.7, LAFS.7.SL.2.6)*

Use the following questions to start classroom discussions prior to attending *The Science of Magic:***

****For grades 5, 6 and 7, have students use electronic devices to research the questions with a partner. Have them present their findings to another group or to the class as a whole.**

- What is MAGIC?
- Name some famous magicians.
- What is your favorite magic trick?
- Does anyone know how to do a magic trick?
- If you could learn how to do one magic trick, what magic trick would you like to learn? Why?
- Do magicians have magical powers or do they use science to fool us?
- Where do magicians learn how to do magic?

***For a complete listing of the Florida Standards Connections, please see pages 11-13 of this study guide.**

Post-Show Discussion Topics

(Florida Standards Connections: LAFS.2.SL.1.3, SC.2.N.1.3, LAFS.3.SL.1.3, SC.3.N.1.6, LAFS.4.SL.1.3, SC.4.N.1.4, LAFS.5.SL.1.3, SC.5.N.2.2, LAFS.6.SL.1.2, SC.6.N.1.5, LAFS.7.SL.1.2, SC.7.N.1.5)

Use the following questions for classroom discussion after attending *The Science of Magic:*

- **How do magicians create magic tricks?**

  They use the steps of the scientific method. They develop a theory (hypothesis) then they test it. If it fails they change one variable and test it again. They repeat this process over and over until they get their theory to work.

- **Do magic tricks always work?**

  No. Just like scientists, magicians must keep experimenting to find ways to make illusions work. Some ideas NEVER work and others take YEARS to create!

- **How do magicians use mirrors to make magic?**

  They use mirrors to reflect light to make a person think they are seeing something (a mirror image) that is not really there.

- **What type of mirror did Bill use to make things disappear in the magic box?**

  Plane mirror

- **Can a solid pass through a solid?**

  No. When molecules are tightly packed together they form a solid. In a solid the molecules can't move or separate in order to allow another solid to pass through.

- **Since a solid can't scientifically pass through another solid, how did Bill pass the metal hoop over the floating teacher?**

  We can't tell you the secret but here's a tip…misdirection and controlled perspective :-)

- **What can you do with an object when you find its center of gravity?**

  Make it balance

- **After everything Bill taught us during the show do you think (teacher's name) was really floating in mid-air at the end of the show?**

Mention the passing of the metal hoop as proof of no supports, etc. Use this question to spawn creative methods of how the teacher was floating.

Activity: *Create experiments to test the student's hypotheses on how they think the teacher floated. Were their hypotheses correct? Why or why not*

Terms

(Florida Standard Connections: LAFS.2.L.3.4, LAFS.3.L.3.4, LAFS.4.L.3.4, LAFS.5.L.3.4, LAFS.6.L.3.4, LAFS.7.L.3.4)

Activity: Have students create a vocabulary foldable with liftable tabs.
http://www.wolcottschool.com/files/2613/7833/2551/Vocabulary_Foldable_.pdf
Give students the list of terms. 2nd & 3rd graders should be given the definitions and asked to complete the sentences and pictures. Upper grades can work with partners to find the meanings and complete the sentences and pictures.

Illusion: something that produces a false impression of reality

Misdirection: focusing attention on one thing in order to distract attention from another

Perspective: the way objects appear to the eye

Levitate: to float in air

Center of Gravity: the point where the effect of gravity on an object is equal

Magnetism: the invisible force that causes items to attract or repel each other

Attract: to come together

Repel: to push apart

Mirror: an object with at least one reflective surface

Mirror Image: the image seen when looking into a mirror

Plane Mirror: a mirror with a flat surface. Most common type of mirror

Reflection: the bouncing of light from a surface

Refraction: the change in direction of light as it moves from one transparent substance to another

Matter: anything that has mass and takes up space

Atom: a tiny particle that all matter is made of

Molecule: forms when atoms bond or link together.

Density: a term used to compare two substances that occupy the same amount of space but have different amounts of matter

Solution: mixing two or more substances together (salt water)

Scientific Method: the process used to prove or disprove a hypothesis using experimentation.

Hypothesis: an educated guess about the results of an experiment you are going to perform

Experiment: a procedure used to test a hypothesis or to make a discovery

Magic Lesson 1: The Floating Egg

(Florida Standards Connections: SC.2.N.1.1, SC.2.N.1.5, SC.3.N.1.7, SC.3.N.3.2, SC.4.P.8.1, SC.4.N.1.8, SC.5.P.8.1, SC.5.N.1.1, SC.6.N.1.4, SC.6.N.1.5, SC.7.N.1.5, SC.7.N.3.2)

Sometimes a magician seems to make things float in air. In this project you won't make things float in air, but you will make an egg float in water.

