Fact of the Matter

Grades: 3rd – 6th

Duration: 30 minutes

Program Description

Students will learn the four states of matter. They will be able to understand that all matter in the world can be classified as a solid, liquid, gas, or plasma. The freezing point, boiling point, condensation, and sublimation of various substances will be demonstrated. The demonstration will also include the phase changes of a number of selected substances.

Louisiana GLE:

Science:

Grade 3

Science as Inquiry: The Abilities To Do Scientific Inquiry

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
4. Predict and anticipate possible outcomes (SI-E-A2)
6. Use the five senses to describe observations (SI-E-A3)
12. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)

English Language Arts,

Reading and Responding

Standard 7

20. Apply basic reasoning skills

Speaking and Listening

Standard 4

38. Give and follow precise directions and instructions
42. Use active listening strategies
43. Assume the role of contributor and active listener

Grade 4

Science as Inquiry: The Abilities To Do Scientific Inquiry

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
4. Predict and anticipate possible outcomes (SI-E-A2)
7. Use the five senses to describe observations (SI-E-A3)

10. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
11. Combine information, data, and knowledge from one or more of the science content areas to reach a conclusion or make a prediction (SI-E-A5)

Understanding Scientific Inquiry

18. Base explanations and logical inferences on scientific knowledge, observations, and scientific evidence (SI-E-B4)

Physical Science: Properties of Objects and Materials

24. Illustrate how heating/cooling affects the motion of small particles in different phases of matter (PS-E-A4)

English Language Arts

Speaking and Listening

Standard 4

34 Adjust pacing to suit purpose, audience, and setting when speaking
35 Interpret, follow, and give multi-step directions
37. Demonstrate active listening strategies, including asking questions, responding to cues, and making eye contact
38. Adjust speaking content according to the needs of the audience

Grade 5

Science as Inquiry: The Abilities To Do Scientific Inquiry

5 Identify independent variables, dependent variables, and variables that should be controlled in designing an experiment (SI-M-A2)

English Language Arts

Speaking and Listening

Standard 4

32 Adjust diction and enunciation to suit the purpose for speaking
33. Use complete sentences and standard English grammar, diction, syntax, and pronunciation when speaking
35. Restate or describe oral directions/procedures for tasks
36. Adjust volume and inflection to suit the audience and purpose of presentations
38. Demonstrate active listening strategies
39. Deliver formal and informal presentations for a variety of purposes, including:
41. Participate in group and panel discussions

Grade 6

Physical Science: Properties and Changes of Properties in Matter

5. Compare physical and chemical changes (PS-M-A3)

Grades 5-8

Science as Inquiry: The Abilities Necessary To Do Scientific Inquiry

1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
2. Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)
12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)

Key Terms:

Atoms: A unit of matter, the smallest unit of an element, having all the characteristics of that element and consisting of a dense, central, positively charged nucleus surrounded by a system of electrons.

Boiling Point: the temperature at which a fluid is converted into vapor, with the phenomena of ebullition. This is different for different liquids, and for the same liquid under different pressures. For water, at the level of the sea, barometer 30 in., it is 212 ° Fahrenheit; for alcohol, 172.96° Fahrenheit; for ether, 94.8 ° Fahrenheit; for mercury, about 675° Fahrenheit. The boiling point of water is lowered one degree Fahrenheit for about 550 feet of ascent above the level of the sea.

Condensation: The act or process of reducing, by depression of temperature or increase of pressure, etc., to another and denser form, as gas to the condition of a liquid or steam to water.

Deposition: The process of changing from a gas to a solid without passing through an intermediate liquid phase. Carbon dioxide, at a pressure of one atmosphere, undergoes deposition at about -78 degrees Celsius. Compare sublimation.

Ebullition: The state or process of boiling.

Gas: The state of matter distinguished from the solid and liquid states by relatively low density and viscosity, relatively great expansion and contraction with changes in pressure and temperature, the ability to diffuse readily, and the spontaneous tendency to become distributed uniformly throughout any container.

