Melting and Dissolving

FOSS Kit: *Chemical Interactions*

8th Grade

- Sometimes solids turn into liquids.
- How does that happen?

- Some say dissolving and some say melting. That's confusing.

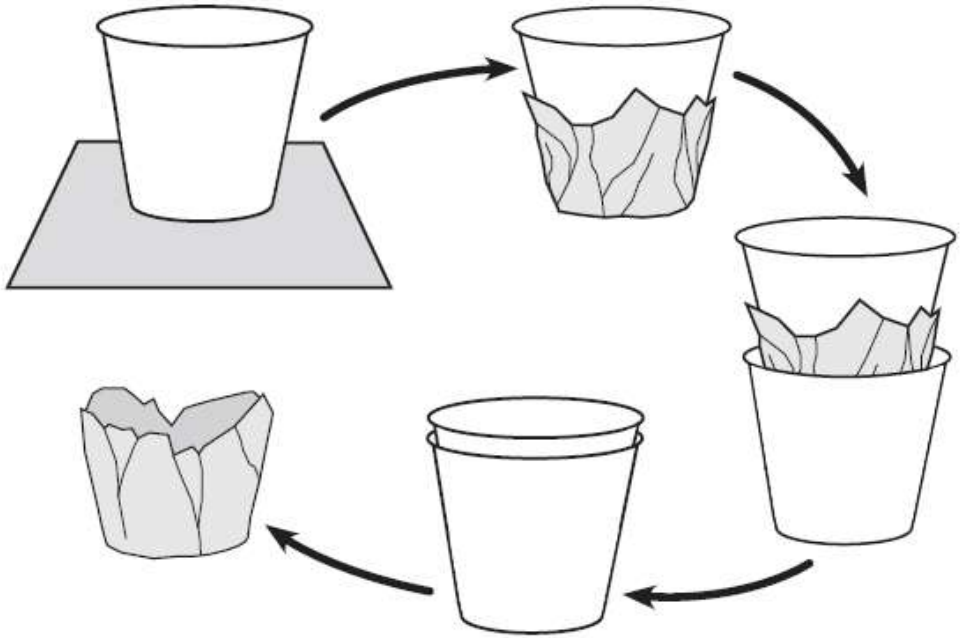
Write this down in notebook

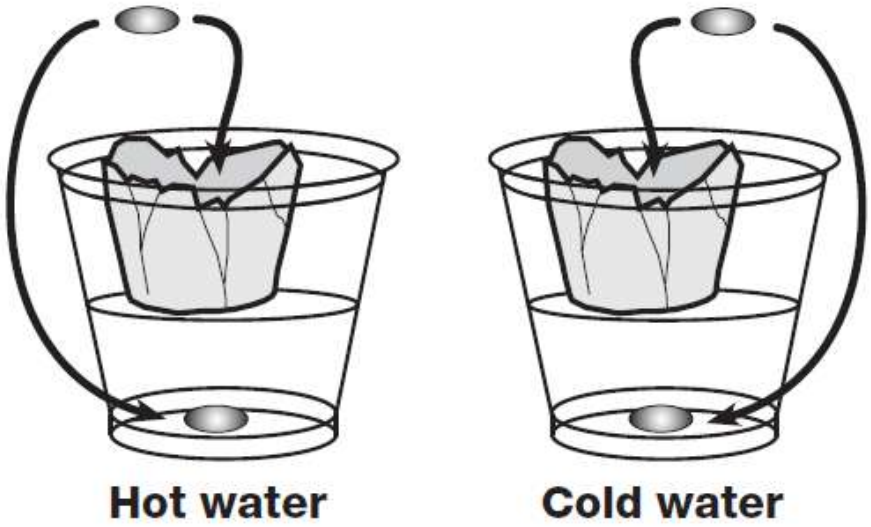
- What is dissolving and what makes it happen?

- What is melting and what makes it happen?

- How are melting and dissolving alike? Different?
- How would you melt a substance?
- How would you dissolve a substance?

FOIL CUP ASSEMBLY

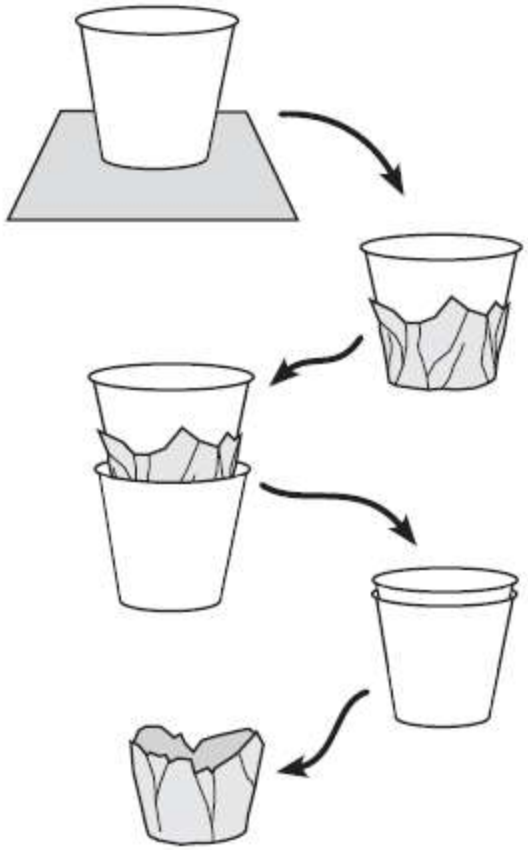




DISSOLVE OR MELT? A

Materials

- 2 Plastic cups
- 2 Aluminum foil squares
- 2 Paper cups
- 4 Candies, all one color
- Hot water
- Cold water



Prepare foil cups

a. Place a paper cup in the center of a foil square. Bring the foil up around the edges of the cup.

