



**Cool Science**  
**Pre/Post-Visit Activity Sheet**

**Thermal Expansion**

**Concepts:**

1. Most materials will contract when they become cooler.
2. The decrease in volume occurs when the molecules move more slowly and closer together.
3. Water is an exception; it will increase in volume as it changes from a liquid to solid ice at 0°C or 32°F.

**Materials:**

1. Plastic disposable container such as a yogurt container

**Directions:**

1. Fill the container all the way to the top with water.
2. Carefully place the container in a freezer and leave it overnight.
3. Remove the container the next day and observe any changes.

**Explanation:**

1. A water molecule is composed of two hydrogen atoms and one oxygen atom.
2. As water freezes into ice, the molecules re-arrange in position relative to each other.
3. The molecules orient into a ring-like pattern that occupies more space.
4. This causes water to be one of the only materials to expand when it freezes instead of contracting like most other materials.

**Elasticity**

**Concepts:**

1. An elastic material will easily return to its original shape after deformation.
2. Temperature will affect elasticity.
3. Warmer materials are more elastic than cooler materials.

**Materials:**

1. Heat lamp with a high watt light bulb
2. 3 racquetballs
3. Heavy gloves

**Directions:**

1. Place one racquetball beneath the heat lamp. Do not let the ball burn or melt!
2. Put the second racquetball in a freezer.
3. Leave the third racquetball on a table.
4. After about 15 minutes, gather all of the racquetballs.
5. Wear the gloves to protect from freezer or heat burn.
6. Get three people to hold them at the exact same height.
7. Count to 3 and drop the racquetballs simultaneously. Do not push them.

**Explanation:**

1. The warm ball will bounce the highest, the cold one the lowest, and the room temperature one will bounce in-between.
2. The warm racquetball has high elasticity; the coolest one exhibits low elasticity.

## Evaporation

### **Concepts:**

1. Temperature is a measure of how much and how fast molecules are moving.
2. Warmer temperatures indicate more molecular motion; cooler temperatures have less motion.

### **Materials:**

1. Rubbing alcohol
2. Cotton ball

### **Directions:**

1. Put a little rubbing alcohol on the cotton ball.
2. Lightly rub the cotton ball on inside of your forearm.
3. Notice how it feels.
4. Observe what happens to the liquid.

### **Explanation:**

1. Heat moves from something that is warm to something that is cooler.
2. Heat moved from your warm arm into the cooler rubbing alcohol.
3. The transfer of heat caused the alcohol to evaporate.
4. Evaporation is when a liquid changes into a gas.
5. The gas molecules move faster than the liquid molecules.

## Sublimation:

### **Concepts:**

1. Melting is the process where a solid changes into a liquid.
2. Sublimation is the process that occurs when a solid changes into a gas without first changing into a liquid.

### **Materials:**

1. Dry ice (this is sold at Kroger)
2. Cooler to store dry ice
3. Heavy work or winter gloves
4. Goggles
5. Tongs or spoon
6. Bucket of water
7. Hammer

### **Directions:**

1. Put-on the goggles and gloves.
2. Use the hammer to carefully break the block of dry ice into smaller chunks.
3. Use the tongs or spoon to carefully pick up a chunk of the dry ice. Do not touch the dry ice with your bare hands!
4. Place the dry ice into the bucket of water and observe what happens.

### **Explanation:**

1. Dry ice is frozen carbon dioxide.
2. Carbon Dioxide needs to be  $-109.3^{\circ}\text{F}$  or  $-78.5^{\circ}\text{C}$  in order to form into solid dry ice.
3. The solid carbon dioxide is colder than the liquid water.
4. Heat transfers into the carbon dioxide.
5. The warmth from the water causes the carbon dioxide to sublime and form bubbles of carbon dioxide gas.
6. The mist is steam, caused by water vapor in the air that condenses (changes from a gas to a liquid or solid).