Liquid: The state of matter in which a substance exhibits a characteristic readiness to flow, little or no tendency to disperse, and relatively high incompressibility.

Matter: Something that has mass and exists as a solid, liquid, gas, or plasma.

Melting Point: (synonym: Freezing Point) The temperature below which a liquid turns into a solid. The degree of temperature at which a solid substance melts or fuses; as, the melting point of ice is 0° Centigrade or 32° Fahrenheit, that of urea is 132° Centigrade.

Phase: Any of the forms or states, solid, liquid, gas, or plasma, in which matter can exist, depending on temperature and pressure.

Solid: A substance having a definite shape and volume; one that is neither liquid nor gaseous.

Sublimation: The process of changing from a solid to a gas without passing through an intermediate liquid phase. Carbon dioxide, at a pressure of one atmosphere, sublimates at about -78 degrees Celsius. Ice and snow on the Earth's surface also sublimate at temperatures below the freezing point of water.

Connections to Permanent Exhibits:

Red River Aquarium: Encounter the life of the Red River—a 10-foot, 860-gallon aquarium highlights the ecosystem and indigenous fish of the river. What fish do you see here? Describe an adaptation of one of the fish.

Big Rambling Red: Use this stream table with water running over sand to erode banks and generate meanders, just like the real river.

Locks and Dams: Move a model boat from a lower to a higher pond and use dams to adjust water levels in the two “river” sections.

Ned Kahn Art-Science: These sculptures engage students in the beauty of the forces in our physical world: Tornado, Turbulent Orb (in the Lobby Balcony), Making Waves (in the Lobby Balcony) and Chaotic Pendulum (in the Lobby Balcony)

Plasma Tower: Touch a glowing tube of gas. The glow intensifies and reaches toward your fingers.

Jacob’s Ladder: Send a high voltage charge between two metal rods to see electrical ionization.

Air Cannon: Children hit the rubber diaphragm over one end of a barrel; from the 3" diameter hole centered in the other end comes a "smoke ring" vortex, which travels across the room and "hits" a scintillating target, which shows the effect
Bernoulli's Bowling Balls: Place the air hose above the bowling balls and turn on the blower. What happens? Why? Can you make the balls spread apart?
Drag: What would cause drag on your car? What will having more drag on your car do to the gas mileage? Why?
Images of Heat: Look at the infrared image on the plasma television. Hold out your hand or look at your face. What part is coldest? What part is warmest?
Mud Family Designer's Workshop: A program area for educational programming.
Units of Volume: How many blue squares fit in the front clear box? What is the relationship between the back two boxes?
Volume Table: Calculate the volume of the cube and the cylinder? How do they relate?

Web Resources:

CHEM4KIDS.COM. is a resource with basic chemistry information, not just for kids. It has information on matter, atoms, elements, the periodic table, reactions, and biochemistry.
http://www.chem4kids.com/index.html

Math --Science -- Integrated Math and Science -- Integrated Math and Art: Activities which target a middle and high school population although some of the activities are approachable by more advanced elementary school students. The activities are also ideal for the general public to review basic concepts and learn about new technologies. The pages make extensive use of javascripts, and Java applets making for a more interactive environment:
http://www.nyu.edu/pages/mathmol/textbook/statesofmatter.html

ED informatics: An anthology of Science and Math Activities that make use of JavaScript and java programming to ensure a more interactive environment.
http://www.edinformatics.com/math_science/

Pre-Visit Activities:

Pre-Visit Activities

Discuss the following with your students:

- All things are made up of matter.
- All matter has mass and takes up space.
- All matter is made up of atoms.
- What is an atom made up of?
- There are four main states of matter: solids, liquids, gases and plasmas

Give each student a copy of the matter word search. This will help introduce the vocabulary.