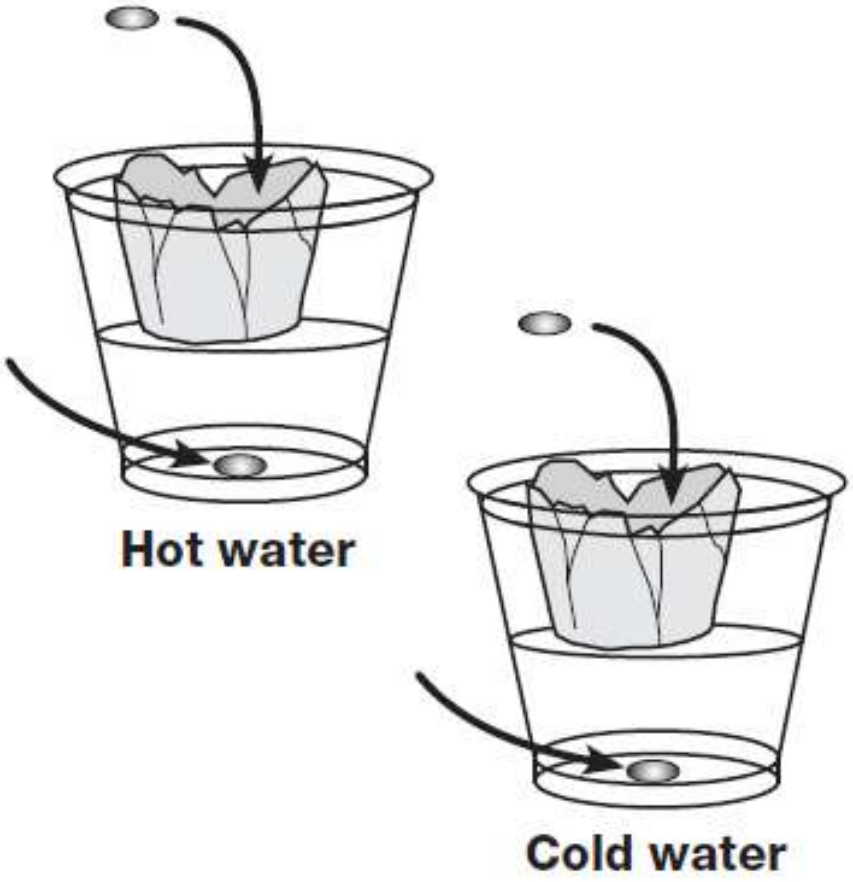
b. Place the foil-wrapped cup inside a second cup. Push gently but firmly all the way down.

c. Remove the foil cup. The foil cup will float on the water in a plastic cup.

d. Repeat the procedure to make a second aluminum foil cup.

Procedure

a. Put about 150 mL of hot water in one plastic cup; put about 150 mL of cold water in the other plastic cup.
b. Put an aluminum foil cup in each cup of water.
c. Get four candies, all one color. Put one candy in each aluminum foil cup and one in the bottom of each of the cups of water.
d. Don't stir, poke, or shake the candies or the cups. Observe to see if anything melts and if anything dissolves.



DISSOLVE OR MELT? B

Results

Record your observations in the table.

Material	Hot water	Cold water	Hot air	Cold air
Candy coating				
Chocolate				

Conclusions

1. a. What melted? _____

   b. Under what conditions? _____

   c. What happened at the particle level when it melted?

   _____

   _____

2. a. What dissolved? _____

   b. Under what conditions? _____

   c. What happened at the particle level when it dissolved?

   _____

   _____

   _____

- Answer in notebook
- What happens to the colored coating in water?
- What is under the colored coating?
- What happens to the chocolate in the center?
- What happens to the candies that are not in water?

Dissolving

- Dissolving is when a solid substance is placed in water, or another liquid, and particles of the solid substance break away and move into the liquid.

Dissolving

- The liquid with the substance dissolved in it is a solution.
  - A solution of a substance is made of particles of that substance mixed uniformly with particles of the liquid in which it is dissolved.

Melting

- When a substance melts, it changes from a solid to a liquid.
- Melted particles do not change the composition of the substance.

Melting

- Heat is used to change a solid to a liquid.
  - Heat changes the kinetic energy of the particles of the substance.
  - When particles have a sufficient level of kinetic energy, the particles start to move over and past one another as liquid.

- Did the candies dissolve or melt?
- What was needed for the colored coating to dissolve?
- What was needed for the chocolate to melt?
- When the colored coating dissolved where did it go?

- What happed to the colored coating at the particle level when it dissolved?
- What was between the particles of colored coating after it dissolved?
- When the chocolate melted, where did it go?

- What was between the particles of chocolate after it melted?
- What happed to the chocolate at the particle level as the chocolate melted?
- What caused the colored coating of the candies in the foil cup over hot water to crack?

