ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.

Chemistry All Around Us - Week 5

Day 5: Changing Matter

Teacher/Parent Background:

You probably don't think that gold could ever exist as a gas, but it can! Almost all substances, including gold, can exist in all three states of matter. You're probably most familiar with the three states of water. Water can exist as a solid, a liquid and a gas. So can metals such as gold. All you have to do to change a substance from one state to another state is add or subtract heat energy.

Overview:

In this activity, young learners will explore various types of matter as they are combined to determine if a new substance is made or if the matter retains its original properties.

Related Standards:

- **Plan and carry out investigations** to demonstrate that some substances combine to form new substances with different properties and others can be mixed without taking on new properties.

Key Terms:

- matter - the "stuff" that everything is made of
- properties - characteristics of a substance
- senses - touch, taste, hear, smell, see
- solid - a state of matter in which the substance has a definite shape and a definite volume
- volume - the amount of space that an object or substance takes up
- liquid - a state of matter in which the substance has a definite volume but not a definite shape. It takes the shape of its container.
- gas - a state or matter in which the substance takes the shape and volume of its container

Materials List:

- Jello mix
- hot water
- bowl
- spoon
- baking soda

- vinegar
- balloon or sandwich bag
- empty water bottle
- ice cube
- ice cube tray
- hair dryer (optional)

Activity Description:

1. Revisit the types of matter the student has been exploring during this week's lessons.
    - This week, you have been sorting different types of matter into groups or categories called solids, liquids and gases. How did you decide which types of matter to group together? Name a few of each type of matter.
    - Yesterday, we explored an interesting type of matter called oobleck. What did you observe/notice about oobleck? Can you think of other examples of matter that act like oobleck? What are they?
2. After revisiting the three types of matter, solids, liquids and gases, introduce the student to changes in matter via several explorations:
    - Exploration 1 - Making Jello
        - Show the student the Jello powder/crystals.
            - What type of matter is Jello powder? (solid)
        - Add water to the Jello powder as directed on the box.
            - What happens to the powder? (A solid is mixed with a liquid. The solid dissolves in the liquid leaving only the properties of the liquid observable.)
            - Does the powder maintain its original physical properties? (No, the solid powder dissolves and becomes part of the liquid water.)
            - Does the water maintain its original physical properties? (The water remains a liquid but changes color.)
        - Place the Jello mixture in the refrigerator as directed on the box.
            - What do you think will happen to the liquid Jello?
            - Do you think any of its physical properties will change while it is in the refrigerator? Why or why not?
        - Remove the Jello from the refrigerator as directed on the box.
            - What happened to the liquid Jello? (The Jello now has the properties of a solid - definite shape and volume.)

- Why do you think this happened? (Hopefully the student will mention the movement of the tiny particles that make up the liquid. The lack of heat energy would slow down the movement of the particles and allow them to stack, forming a solid.)

- Exploration 2 - Inflate a Balloon
  - Show the student the baking soda.
    - What type of matter is baking soda? (solid)
  - Place the baking soda (several tablespoons) in an empty water bottle.
  - Show the student the vinegar.
    - What type of matter is vinegar? (liquid)
  - Prepare the balloon to fit over the neck of the empty water bottle once the vinegar has been added.
  - Quickly pour the vinegar into the empty water bottle and place the deflated balloon over the neck of the bottle.
  - Observe as the balloon begins to inflate:
    - What is happening to the balloon? (The balloon is filling up/getting bigger/inflating)
    - What is causing the balloon to do this? (The student may say air or gas is filling the balloon.)
  - Explain that when some types of matter mix, such as baking soda and vinegar, a new type of matter is made. When baking soda and vinegar interact with one another, they form carbon dioxide which is a type of gas. The gas is trapped in the balloon, causing the balloon to inflate.
- Exploration 3 - Melting Ice
  - Show the student an empty ice cube tray.
    - What is this called? (An ice cube tray.)
    - What do we do with it? (Make ice cubes.)
    - What type of matter is an ice cube tray? (Solid)
  - Pour water into the ice cube tray until filled.
    - What are we adding to the ice cube tray? (water)
    - What type of matter is water? (liquid)
  - Place the filled ice cube tray in the freezer.
    - What do you think is going to happen to the water in the ice cube tray? Why?
  - Once enough time has passed for the water to form cubes, remove the ice cube tray from the freezer.
    - What happened to the liquid water that we poured into the ice cube tray? (It turned into ice/a solid.)
  - Dump the ice cubes from the tray.
  - Explain that the water poured into the ice cube tray is still in the tray but it changed states/form. The liquid water is now in a solid state/form.

- How have the physical properties of the water changed? (The water is no longer a liquid. It is now a solid. The tiny particles are not moving freely.)
- How do you think we can change the water back to a liquid? (Apply heat energy.)

- Apply heat to the ice cube using a hair dryer or by placing the cube in the sun or other warm location (depending on the amount of time you have to observe the change in states).
  - What is happening to the frozen water? (It's melting/changing state.)
  - What state did the water start out in? (Solid)
  - What state did the water end up in? (Liquid)

Closure:

Explain that adding or taking away heat energy from matter can cause it to change state.

- When we added heat energy to the Jello by mixing it with hot water, we caused the solid Jello to change into liquid Jello. When we removed heat energy from the liquid Jello by placing it in the refrigerator, the Jello changed into a solid.
- When we removed heat energy from the liquid water by placing the ice cube tray in the freezer, the water changed into a solid. When we added heat energy to the solid water, it changed back into a liquid.

Explain that mixing different types of matter can cause new types of matter to be created or changes to the physical characteristics of the original matter.

- When we mixed the baking soda and vinegar together, carbon dioxide was formed. We could still see the baking soda (solid) and vinegar (liquid) matter in the bottle of the bottle but we had evidence of a new type of matter being created, gas, because the balloon inflated.

Extension:

Explore Compounds and Mixtures

- Compounds and Mixtures - BrainPOP
- Element, Mixture, Compound - TeachEngineering
- Mixtures and Compounds - Flocabulary