Materials

Quart (liter) jar, tap water, scissors, ruler, masking tape, ½ cup salt, felt-tip pen, uncooked egg, large spoon

The Setup

1. Fill the jar half full of water
2. Cut a 3" piece of tape and stick it to the outside of the salt container. Use the pen to write on the tape, "Magic Swimming Powder."
3. Place the egg and spoon on the table

Magic Science Time!

1. Tell your audience, "I am going to teach an egg how to swim."
2. Begin by showing the audience that the egg doesn't know how to swim by placing the egg in the jar filled with tap water. The egg will sink to the bottom. Remove the egg from the jar with the spoon.
3. Tell the audience that for the egg to swim you need to add magic swimming powder to the water. Pour the salt in the water and stir with the spoon. Say some magic words!
4. Place the egg in the water. The egg will float!

Discussion

- How did the magic powder help the egg float?
- What was created by mixing the powder in the water?
- Why didn't the egg float without the powder?

Explanation

All matter floats or sinks depending on its density. Less dense substances float on more dense substances. The egg floats in salt water because the egg is less dense than the salt water. However, the egg is denser than tap water, so it sinks.

Salt water is a **solution** that contains both salt and water. A solution occurs when a solid is dissolved in a liquid.

Magic Lesson 2: The Broken Pencil

(Florida Standards Connections: SC.2.N.1.5, SC.3.N.3.2, SC.3.P.10.4, SC.4.N.1.8, SC.4.P.10.1, SC.5.N.1.1, SC.5.P.10.1, SC.6.N.1.5, SC.7.N.1.5, SC.7.P.10.2)

In this trick you'll use water and light to perform an interesting illusion.

Materials

A glass, tap water, pencil

The Setup

1. Fill the glass about two-thirds full of tap water.
2. Place the glass of water and pencil on the table.

Magic Science Time!

1. Hold the pencil in front of you. Tell the audience, "I am going to break the pencil by simply sticking it in this glass of water."
2. Hold the pencil upright in the water so that the tip is about halfway between the surface of the water and the bottom of the glass. Make sure the pencil is near the back of the glass, away from the audience.
3. Move the pencil back and forth in the water, keeping it upright. Ask them what they see. It will appear as though the pencil is broken when in the water.
4. Remove the pencil from the water.

Discussion

- Did the pencil really break when it was placed in the water?
- If not, then why did it look like the pencil was split in half?

Explanation

This trick works because of **refraction**. Light travels in straight lines, but when it travels from one transparent substance to another the light rays bend. This is refraction. When light travels from a more dense transparent substance, such as water, to a less dense substance, such as air, the light refracts, or bends noticeably. Light travels at different speeds in substances with different densities.

Light reflected from the pencil appears to the audience to be in one place when it travels to their eyes through the air, and in another place when it is refracted through water.

Magic Lesson 3: Disappearing Penny

(Florida Standards Connections: SC.2.N.1.5, SC.3.N.3.2, SC.3.P.10.4, SC.4.N.1.8, SC.4.P.10.1, SC.5.N.1.1, SC.5.P.10.1, SC.6.N.1.5, SC.7.N.1.5, SC.7.P.10.2)

Here's another effect that uses light and water to produce a mind-boggling effect.

Materials

Quart (liter) jar with lid, tap water, penny, helper

The Setup

1. Fill the jar with tap water. Put the lid on the jar.
2. Place the jar and penny on the table in front of you.

Magic Science Time!

1. Get a helper from the audience to assist you.
2. Have your helper examine the penny and confirm that it's a real penny.
3. Have the helper place the penny on the table. Ask "Can you see it?"
4. Place the jar filled with water on top of the penny.
5. Say a few magic words and wave your hands over top of the jar.
6. Have the helper look through the water from the side of the jar and see if the penny is there or gone. What is the answer?

Discussion

- Where did the penny go?
- Why can't the helper see the penny through the clear water?

Explanation

When light travels from air to water, light bends toward the normal, a line perpendicular to the surface. Traveling from water to air, light bends in the opposite direction, away from the normal.

This trick works because at a certain angle, when light travels from a more dense substance (water), to a less dense substance (air), it no longer refracts but will reflect. **Reflection** is the bouncing back of light from a surface. When the image of the penny comes toward the side surface of the jar at too great an angle, reflection rather than refraction occurs, and the image cannot be seen outside of the jar.

Magic Lesson 4: Keeping Dry

(Florida Standards Connections: SC.2.N.1.5, SC.2.E.7.4, SC.3.N.3.2, SC.4.N.1.8, SC.5.N.1.1, SC.6.N.1.5, SC.7.N.1.5)

Air can be used in many magic tricks. Try this trick to learn one way air can amaze!

