

LESSON 37

Observing and describing cohesion, surface tension, and adhesion

Lesson Preparation

Program Materials

- Children's Booklet C *Investigating Matter and Its Interactions* (pp. 6–8)
- Lesson 37 Slide Show (see website *Teacher and Student Links*)
- Lesson Activity 37
- Science Word Wall cards (see inset)
- Lesson Review 37

Science
Word Wall

cohesion

surface tension

adhesion

Tool Kit Materials

- Pipettes (1 per group of 3 children)
- Clear-plastic cups (1 per group of 3 children; see *Before the Lesson*)

Teacher Collected Materials

- Yellow highlighters (1 per child)
- Sandwich-size plastic bags (1 per child)
- Aluminum foil (1 small piece per child)
- Paper towels (1 per child)
- Pennies (1 per group of 3 children)

Before the Lesson

- Fill the plastic cups with water.
- **Note:** This lesson may take two days.

The Lesson

"In our last science lessons, we learned about matter changing state."

"Let's review what we learned."

"Take out your chemistry booklet and highlighter."

"Open your booklet to pages 6 and 7."

"What happens during the process of condensation?" *A gas changes to a liquid.*

“What happens during the process of ionization?” *A gas changes to plasma.*

“What is the process of plasma changing to a gas called?” *deionization*

“What happens during the process of sublimation?” *A solid changes to a gas.*

“What is the process of a gas changing to a solid called?” *deposition*

“What happens during the process of vaporization?” *A liquid changes to a gas.*

“What are two types of vaporization?” *boiling and evaporation*

“What are two ways boiling and evaporation differ?” *Boiling occurs throughout the liquid and evaporation occurs only at the surface of the liquid; boiling occurs at the liquid’s boiling point and evaporation occurs at temperatures below the boiling point.*

“Water is a compound that can be easily observed changing state.”

“At what Celsius temperatures does water change state?” *0 °C and 100 °C*

“What happens at zero degrees Celsius?” *water freezes*

“What happens at 100 degrees Celsius?” *water boils*

“At what Celsius temperatures does water evaporate?” *any temperature below 100 °C and above 0 °C*

“In today’s science lesson, you will learn about cohesion (kō-hē'zhən), surface tension, and adhesion (ăd-hē'zhən).”

- Show children Lesson 37 Slide Show—Photo A.

“What do you notice in this photo?” *There are round drops of water on a leaf.*

- Show children Photo B.

“What do you notice in this photo?” *There is an insect walking on water.*

- Show children Photo C.

“What do you notice in this photo?” *There are round water drops on a spider web.*

“Let’s read about why water forms round drops, why some insects can walk on water, and why water drops are attracted to a spider web.”

“Turn to page 8 in your booklet.”

“The title of this page is ‘Cohesion, Surface Tension, Adhesion.’”

“These words describe what we observed in the photos.”

“Paragraph 1 describes cohesion.”

- Ask a child to read paragraph 1 aloud.

Molecules are attracted to one another because of their chemical structure. The attraction molecules of a substance have for one another is called cohesion. Cohesion is what causes the molecules of a liquid to stay connected and to form spherical drops.

“Which sentence tells us the definition of cohesion?” *second sentence*

“At the end of the second sentence, highlight the word ‘cohesion.’”

“What is the definition of cohesion?” *the attraction molecules of a substance have for one another*

“What does cohesion cause?” *molecules of a liquid to stay connected and form spherical drops*

“Which photos on this page show cohesion?” *first and last photos*

“How do you know?” *There are spherical water drops.*

“Paragraph 2 describes surface tension.”

- Ask a child to read paragraph 2 aloud.

The molecules at the surface of a liquid are more attracted to one another than they are to the air above them. The strong attraction molecules at the surface of a liquid have for one another is called surface tension. Surface tension is what allows the surface of a liquid to support light objects.

“Which sentence tells us the definition of surface tension?” *second sentence*

“At the end of the second sentence, highlight the words ‘surface tension.’”