Post-Visit Activities

Make a matter Collage: Give each student an old magazine. Give each student or team a poster paper. Tell them to divide the poster into four sections and to label each section: liquid, solid, gas and plasma. Tell the students to cut pictures of matter from magazines and classify the physical state: liquid, solid, gas, plasma then glue them into the appropriate section of the poster.

Follow-Up experiments:

- Have students separate into groups with three to four students in each group. Give each group the following materials: Book, ruler, drinking glass, glass jar, and balloon.

- Experimenting With Sizes and Shapes of the Three Forms of Matter –

- Have each team measure a book. Draw findings. (Discuss the book's definite size and shape.)

- Have each team pour water from a drinking glass into a glass jar. Have students observe that size (amount) of water does not change but the water assumes the shape of the container. Draw their findings.

- Have one member on each team inflate a balloon. Ask students to observe that the air inside the balloon assumes both the size and shape of its container. Draw findings.

- Finally have students label their drawings to identify the form of matter for each example. (book--solid, water--liquid, air--gas)

Mystery Matter: www.usoe.k12.ut.us/curr/science/sciber00/7th/matter/sciber/mattrlab.htm

Grade level activities and quizzes: http://classroom.jc-schools.net/sci-units/matter.htm

Other activities can be found: http://www.nclark.net/StudyMatter

A Matter of Fact

Students are presented with the task of creating a poster that presents basic information about matter. To accomplish this task, students will apply concepts they have learned about matter, characteristic properties, physical and chemical changes, mixtures and pure substances, and atoms.

◆ Expected Outcome

Students' posters should use both words and pictures to present information about matter. Students should define matter and characteristic properties. They should give three examples of characteristic properties, an example of a physical change, and an example of a chemical change. Students should also describe atoms and distinguish between mixtures, pure substances, compounds, and elements.

◆ Content Assessed

This activity assesses students' understanding of basic concepts related to matter.

◆ Skills Assessed

communicating, applying concepts

◆ Materials

- Provide students with poster board and materials for making posters such as tempera paint, pencils, rulers, colored marking pens or pencils, and paintbrushes.
- Consider placing the materials in a central location where all students will have access to them.
- If students will be painting, provide them with small paper cups of water in which to wash their brushes.

◆ Advance Preparation

- You may want to bring magazines to class so students could cut out pictures to paste on their posters.

◆ Time

45 minutes

◆ Monitoring the Task

- Encourage students to give examples of the concepts they present. For example, students could use pictures of sugar and water to show pure substances and a picture of a glass of lemonade to show a mixture.
- As students are planning their posters, suggest that they consider what information they want to communicate with words and what information is better communicated visually.
- If necessary, provide a place for students to dispose of the water they have used to rinse their paintbrushes.
- You may want to display the posters in the classroom or in a nearby hallway so that students will have the opportunity to see each other's work.

A Matter of Fact

The science museum where you work is adding a display about chemistry. You want to make a poster for the display that will help to teach visitors the basics about matter.

◆ Problem

How can you design a poster to teach visitors about matter?

◆ Suggested Materials

poster board
colored marking pens or pencils
ruler
tempera paint
paintbrush

◆ Devise a Plan

1. You want to include the following information on your poster:
   - ◆ a definition of matter
   - ◆ a description of characteristic properties that gives at least three examples
   - ◆ an example of a physical change and a chemical change
   - ◆ an explanation of how matter is classified into mixtures, pure substances, compounds, and elements
   - ◆ a definition and brief description of atoms
2. Decide how you will present the information on your poster. Be sure to use pictures as well as words. Make a quick sketch of your design. Experiment with different layouts of the information to get the most effective display.
3. Lightly sketch your design on the poster board so that you can make changes if you need to. When you are satisfied with your design, complete your poster.

◆ Analyze and Conclude

After following the plan that you devised, answer the questions below on a separate sheet of paper.

1. Describe how your poster teaches museum visitors about matter.
2. What are the most important pieces of information that you want museum visitors to learn from your poster?
3. Was there any information about matter that you weren't able to include on your poster? What was it?