- Think about the two ways the candies changed in the previous experiment.

- Most matter exists on earth in one of three common phases or states of matter, solid, liquid or gas.

- We are going to focus on melting today. I have three materials, margarine, wax and sugar.

- What could you do to find out if these materials melt in hot water?

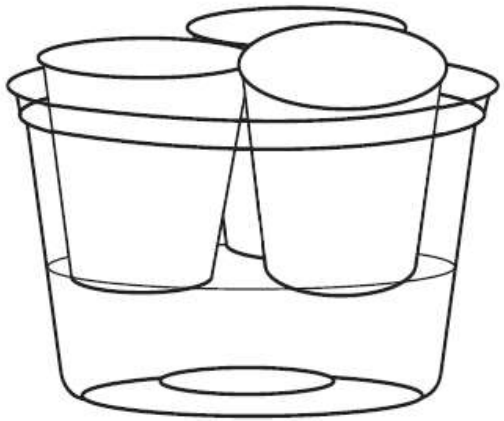
These are the materials for our lab

- Containers, 1/2-liter
- Paper cups
- Hot water
- Margarine cubes
- Sugar
- Thermometers
- Wax cubes

MELT THREE MATERIALS

Materials

- Containers, 1/2-liter
- Paper cups
- Thermometers
- Margarine cubes
- Wax chunks
- Sugar
- Hot water



Prediction

Will margarine, wax, and sugar melt in hot water? Record your predictions in the table below. Then write your procedure and conduct the test.

Procedure

Prediction

Will margarine, wax, and sugar melt in hot water? Record your predictions in the table below. Then write your procedure and conduct the test.

Procedure

Results

Material	Prediction: Will it melt?	Water temperature (°C)	Observations
Margarine			
Wax			
Sugar			

- Which materials melted in the hot water?
- What was the temperature of the water?
- What was the melting temperature of the margarine?
- What was the melting temperature of the wax? Sugar?
- At what temperature does margarine melt? How can you find out?

- At the start of the experiment, what state of matter was the margarine?
- At the end of the experiment?
- If you could see the particles of margarine, what would be happening to them as the margarine melts?
- What would happen to the particles if melted margarine were put in cold water?

- If you could see the particles of wax, what would be happening to them in the hot water?

- If you could see the particles of sugar, what would be happening to them in the hot water?

Part 3

- Margarine melted- it turned into liquid, Wax got soft, but didn't really melt into liquid. Sugar didn't seem to change much at all.

- Do you think wax and sugar can melt?

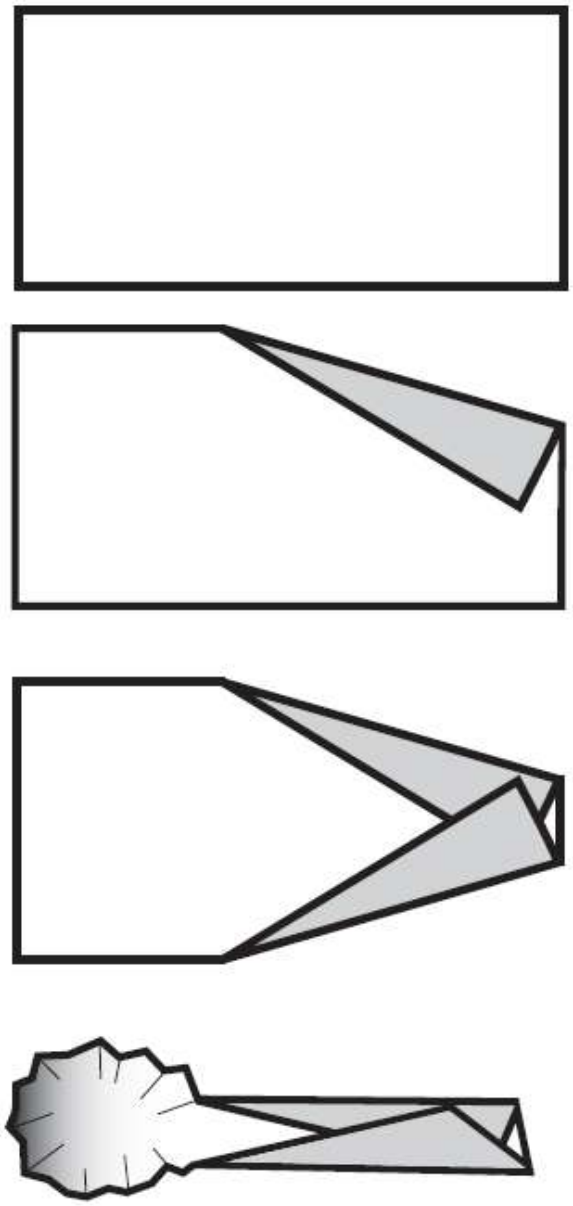
- What would you do to find out if wax and sugar can melt?

