Children's Museum of Houston

Pre/Post Classroom Activities

# Matter, Matter, What's the Matter?

*How to use these materials:*
This unit on matter is designed to enhance students' understanding and experience with properties of matter. It correlates with the fundamental concepts explored at The Children's Museum of Houston's Matter Factory exhibit. The four main activities in this unit can be used all together as a complete unit, or individually as they fit into your lesson schedule. They can be used before or after your class trip to the museum. When used in advance, they provide an in-depth, hands-on introduction to matter's most basic properties that can then be further investigated at the Matter Factory exhibit. When used after your museum visit, the activities reinforce and serve as practical applications of the concepts explored at the exhibit. It may be helpful to break up the unit and do part before your trip (such as the Introduction on Matter), and part after (Stranded on a Desert Island is a great application activity for afterwards).

*Objectives:*
Provide students with hands-on opportunities to construct a fundamental understanding of matter. This understanding includes the ideas that everything is made of matter, different matter has different properties that make them unique and useful in different ways, material can be sorted and described by their properties, and matter is made of smaller parts called molecules and atoms. The specific properties explored include: magnetism, opacity, density, elasticity, conductivity, and buoyancy.

*TEKS:*

§112.7.b. Science, Grade 5.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

> (A) collect and analyze information using tools including calculators, microscopes, cameras, sound recorders, computers, hand lenses, rulers, thermometers, compasses, balances, hot plates, meter sticks, timing devices, magnets, collecting nets, and safety goggles; and
>
> (B) demonstrate that repeated investigations may increase the reliability of results.

(7) Science concepts. The student knows that matter has physical properties. The student is expected to:

> (A) classify matter based on its physical properties including magnetism, physical state, and the ability to conduct or insulate heat, electricity, and sound;

(8) Science concepts. The student knows that energy occurs in many forms. The student is expected to:

> (C) demonstrate that electricity can flow in a circuit and can produce heat, light, sound, and magnetic effects;

*Key Words and Concepts:*
**Matter-** The substance, or stuff, that makes up physical objects. Everything is made of matter, whether it is a solid, liquid, or gas. All matter is made of smaller particles called molecules, or atoms.

**Magnetic-** The ability of matter to be attracted to a magnet. If something is magnetic, it will be attracted or stick to a magnet.

**Opacity-** The ability of matter to obstruct the transmission of light or other radiant energy; how much light a material can block. Something is very opaque if no light or energy can get through it.

**Density-** The amount of mass an object has per unit of volume. Or in other words, how much stuff is inside an object, and how tightly it's packed in. Density = Mass/Volume

**Elasticity-** The property of matter that describes how much something can be expanded or stretched and still return to its original shape afterwards.

**Conductivity-** The ability of matter to act as a medium for transmitting an electrical charge. Matter that is a good conductor allows electricity to flow easily through it.

**Buoyancy-** The ability of matter to float when placed in fluid. In order for an object to float, it must be less dense than the fluid it is placed in.

*Unit Activities:*
**Activity 1: Introduction to Properties of Matter (40 minutes)**

**Activity 2: Description and Demonstration of Specific Properties of Matter (40 minutes)**

**Activity 3: Stranded on a Desert Island (90 minutes)**

**Activity 4: But what I really needed was… (30 minutes)**

*Evaluation:*
Activities 1 and 2 consist of the teacher setting up an enriching learning discussion that facilitates the students constructing concepts of the properties of matter. Consequently, evaluation of these activities includes observation and attention to the ideas the students construct. Look for the main properties of magnetism, opacity, density, elasticity, conductivity, and buoyancy to come forward as evidence of students' learning.

Activities 3 and 4 are best evaluated by reviewing the students' work as recorded in the research labs, plans and explanations for their three structures on the island, and the invention of their new material.

**Activity 2: Description and Demonstration of Specific Properties of Matter (40 minutes)**

*Objective:*
Students become more familiar with the properties of *magnetism, conductivity, density, opacity, buoyancy, and elasticity* through their efforts to explain various demonstrations presented by the teacher on the various properties.

*Note:*
If your class is not doing the Stranded on a Desert Island Activity, proceed to this activity without any special instructions. If your class is participating in the Desert Island Activity, then read the Desert Island Scenario to the students before this activity, explaining that in order to determine which materials to use to build their structures, they need to learn more about the properties these materials possess. Only by learning about these properties can they test their building materials and determine which will be most suitable for the different structures.

*Materials Needed:*
• Glass of water
• Wooden ball- ¾" diameter (See resource guide if you need to purchase one)
• Metal ball- ¾" diameter (See resource guide if you need to purchase one)
• Flashlight
• Piece of paper
• Wooden block
• Magnets (2)
• Simple Circuit (see Teacher's Resource Packet for supplies and how to make the circuit)
• Pencil
• Nail
• Pink eraser
• Sticky tack
• Rubber band
• Stapler
• Soccer ball
• Rubber ball (tennis or racquetball ball)

*Procedure:*
• The teacher demonstrates the following properties for the class: magnetism, conductivity, density, opacity, buoyancy, and elasticity. With each demonstration the teacher encourages the students to question and subsequently explain what they are seeing and how it informs their understanding of the property of matter being demonstrated.

