



Fire and Ice

Pre & Post Activity Guide

Mad Science sparks imaginative learning with inquiry-based science for children.

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Congratulations! Your class is going to have the opportunity to participate in a live Mad Science Special Event. This spectacular show will demonstrate to your students the amazing, and pretty cool, things that science can do. It will also teach them about the scientific method and principles that scientists study. To reinforce these concepts this package includes experiments for you to do with your class before and after the special event. It also contains book suggestions, vocabulary and extension activities for a variety of subject areas related to the topics presented by Mad Science.

Mad Science can also bring this exciting science experience to individual classrooms with our workshops, which are in-school field trips. Designed to enhance your curriculum, these programs emphasize hands-on techniques to achieve minds-on learning. Each workshop has its own Pre and Post activity guide like the one you are reading right now! These programs are a great way to start, end or reinforce a specific science unit in your classroom. Call us for prices and topics.

BEFORE THE EVENT

To maximize the impact and educational value of the Mad Science presentation, it is recommended that you introduce your students to the fun side of science. These experiments will also help your students to become familiar with the concepts of **observation, hypothesis, experimentation** and the **scientific method**.

The States of Matter

This experiment will provide students with an opportunity to explore the states of matter.

Materials

- ◆ 2 large empty plastic bottles (either 1 or 2 liter)
- ◆ Water
- ◆ Water Pitcher
- ◆ 4 Pieces of construction paper about 3 inches long and 1 inch wide
- ◆ Tape
- ◆ Freezer
- ◆ Optional: Food Coloring

Procedure

1. Ask the students if they know what happens to water when it is put somewhere very cold, like the freezer. Explain that these are their **hypotheses**, or best guesses, and that you are going to conduct an experiment to see if their **hypotheses** are correct.
2. Tape two pieces of construction paper on each bottle at about the half way mark on the bottle.
3. Fill the pitcher with water and then place the water in the containers to the mark you made with the paper.
4. You may want to add some food coloring at this point so that the students can see the water and any changes that occur more clearly.
5. Take one of the bottles and put it in a freezer overnight, or for about eight hours.
6. Place the other bottle in the classroom in a spot where it will not be disturbed.
7. The next day, place the two bottles side by side so all the students can see them.
8. Ask them to share their **observations** with the group.

Explanation

The students should notice that the water in the bottle that was frozen expanded so it appears as though there is more ice than water. As the water freezes it expands, or gets larger.

Fishing for Ice

Do you think you can catch an ice cube?

Materials

- ◆ An ice cube
- ◆ A piece of string
- ◆ Salt
- ◆ A pie plate

Procedure

1. Ask the class if they think you can catch an ice cube using a piece of string. Explain that these are their **hypotheses**, or best guesses, and that you are going to conduct an **experiment** to see if they are correct.
2. Take the ice cube and rinse it under water for a couple of seconds.
3. Place the ice cube in the pie plate. Ask the students to make some **observations** about the ice cube and share them with the group.
4. Place the string right on top of the ice cube and sprinkle a little bit of salt on top of the ice cube and the string.
5. Count to five and lift the loose end of the string, the ice cube should come with it.
6. Ask the students what they **observed**. Ask them if they were correct with their **hypotheses**.
7. Depending on the grade you teach you can also ask the class why they think you were able to lift the ice cube up using the string.

Explanation

When salt is added to water, it lowers the temperature of the water. The salt melts the ice because it lowers the freezing point of the water. The string absorbs water and since there is water on the surface of the ice cube because you rinsed it under water. When

you added the salt, it caused the water to re-freeze on the ice cube. This is how you were able to use science to help you catch an ice cube.

AFTER THE EVENT

Here are some activities you may wish to do with your class after the special event to reinforce and expand the concepts introduced by Mad Science.

The Water Cycle – In a Jar

This activity will show students how water can change from a solid to a gas and then to a liquid.

Materials

- ◆ Hot tap water
- ◆ Ice cubes
- ◆ Jar with a metal lid

Procedure

Notes: *This experiment can be performed as a demonstration or the students could work in groups.*

1. Ask your students if they know anything about the three states of matter. Hopefully they will have retained some of the information from the Mad Science Presentation.
2. Review with the class that the three states of matter are solid, liquid and gas. Ask them if they think they can transform water into a solid, a liquid and a gas. Have the class share their ideas with the group.
3. Pour about an inch of hot tap water in the jar.
4. Place the lid upside down on the top of the jar and put the ice cubes in the lid.
5. Ask the students to predict what they think will happen. You may need to guide their thinking slightly by asking what they think will happen to the ice cubes and the warm water inside the jar.
6. Ask the students to share their observations and explanations with the class.

Explanation

The water in the jar evaporates into water vapor which rise to the top of the jar. When they hit the lid, which is cold, the water molecules lose energy, slow down and change to liquid again. This is the process of condensation and illustrates how water can change from a liquid to a gas and back to a liquid again. The ice cubes, which rest on the lid, are also going through a change of state as they are warmed by the air that is around them they melt and change from a solid to a liquid.