- We can use candles to heat wax and sugar. We will need to be careful when working with the flames. The temperature of the flame is very hot – about 1400^0C

- In a candle flame a quarter of the energy created, is released as heat, which radiates in many directions. Only the 4% of the candle's heat goes into melting wax. There are three main reaction zones in a candle. The part where combustion starts is called the primary reaction zone. In the main reaction zone, the process of burning ends. The luminous zone is where the free carbon burns and releases light. The burning of a candle flame is a very complicated process. Liquid wax is drawn up the wick by capillary motion and vaporized with oxygen. The remaining carbon dioxide and water form many kinds of complex carbon-rich particles called soot. Soot is raised up to the top of the flame where the very strong temperature burns it.
- Color tells us about the temperature of a candle flame. The outer core of the candle flame is light blue -- 1670 K (1400 °C).That is the hottest part of the flame. The color inside the flame becomes yellow, orange and finally red. The further you reach to the center of the flame, the lower the temperature will be. The red portion is around 1070 K (800 °C).

- http://hypertextbook.com/facts/1999/JaneFishler.shtml

ALUMINUM FOIL SPOON



WAX AND SUGAR MELTING

a. Make two foil spoons.

b. Put on protective eyewear.

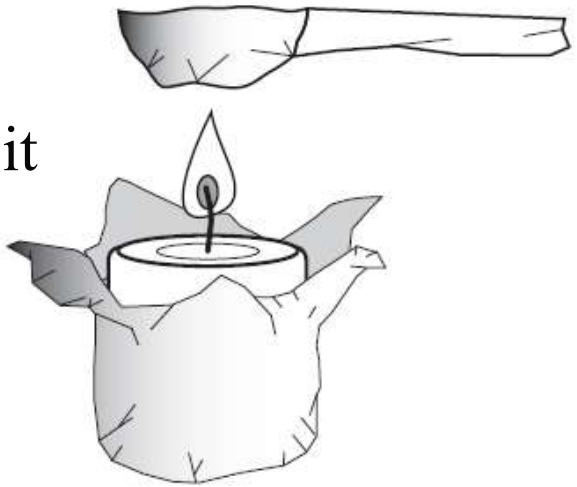
c. Light the candle.

d. Put one cube of wax in one spoon. See if the wax will melt.

e. Put 1 midispoons of sugar in another spoon. See if the sugar will melt. You might try salt, but not for too long

f. If a material melts, immediately remove it from the heat. Observe.

Make a Data Table of How long it takes to melt



1. What does the word *melt* mean?
2. Did the wax melt?
3. What was your evidence?
4. Did the sugar melt?
5. What was your evidence?
6. Did the melted wax and sugar stay liquid?
7. Did the melted wax and sugar freeze? What is your evidence?
8. Do all solids melt? How would you find out?
9. Do all solids melt at the same temperature?
10. Do all liquids freeze at the same temperature?
11. How could you find out if all liquids freeze?
12. When wax melts, how do the wax particles change?
13. Why do materials melt when they get hot?
14. What happens at the particle level when a material freezes?
15. Look at the puddle of wax around the wick of your candle. Explain why it is solid now.

- Melting is the change of state from solid to liquid. Freezing is a change of state from liquid to solid. Change of state is the result of change of the kinetic energy of the particles of the material. Nothing changes during the change of state except the motion of the particles. The particles do not melt, freeze, contract, expand or change into another type of particle.

- Change of state is not a chemical reaction, so no new products are formed. Water freezes at 0^0 C. Iron freezes at 1538^0 C. That's very hot. The alcohol in a thermometer freezes at -98^0 C. That's really cold. Substances freeze at their own temperature.

- Read the article Rock Solid and answer questions at the end of the chapter.

- 1. What causes a substance to change from one phase to another?
- 2. What are the three important things to know about freezing and melting?
- 3. Why does liquid water form on the bottom of a cup of ice placed over warm water?
- 4. What happens to water particles as a cup of ice melts and then evaporates?

Part 4

- Today we will freeze some water.
- How can we do that?

Water in Ice

- What is the temperature of the water in the vial?
- Water freezes at 0C. Is the water frozen?
- Is it freezing?
- Will it freeze in a while?
- What do we need to do to get the water to freeze?

FREEZE WATER A

Materials

- 1 Glass thermometer
- 1 Metal-backed thermometer
- 1 Plastic cup
- 1 Vial
- 1 Stirring stick
- Sodium chloride, 3 spoons
- Ice, crushed
- Protective eyewear
- Water

Procedure

a. Fill a plastic cup halfway with crushed ice.

b. Put on protective eyewear. Add three 5-mL spoons of sodium chloride to the ice. Stir in thoroughly.

c. Put about 10 mL of water in a vial.

d. Carefully work the vial of water into the crushed ice. Make sure the surface of the water is below the level of the ice.

e. Monitor the temperature of the water in the vial with a glass thermometer. Monitor the temperature of the ice/salt environment with a metal-backed thermometer.

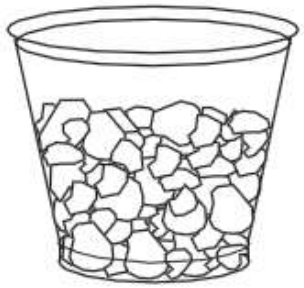
f. Record your observations. Include time, temperatures, and changes to the system.