• Demonstrations for the various properties:

*Magnetism*
Explain that for something to be magnetic it needs to be attracted to a magnet. Hold a magnet to a piece of paper, showing that the paper is not magnetic because it doesn't stick to the magnet. Next hold the magnet to a metal ball, showing that the ball is magnetic because it sticks to the magnet. Ask the class if they think all magnetic objects have the same strength of magnetism. Can they think of anything with weak or strong magnetism? Do the magnets on their fridge all stick with the same strength? With two magnets demonstrate that magnets have poles and that opposite poles attract each other by bringing the magnets together with like ends repulsing the magnets, and opposite ends attracting the magnets to each other.

*Conductivity*
Bring the simple circuit forward. Explain that the electricity flows through the wires to light up the light bulb when the circuit is complete. If the circuit is broken, the electricity cannot get to the light bulb. An object that is a *conductor* allows electricity to flow through it and complete the circuit. Attempt to complete the circuit with a non-conductor (the pencil). Ask the students where they think the circuit is broken (at the pencil). Explain that the pencil does not conduct electricity, so the electricity stops at the pencil and cannot continue to provide energy to turn it on. Next complete the circuit with the nail. When the light turns on explain that it's because the electricity flows through the nail. The nail is a conductor. Explain that most metals make good conductors.

*Density*
Show the class the metal and wooden balls. Show that they are the same size. Ask if they think they weigh the same. If some answer no, explore that answer by having them explain themselves. Why do they think two objects of similar size can weigh different amounts? What is the difference between metal and wood that would explain this? Explain that this is a result of the property called density. Density is a description of how much stuff is in an object. The substance of an object can be loosely packed, tightly packed, or anything in between. Two objects of the exact same size can weigh different amounts if one is more tightly packed than the other. Allow the students to handle the two balls to show that although they are the same size and volume, one weighs more because the stuff inside it is more tightly packed.

*Buoyancy*
Take the metal and wooden balls again and ask the students what they think will happen when each is placed in a glass of water. Why do they think that will be the outcome? What do they think dictates whether something floats or sinks? Guide the conversation in such a way to help the students come up with the definition of buoyancy, and what factors impact an object's buoyancy. Help them construct the understanding that buoyancy describes an object's ability to float. Something will float in a liquid, like water, if the object's density is less than the density of that liquid. How do they think the wooden and metal balls' densities compares to the water's density? Drop each ball in the water to see if their predictions are correct.

*Opacity*
Hold up a block of wood and a piece of paper. Ask the students if there's anything they can think of that can go through the paper or the wood without ripping or damaging the paper and wood. If the answer is 'yes', continue to prompt them for what types of things or forces could move through the objects. If the answer is 'no', ask if they think the heat from a lamp would be felt on the other side of the paper. What about on the other side of the wood? Do they think the paper and wood could stop wind? Would it be felt on the other side? What about light? Turn down the classroom lights. Hold up the block a few inches from the chalk board, or wall. Hold the flashlight up to the side of the block that faces away from the wall, but point the flashlight towards the wall. Have the students predict what will happen when you turn on the

flashlight. Turn the flashlight on and discuss what they see. Why doesn't light go through the block to the wall? Explain that the ability of a material to resist energy such as light from moving through it is known as opacity. The block is opaque because it doesn't allow light to move through it to the other side. Ask if they think the block is totally opaque. Can they see some light going through part of the wood? Explain that opacity is a gradient. Do the same demonstration with the piece of paper, showing that light can move through the paper onto the wall on the other side. It is less opaque than the wood, but do they think there is material even less opaque than paper? What about clear plastic or glass?

*Elasticity*

Use a rubber band to demonstrate that some types of matter have the ability to stretch and return afterwards to their original form and size. Hold up a pencil and ask the class how elastic they think a pencil is. How much could you bend it and have it return back to its original shape? What happens if it bends or stretches past that point? Have a student come up and bend the pencil just a little. Does the pencil return to its original shape? Have the student bend the pencil as hard as they can. Did it return to its original shape or form a new shape? Did it break? Pick up the stapler and ask the student to bend the stapler. Is he/she able to? Ask the class why not and have them describe the stapler in terms of its elasticity, how it compares to the pencil, rubber band and how they compare to each other. Take the soccer ball, rubber ball, and wooden ball. Drop each one individually and ask the students if they think elasticity has anything to do with how well something bounces. How are bounciness and elasticity related? Help the students understand that an object's ability to return to its original shape after being stretched (elasticity) is what provides the upward thrust of a bounce. The faster and more completely an object returns to its original shape, the better the object will bounce. Have the students come to the board and draw what they think the soccer ball, rubber ball, and wooden ball look like at the exact moment these balls hit the ground. Which ball's shape would change the most as it hits the ground? What would it look like? Which do they think bounces back to its original shape the fastest?