Jumping Paper

Moving paper inside a bottle with a gust of air is more complicated than it seems.

Materials

- ◆ 2 L Empty Plastic Soft Drink Bottle
- ◆ Small Piece of Paper

Note:

Depending on the age and ability of the students this experiment can be conducted either as a demonstration with student volunteers or the class can perform it independently while working in small groups.

Procedure

1. Crumple a piece of paper into a small ball about the size of a marble or slightly smaller.
2. Place the plastic bottle on its side on a table and set the piece of paper just inside the opening of the bottle.
3. Make sure that the class can see the bottle with the paper inside. Ask the students if they think you can blow into the bottle to push the paper inside. Explain that these are their **hypotheses**, or best guesses, and that you are going to conduct an **experiment** to help draw some **conclusions** about air pressure.
4. Ask the students to **observe**, or watch carefully, as you conduct the experiment.
5. Blow in hard, fast breaths into the bottle to try and push the paper into the bottle. The bottle must be left lying on its side and you should bend to be at the same level as the opening of the bottle.
6. Ask the students to share their **observations** with the group. Depending on the age and ability of the class you may also want to ask them to provide possible explanations for their **observations**.

Explanation

The piece of paper comes shooting out of the bottle at you instead of dropping inside. This occurs because as you blow air into the opening of the bottle with force, it moves past the paper and hits the bottom of the bottle. The air pressure inside the bottle increases, rushes out and carries the piece of paper out with it.

MORE TO DO

Math

- This is an excellent introduction to measurement and is fun because it gets the children outside. After it has rained, or you can make puddles yourself, give the students some chalk and ask the students to draw a circle around the puddle. Revisit the puddles at various times during the day and continue to outline the water with chalk. The students will be able to see the differences once water evaporates with heat.
- Explore the units of measurement that are used for the three states of matter. You may want to discuss gas and that it is measured by the amount of space it occupies but it can be a complicated concept for students to grasp so a general explanation may be more beneficial to the students rather than presenting them with a hands on activity.
- Solids could also be explored through a unit on geometric shapes.

Language Arts

- Challenge your students to write an advertisement for the amazing show presented by Mad Science. Encourage them to include things that they learned in their posters or flyers.
- Have your students write poems about the power of air pressure, for example the wind blower that was able to support the ball in the air.
- Ask the class to imagine they lived in a town that was completely made from ice, what might life be like? They could either write a short story about their daily routine or they could write a guide book for tourists visiting the town.
- Challenge the class to invent a new holiday to celebrate the Mad Science show that you saw. It could be National Science Day, National Icicle Day or Air Pressure Day. They should write up all of the criteria associated with the day. For example, the name, date, colors, symbols, slogan or saying, songs, food, reason.

Art

- Place food coloring in ice cube trays and add water. Once the cubes have frozen crush them into small pieces and have the class create pictures from the pieces of colored ice. Set the papers in a sunny spot and watch what happens when the ice melts.
- Take liquid paint and place it in globs on construction paper. Have the students blow across the top of the paper to move the paint and create new patterns.
- Challenge the class to think of their favorite part of the Mad Science Special Event. Have them create flip books to illustrate that section of the show. It should be a series of pictures so that when all the pages are attached you can flip through them quickly and they run together, like a cartoon.
- Using an eye dropper place some paint on a sheet of paper. Provide the students with straws and ask them to blow the paint all over the paper to see what interesting patterns and designs they can create.

- Have the students create mobiles with paper, streamers and hangers. Place them near a window so they can see the movement of the objects in the wind.
- As a class you can build and decorate your own kites.

Social Studies

- Challenge the class to conduct research projects about discoveries and experiments related to dry ice and sublimation.
- Have students to explore the history of the freezer, dry ice, or other inventions related to the three states of matter.

Field Trip Suggestions

- Science Center
- Visit an ice cream factory or popsicle making plant
- Visit an energy plant to learn about how steam is used to turn turbines to create electricity (dam, hydro company etc.)

Reference Books

Title: The Oxford Children's Book of Science

Author: Stephen Pople

Publisher: Oxford University Press

ISBN#: 0-19-910084-5

Description: *Reference book with excellent illustrations and diagrams. It provides everyday examples of science concepts and topics such as, matter, energy, sound and light. It is appropriate for children in Grades 3 to 6.*

Title: Heat

Author: Joy Richardson

Publisher: Franklin Watts

ISBN#: 0531142396

Description: *This book briefly describes the scientific explanations for the way heat is produced, conducted, used and measured. It is appropriate for students in Grades 1 to 3.*

Title: Air: Look and Learn Series

Author: Cathy Poth

Publisher: Silver Burdett

ISBN#: 0382098293

Description: *This book discusses air as wind, something to breathe, a part of weather and a layer around the Earth. It is appropriate for children in Grades 1 to 3.*