Results

Time	Water temperature (°C)	Ice bath temperature (°C)	Observations

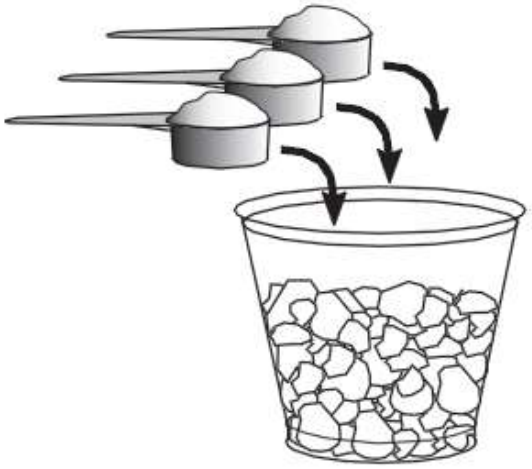
FREEZE WATER WITH ICE

a. Fill a cup half full with ice.



b. Put three heaping 5-mL spoons of sodium chloride in the cup with the ice.

Stir thoroughly.



c. Put a vial with 10 mL of water in the ice/salt mixture.

d. Measure and record temperatures.

Procedure

a. Fill a plastic cup halfway with crushed ice.

b. Put on protective eyewear. Add three 5-mL spoons of sodium chloride to the ice. Stir in thoroughly.

c. Put about 10 mL of water in a vial.

d. Carefully work the vial of water into the crushed ice. Make sure the surface of the water is below the level of the ice.

e. Monitor the temperature of the water in the vial with a glass thermometer. Monitor the temperature of the ice/salt environment with a metal-backed thermometer.

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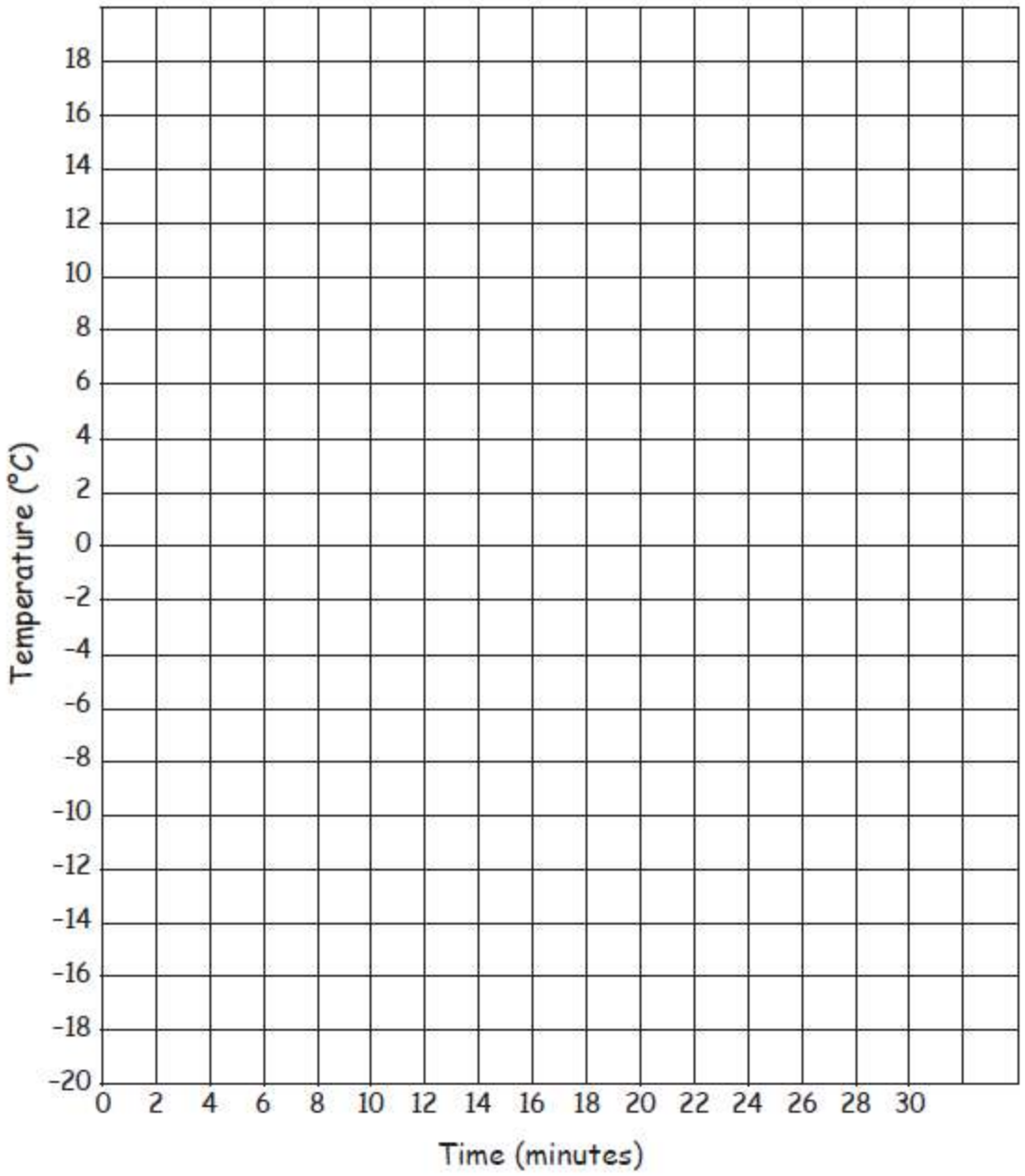
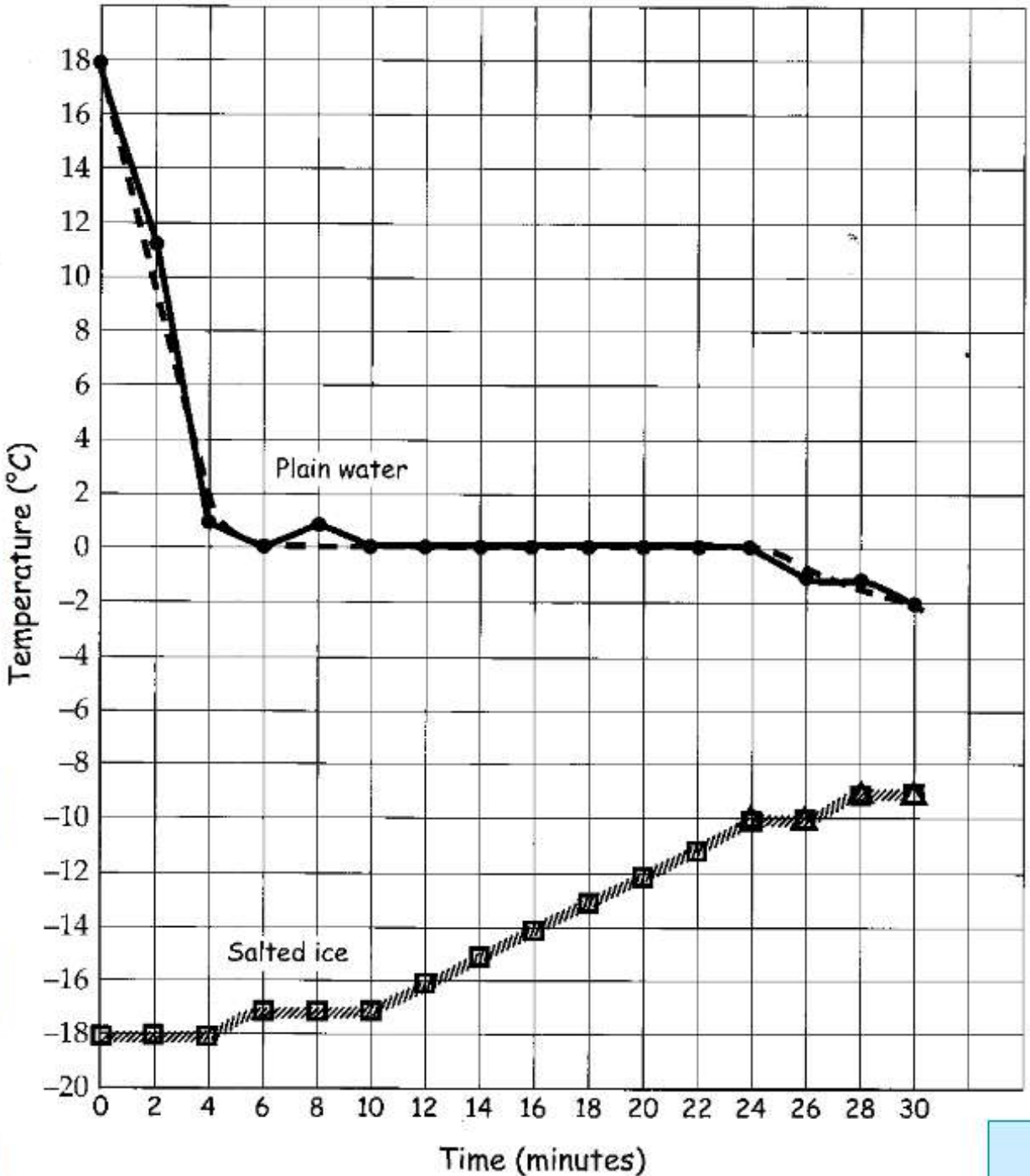
Results