Materials

Paper towel, drinking glass, plastic tub or bucket filled with enough tap water to reach the height of the glass

The Setup

1. Place the materials on the table

Magic Science Time!

1. Crumple the paper towel and place it in the bottom of the glass.
2. Turn the glass over and make sure that the paper will stay in place at the bottom of the glass.
3. Slowly lower the upside-down glass into the tub of water. Keep the glass as straight up and down as possible, until the entire glass is under the water.

   **Good time for discussion topic #1*
4. Take the glass out of the water and let the water drip off the glass.
5. Turn the glass right side up and remove the paper towel. Let the audience feel the paper towel to determine if it is wet or dry.

Discussion

1. Will the paper towel in the cup get wet? Why or why not?
2. Why didn't the paper towel get wet when it was placed in the water?

Explanation

Air takes up space. The glass is filled with air when it's right side up and when it is upside down. When you turn the glass over and slowly lower it into the water, air remains in the glass.
The water cannot enter the glass because of the air inside the glass. The air creates pressure that is greater than the pressure of the water trying to get in. The towel in the top of the glass stays dry. If you were to tilt the glass on its side in the water, air would exit the glass and form bubbles. Water would then be able to enter the glass and soak the paper towel.

Additional Classroom Activities

Here are some additional ideas to use in the classroom to further explore magic and science!

Activity 1: Make Magic!

(Florida Standards Connections: SC.2.N.1.5, SC.2.N.1.6, SC.3.N.3.2, SC.4.N.1.4, SC.4.N.1.8, SC.5.N.2.2, SC.5.N.1.5, SC.6.N.1.4, SC.6.N.3.4, SC.7.N.1.4, SC.7.N.3.2)

- Have students create their own magic tricks. Promote students to develop their own unique magic trick. Guide them through the steps of the Scientific Method to help them in their quest to create their very own illusion.
- If time is of the essence perform this activity as an all class magic trick. Ask students to share ideas of a magic trick they'd like to create. Select one idea and as a class follow the steps of the Scientific Method to make the trick a reality!
- Remember sometimes no matter how many times you try the trick won't work. Be sure to document your experiments and the single variables you change each time. Use those notes to spawn classroom discussion on why the magic didn't work. What else could be tried to make it work? Have students suggest other methods to try. Did they work?

Activity 2: Magic Show!

(Florida Standards Connections: TH.2.S.2.1, TH.3.C.2.2, TH.4.C.3.3, TH.5.C.3.3, TH.68.C.1.4)

- Have students select a magic trick from a magic book in the library.

  ** If you're school library doesn't have any magic books find some magic tricks online to hand out to the students. See credits/resources at the end of this guide.*

- Discuss with students the importance of showmanship when performing magic. Encourage them to use magic words, hand gestures, etc. when performing.
- Instruct the students to practice the trick at home.
- Plan a day to have the students perform their very own magic show.
- Following each trick explain the science that allows the magic to happen.

Credits / Resources

Many of the tricks in this guide were adapted from the references below.

Books

Wiess, Jim (1998). *Magic Science: 50 jaw dropping, mind-boggling, head-scratching, activities for kids.* San Francisco: Jossey-Bass

Shalit, Nathan (1981). *Science Magic Tricks.* New York: Holt, Rinehart and Winston

Web Links

Card Trick Central – http://web.superb.net/cardtric

This website has hundreds of card tricks. They are sorted by ability level and make it easy to find an appropriate one to try.

Magical Youth International – http://magicyouth.com

Magical Youth International is the youth program of the International Brotherhood of Magicians (IBM).

Bill Blagg – http://www.billblagg.com

Official website for Bill Blagg that includes tour dates, biography, videos, pictures and an e-mail group sign up form.

Special Thanks

Overture Center for the Performing Arts (Madison, WI) – Educational Series (2010).
**Excerpts from the self-produced Overture Center Guide have been referenced in this resource guide.*

Simon Shaw – Shaw Entertainment Group. Great Barrington, MA

Florida Standards Connections

Preshow Discussion Questions, pg. 2

LAFS.2.W.3.8: Recall information from experiences or gather information from provided sources to answer a question.
LAFS.2.SL.1.1: Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
LAFS.3.W.3.8: Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
LAFS.3.SL.1.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
LAFS.4.W.3.8: Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
LAFS.4.SL.1.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
LAFS.5.W.3.8: Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
LAFS.5.SL.2.4: Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
LAFS.6.W.3.8: Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.
LAFS.6.SL.2.4: Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
LAFS.7.W.3.7: Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
LAFS.7.SL.2.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

Post Show Discussion Topics, pg. 3

LAFS.2.SL.1.3: Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
SC.2.N.1.3: Ask "how do you know?" in appropriate situations and attempt reasonable answers when asked the same question by others.
LAFS.3.SL.1.3: Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
SC.3.N.1.6: Infer based on observation.
LAFS.4.SL.1.3: Identify the reasons and evidence a speaker provides to support particular points.
SC.4.N.1.4: Attempt reasonable answers to scientific questions and cite evidence in support.
LAFS.5.SL.1.3: Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.
SC.5.N.2.2: Recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.
LAFS.6.SL.1.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
SC.6.N.1.5: Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.
LAFS.7.SL.1.2: Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.
SC.7.N.1.5: Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.