Title: Air is All Around You

Author: Franklyn Mansfield Branley

Publisher: Harper Trophy

ISBN#: 0064450481

Description: *This book provides an excellent explanation and directions to help illustrate to students that air is all around us all the time. This book is intended for students in Grades 1 to 3.*

Experiments & Activities

Title: Experiments with Heat

Author: Walter Olesky

Publisher: Children's Press

ISBN#: 0516012770

Description: *This book contains scientific experiments that illustrate to students the nature of heat, its sources and how it travels. It is intended for students in Grades 1 to 3.*

Title: Heat Fundamentals

Author: Robert Wood

Publisher: Learning Triangle Press

ISBN#: 0070718024

Description: *This book compiles 36 safe and simple activities to that help to demonstrate the principles of heat complete with relevant and age appropriate scientific explanations. It is appropriate for students in Grades 3 to 6.*

Title: Experiment with Air

Author: Bryan Murphy

Publisher: Lerner Publications

ISBN#: 082252452X

Description: *This book presents simple experiments that demonstrate the basic scientific principles of air. It is appropriate for students in Grades 1 to 3.*

Title: Up in the Air

Author: Wendy Madgwick

Publisher: Raintree

ISBN#: 0817253254

Description: *This book provides a variety of projects that demonstrate the properties and uses of air. It is intended for students in Grades 1 to 3.*

Storybooks

Title: Water Dance

Author: Thomas Locker

Publisher: Harcourt Brace

ISBN#: 0152012842

Description: *The various states of water – solid, liquid and gas – is the topic of this storybook. It is wonderfully illustrated and is told through a first person narrative which is appropriate for children in Kindergarten to Grade 3.*

Title: Popcorn Magic

Author: Phylliss Adams, Carole Mitchener and Virginia Johnson

Publisher: Modern Curriculum Press

ISBN#: 0813656958

Description: *During a rainy day Ann teaches her young brother and sister all about how heat makes popcorn kernels pop. This book is appropriate for students in Grades 1 to 3.*

Title: The Magic School Bus in the Arctic: A Book About Heat

Author: Joanna Cole (Ed.) and Scholastic Productions

Publisher: Scholastic Trade

ISBN#: 0590187244

Description: *Another of the wild adventures of Ms. Frizzle and her class, this time their crazy shenanigans teach them all about heat. It is intended for students in Grades 1 to 4.*

Title: Altoona Baboona

Author: Janie Bynum

Publisher: Harcourt Brace

ISBN#: 0152018603

Description: *Altoona Baboona is an ape who becomes bored with her regular life and hops on board a hot air balloon for some wild adventure. The language and spectacular illustrations make this book appropriate for students in Kindergarten to Grade 3.*

Teacher Guides

Title: Investigating Solids, Liquids and Gases with Toys: States of Matter and Changes of State

Author: J. Sarquis, L. Hogue, M. Sarquis and L. Woodward

Publisher: McGraw Hill

ISBN#: 0070482357

Description: *This book is a teacher resource that has great activities to help teach about the three states of matter using a hands-on approach. It includes experiments that are appropriate for children in Grades 4 to 6.*

VOCABULARY

Air: A mixture of gases consisting of nitrogen, oxygen, water vapor, carbon dioxide and other gases.

Air Pressure: The pushing power of air.

Atoms: Largely made up of space, the atom is the smallest part of a particular element that exists. Atoms consist of a central nucleus made of protons and neutrons. The nucleus is circle by orbiting electrons.

Bernoulli's Principle: The faster a gas flows, the lower its pressure.

Chemical: A substance with a distinct molecular composition that is produced by or used in a chemical process.

Chemical Reaction: When two or more different chemicals are mixed together to produce a substance with different properties.

Chemistry: Is the science that explores substances. It is broken down into three different categories; inorganic

Dry Ice: Solid Carbon Dioxide (CO₂).

Force: Any type of push or pull.

Gas: Matter which spreads out to fill an entire space, like the air we breathe.

Gravity: The force that allows us to stay "attached" to our planet (the force that works against lift).

Heat: The result of the continuous movement of the atoms and molecules that make up all matter.

Hypothesis: Technically, a hypothesis is a tentative explanation that accounts for a set of facts and can be tested by further investigation; a theory. Put simply it is a scientist's "educated guess" and student's "best guess". The scientist would then perform experiments to determine if the guess was correct.

Matter: Anything that takes up space and has mass.

Molecules: Atoms bond together to make molecules. How many molecules are in a drop of water? If someone wanted to count them, and they could count at a rate of 10 million molecules per second, it would take about five million years to tally up every molecule that is in a single drop of water.

Observation: The act of noting and recording something.

Solid: A solid is any substance that keeps its shape and is not a liquid or a gas. It has a definite shape and volume.

Sublimation: When matter goes directly from a solid state to a gaseous state, without turning into a liquid.