Molecules in Motion
The Science of Melting

Activity Summary
Melting occurs when heat is applied to a material and turns it from a solid to a liquid. A material's melting point can be altered by adding chemicals such as salt or changing how the heat is transferred. In this experiment, participants will see both of these processes in action.

Related Vocabulary
- **Melting**: The state change where a solid turns into a liquid.
- **Melting/Freezing Point**: The temperature where a substance transitions between its solid and liquid states.
- **Freezing Point Depression**: When a substance added to a material allows it to stay a liquid at a lower temperature. For example, using salt to prevent water from becoming ice on walkways.

Materials
- Paper cups
- Ice
- Salt
- Sugar
- Hot water
- Cold water
- Room-temperature water

Instructions
1. Fifteen minutes before doing the experiment, add one ice cube to six different paper cups.
2. Add the following materials to a different cup and label it.
   a. Salt: ¾ teaspoon
   b. Sugar: ¾ teaspoon
   c. Hot Water: fill half the cup
   d. Cold Water: fill half the cup
   e. Room-temperature Water: fill half the cup
   f. Control: Do not add anything other than the ice cube
3. Allow participants to record their observations in the Molecules in Motion passport.
4. If time permits, discuss observations with the participants.
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The Science of Transpiration

Activity Summary

In order to harness the power of the sun, plants move water up from their roots, through their stem, and out their leaves. This process is called Transpiration. In this experiment, participants will observe capillary action—the force plants use to defy gravity and pull water up their stems.

Materials

- Washable markers
- Coffee filters
- Water
- Cups
- Paper plates

Instructions

1. Divide group into teams of 2 to 3 participants.
2. Give each team a coffee filter and a paper cup with one-inch of water in the bottom.
3. Using a washable marker, make a large dot in the center of the coffee filter.
4. Fold the coffee filter in half three times, until it is folded into a wedge shape.
5. Twist the bottom of the coffee filter.
6. Dip the bottom of the coffee filter into water and observe what happens.
7. After 15 seconds, remove the coffee filter from the cup.
8. Unfold the coffee filter and lay it out on a paper plate. Be sure not to allow the coffee filter to touch or drip onto the table as it may stain.
9. Sketch the pattern on the coffee filter in the Molecules in Motion passport and take notes.
10. If time permits, discuss results as a group.
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The Science of Condensation

Activity Summary
Did you know scientists estimate there are over 17 million gallons of water in an average cloud? That means a cloud can weight more than 140 million pounds! In this experiment, participants will make miniature clouds and might even produce some rain.

Materials
- Glass mason jar
- Sponge
- Ice
- Water
- Microwave-safe plate
- Microwave

Instructions
1. Soak sponge in water.
2. Place sponge on a plate and microwave it for about 2 minutes.
3. Put the hot, wet sponge inside a glass Mason jar and quickly screw on the lid.
4. Cover the jar’s lid with ice.
5. Have participants observe changes inside the jar and take notes in the Molecules in Motion passport.
6. If time permits, discuss observations with participants.

Note: If a microwave is not available for this experiment, a hot plate or coffee pot can be used to heat the water.
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The Science of Freezing

Activity Summary

Water doesn’t instantly turn into ice the moment it reaches 0° Celsius; sometimes it needs a little help to start the crystallization process. During this experiment, participants will observe the freezing of supercooled water.

Materials

- Bottled water
- Thermometer
- Freezer or bucket with ice and salt

Supercooling Method #1 - Suggested Method

1. Place bottles of water in a freezer.
2. Let water bottles cool in the freezer for 2 to 2.5 hours.
3. Remove the water bottles from the freezer and use immediately in the demonstration.

Supercooling Method #2

1. Put bottles of water in a bucket of ice.
2. Sprinkle salt on the ice and monitor the temperature.
3. Over the next 30 to 45 minutes, continue to add salt every 5 minutes and monitor the temperature.
4. When the temperature dips to -17° Celsius, remove the bottles from the ice and immediately use them in the demonstration.

Instructions for Demonstration

1. Gently remove the supercooled water bottles from the freezer or ice bucket. Be careful not to shake or bump the bottles as movement can prematurely start the crystallization process.
2. Firmly grasp a water bottle and bang the bottom on the table.
3. Place the bottle on the table and make observations.
4. If time permits, discuss observations with participants.
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The Science of Sublimation

Activity Summary

Sublimation is the process where materials change from a solid to a gas without melting or turning into a liquid. In this experiment, participants will observe solid CO₂ turn into CO₂ gas.

Materials

- Plastic bowl
- Dish soap
- Heavy gloves
- Warm water
- Dry ice
- Spoon

Instructions

1. In a bowl, mix 3 cups of water with about 3 tablespoons of dish soap.
2. Wearing the gloves, place a chunk of dry ice in the bowl.
3. Observe what happens and take notes in the Molecules in Motion passport.
4. The rate of sublimation is driven by the temperature of the water. If sublimation slows down, it can be increased by using a spoon to stir the water in the bowl or by adding more warm water.
5. If time permits, discuss observations with participants.

Note: Dry ice can be dangerous when it comes in contact with human skin. Although, participants can safely pop the CO₂ bubbles, it is suggested they not be allowed to put their hands inside the bowl.

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