Terms, pg. 4

LAFS.2.L.3.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 2 reading and content, choosing flexibly from an array of strategies.
LAFS.3.L.3.4: Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.
LAFS.4.L.3.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.
LAFS.5.L.3.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.
LAFS.6.L.3.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 6 reading and content, choosing flexibly from a range of strategies.
LAFS.7.L.3.4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 7 reading and content, choosing flexibly from a range of strategies.

Magic Lesson 1, pg. 5

SC.2.N.1.1: Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.
SC.2.N.1.5: Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).
SC.3.N.1.7: Explain that empirical evidence is information, such as observations or measurements, that is used to help validate explanations of natural phenomena.
SC.3.N.3.2: Recognize that scientists use models to help understand and explain how things work.
SC.4.P.8.1: Measure and compare objects and materials based on their physical properties including: mass, shape, volume, color, hardness, texture, odor, taste, attraction to magnets.
SC.4.N.1.8: Recognize that science involves creativity in designing experiments.
SC.5.P.8.1: Compare and contrast the basic properties of solids, liquids, and gases, such as mass, volume, color, texture, and temperature.
SC.5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.6.N.1.4: Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.
SC.6.N.1.5: Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.
SC.7.N.1.5: Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.
SC.7.N.3.2: Identify the benefits and limitations of the use of scientific models.

Magic Lesson 2, pg. 6

SC.2.N.1.5: Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).
SC.3.N.3.2: Recognize that scientists use models to help understand and explain how things work.
SC.3.P.10.4: Demonstrate that light can be reflected, refracted, and absorbed.
SC.4.N.1.8: Recognize that science involves creativity in designing experiments.
SC.4.P.10.1: Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.
SC.5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.5.P.10.1: Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.
SC.6.N.1.5: Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.
SC.7.N.1.5: Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.
SC.7.P.10.2: Observe and explain that light can be reflected, refracted, and/or absorbed.

Magic Lesson 3, pg. 7

SC.2.N.1.5: Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).
SC.3.N.3.2: Recognize that scientists use models to help understand and explain how things work.
SC.3.P.10.4: Demonstrate that light can be reflected, refracted, and absorbed.
SC.4.N.1.8: Recognize that science involves creativity in designing experiments.
SC.4.P.10.1: Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.
SC.5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.5.P.10.1: Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.
SC.6.N.1.5: Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.
SC.7.N.1.5: Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.
SC.7.P.10.2: Observe and explain that light can be reflected, refracted, and/or absorbed.

Magic Lesson 4, pg. 8

SC.2.N.1.5: Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).
SC.2.E.7.4: Investigate that air is all around us and that moving air is wind.
SC.3.N.3.2: Recognize that scientists use models to help understand and explain how things work.
SC.4.N.1.8: Recognize that science involves creativity in designing experiments.
SC.5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.6.N.1.5: Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.
SC.7.N.1.5: Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.

Activity 1, pg. 9

SC.2.N.1.5: Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).
SC.2.N.1.6: Explain how scientists alone or in groups are always investigating new ways to solve problems.
SC.3.N.3.2: Recognize that scientists use models to help understand and explain how things work.
SC.4.N.1.4: Attempt reasonable answers to scientific questions and cite evidence in support.
SC.4.N.1.8: Recognize that science involves creativity in designing experiments.
SC.5.N.2.2: Recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.
SC.5.N.1.5: Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method."
SC.6.N.1.4: Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.
SC.6.N.3.4: Identify the role of models in the context of the sixth grade science benchmarks.
SC.7.N.1.4: Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment.
SC.7.N.3.2: Identify the benefits and limitations of the use of scientific models.

Activity 2, pg. 9

TH.2.S.2.1: Collaborate with others to perform a scene and solve challenges.
TH.3.C.2.2: Discuss the meaning of an artistic choice to support development of critical thinking and decision-making skills.
TH.4.C.3.3: Define the elements of a selected scene that create an effective presentation of an event or person.
TH.5.C.3.3: Define the visual elements that must be conveyed dramatically to make a scene effective.
TH.68.C.1.4: Create and present a design, production concept, or performance and defend artistic choices.