Time	Water temperature (°C)	Ice bath temperature (°C)	Observations


Temperature (°C)
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Time (minutes)

Freezing Graph

Transparency #23



Conclusions page 71

- 1. Describe what happened to the ice/salt mixture as the investigation progressed.
- 2. Describe what happened to the vial of water as the investigation progressed.
- 3. What happened to the temperature of the water in the vial as the water was freezing?
- 4. Why do you think a vial of water in plain ice wouldn't freeze, but the vial of water in salted ice did freeze?
- 5. People put salt on ice when they make ice cream. Why do they do that?

Name _____

Period _____ Date _____

WATER-AND-ICE SYSTEM OBSERVATIONS

Write a description of the changes you observed when a cup of ice was placed over warm water and then when salt was added to the ice.

Include particles, energy transfer, and phase change in your description, and label the illustration.

WARNING — This set contains
that may be harmful if misused. Rea
on individual containers carefully.
used by children except under adult

MIXTURES A

Materials

- 2 Plastic cups, 250-mL
- 2 Self-stick notes
- 2 Stirring sticks
- 2 Hand lenses
- Protective eyewear

Procedure

a. Label two cups using sel
chloride (NaCl)."

b. Put on protective eyewea

c. Measure one level, 2-mL

d. Measure one level, 2-mL

e. Observe the two solid m

f. Use a syringe to add 30 r

Observations

Substance	Before

Part 5

- What phase changes did you observe in the last activity with sugar and wax?
- What can you do to get a solid material to melt?
- What happens to the solid material at the particle level when it melts?

Turn into gas

- Remember the particles in gas travel in straight lines through space as individuals. The average distance between them is relatively large.
- When the particles of a substance have enough kinetic energy to break away and fly into space, the material substance changes into the gas phase.

Water Vapor

- If water boils and turns into gas, where does it go?
- What is water gas called?
- What does water vapor look like?
- When water turns into water vapor, a gas, is it still water or something else?
- How can you tell if water vapor is present?

- If water in its gas state is invisible, what can we do to find if water vapor is present?

- Draw the next experiment in your notebook and label everything.

Name _____

Period _____ Date _____

WATER-AND-ICE SYSTEM OBSERVATIONS

Write a description of the changes you observed when a cup of ice was placed over warm water and then when salt was added to the ice.

Include particles, energy transfer, and phase change in your description, and label the illustration.

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e. Observe the two solid m

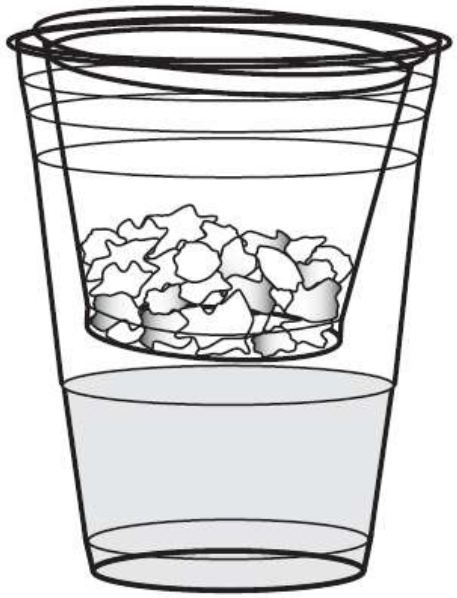
f. Use a syringe to add 30 r

Observations

Substance	Before

Experiment set up
Hot water in bottom cup
Ice in smaller top cup

WATER-AND-ICE SYSTEM OBSERVATIONS



Where does the dew come from?

- You can see the steam, fog and dew on the cup. What are they composed of?
- Where did the liquid water come from?
- What happened at the particle level to cause the change of state from gas to liquid?

- **Condensation** is the process of changing state from gas to a liquid.

- **Evaporation** is changing state from liquid to gas

Answer in notebook

- Water condensed on the ice cup. Where did that water come from?
- Why did the liquid water condense on the bottom of the cup?
- We observed a phase change from gas to liquid in the hot water and ice system. How could we create another phase change in the system from liquid to solid?

Add salt to the system

- Use a stirring stick and carefully stir the salt into the ice.
- Leave it sit still for several minutes.
- Carefully lift the ice cup and observe the bottom.
- Write down your observations into your notebook and draw the two cups.

Water & Ice System Observations

- Write a description of the changes you observed when a cup of ice was placed over warm water and then when salt was added to the ice.
- Include particles, energy transfer, and phase change in your description, and label the illustration.

Add to notebook

- What will happen when all the ice melts?
- How would dry ice change this lab?
- Would you have more frozen water vapor or less?

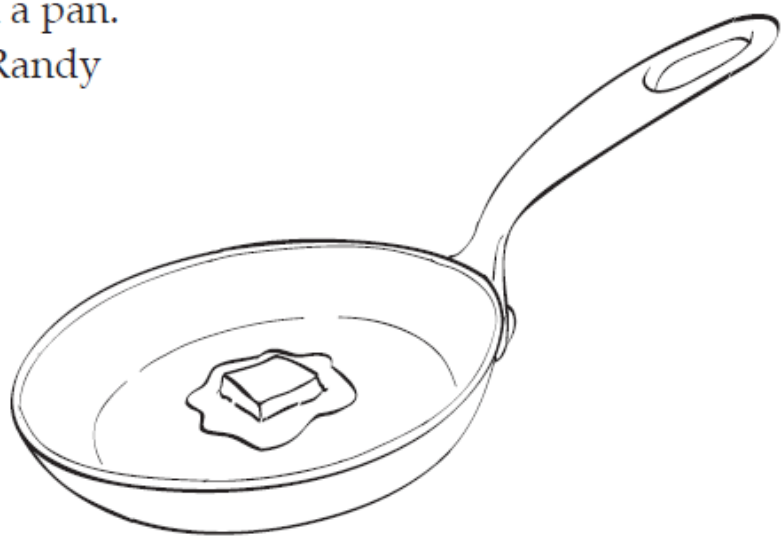
Quiz Warm-up

RESPONSE SHEET—PHASE CHANGE

Randy watched his mom put a piece of wax in a pan. She put the pan on the stove. A minute later, Randy looked in the pan and said,

Look, the wax is turning into water.

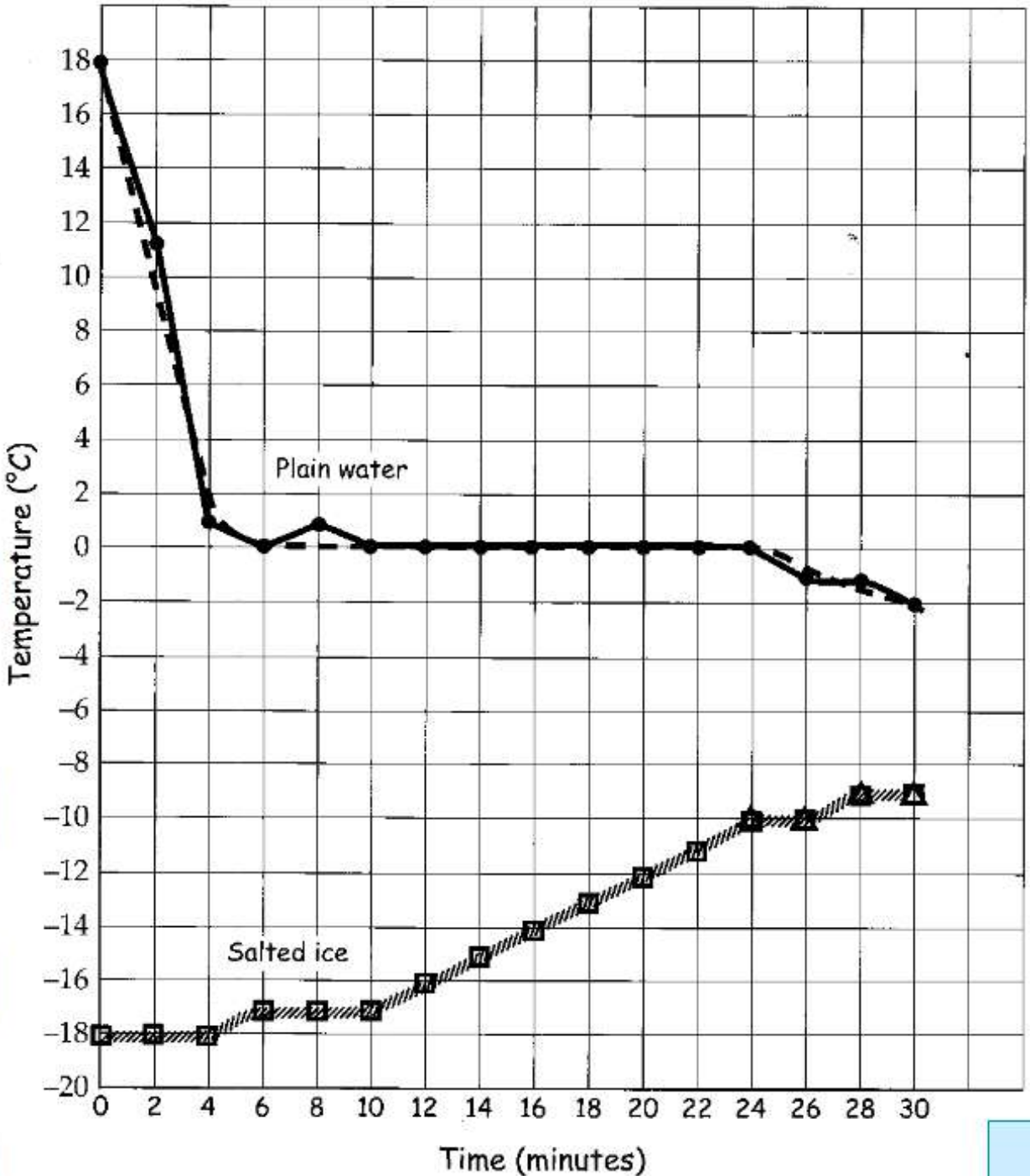
What would you tell Randy to help him understand what happened in the pan?



Section 7 Review

- **Vocabulary**
- Dissolving
- Melting
- Evaporate
- Freeze
- Condense
- Freezing point – melting point
- Equilibrium

Freezing Graph Transparency #23



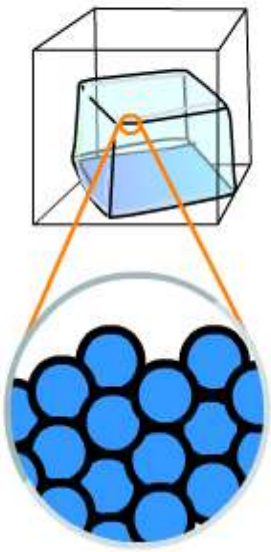
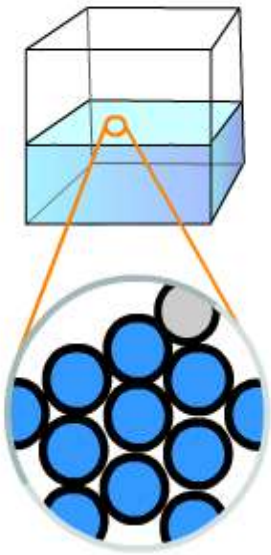
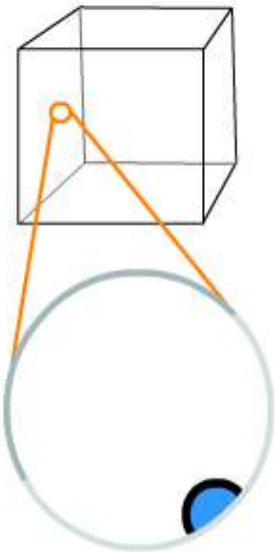
Particles in Solids, Liquids, and Gases

Choose material: Water Lead

Show Phase Change

Highlight One Particle

Key
- Water particle
- Air particle

Solid	Liquid	Gas
Warm It Up	Warm It Up	Warm It Up
		
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