“What is the definition of surface tension?” *the strong attraction molecules at the surface of a liquid have for one another*

“Which photo shows surface tension?” *middle photo*

“What do you think might happen if the insect was larger and weighed more?” *The surface tension wouldn’t be strong enough to hold it up and it would fall into the water.*

“Paragraph 3 describes adhesion.”

- Ask a child to read paragraph 3 aloud.

Sometimes molecules are more attracted to another substance than they are to each other. The attraction between molecules of different substances is called adhesion. Adhesion is what causes a liquid to stick to the surface of a solid.

“Which sentence tells us the definition of adhesion?” *second sentence*

“At the end of the second sentence, highlight the word ‘adhesion.’”

“What is the definition of adhesion?” *the attraction between molecules of different substances*

“Which photo shows adhesion?” *last photo*

“What is written below the first photo?” *Spherical water drops are an example of*

“What are spherical water drops an example of?” *cohesion*

“Write the word ‘cohesion’ below the picture of the spherical water drops.”

- Allow time for the children to do this.

“What is written below the second photo?” *A water strider can walk on water because of*

“Why can a water strider walk on water?” *because of the surface tension of the water*

“Write the words ‘surface tension’ below the picture of the water strider walking on water.”

- Allow time for the children to do this.

“What is written below the third photo?” *Water drops are attracted to the spider web because of*

“What causes the water drops to be attracted to the spider web?” *adhesion*

“Write the word ‘adhesion’ below the picture of the water drops on the spider web.”

- Allow time for the children to do this.

“Let’s observe cohesion and adhesion.”

- Seat children in groups of three.
- Distribute a plastic bag, a piece of aluminum foil, and a paper towel to each child.

“You will take turns using a pipette to put a drop of water on the plastic bag and a drop of water on the aluminum foil.”

- Distribute a cup of water and a pipette to each group.

“What do you notice about the drop of water you put on the plastic bag?”
It has a round shape.

- Allow time for the children to share observations.

“What caused the water to form spherical drops on the plastic bags?”
cohesion

“Why did this happen?” ***The water molecules are more attracted to each other than they are to the plastic.***

“What do you notice about the drop of water you put on the aluminum foil?” ***It spreads out.***

- Allow time for the children to share observations.

“On the aluminum foil, the water molecules spread out because they are attracted to the aluminum.”

“What is the attraction between two different substances called?”
adhesion

“Now put two more drops of water on your plastic bag so the drops aren’t touching.”

- Allow time for the children to do this.

“Gently move the plastic bag and observe what happens.”

“What did you observe?” ***The water drops joined together to make a larger water drop.***

“Why did this happen?” ***The water drops are more attracted to each other than they are to the plastic.***

- Allow time for the children to share observations.

“Use your paper towel to soak up the water drops on your foil and plastic bag.”

- Collect the plastic bags and aluminum foil. Leave the paper towels.

“Let’s conduct an experiment using drops of water and a penny.”

- Distribute Lesson Activity 37.

“What is the title?” ***Drops of Water on a Penny***

“What question will you answer?” ***How many drops of water will fit on the heads side of a penny?***

“How many drops of water do you think will fit on the heads side of a penny?”

- Allow time for the children to offer predictions.

“Write your prediction on your paper.”

“What materials will you use in this activity?” *penny, pipette, water, and paper towel*

“What is the procedure, or steps, you will follow?”

- Ask a child to read the procedure aloud.

Place a penny on a flat surface with the heads side facing up. Use the pipette to add one drop of water at a time to the heads side of the penny. Count the drops of water as they are added. Record the number of drops added before the water flows off the penny. Dry the penny. Repeat the activity two more times. Find the average of the three trials.

“You will work with your partners to conduct this experiment.”

“One group member will use the pipette to put drops of water on a penny.”

“Do not touch the penny with the pipette.”

“Your partners will count the drops as you add them to the top of the penny.”

“Each group member will record the number of drops the penny holds.”

“Repeat two more times with a different group member adding drops of water.”

“Use a paper towel to dry the penny off between trials.”

“When everyone in your group has had a turn, find the average for your three trials.”

“For example, if trial 1 had 11 drops, trial 2 had 15 drops, and trial 3 had 17, to find the average you would add the three numbers and divide by 3.”

- If necessary, show children how to find the average by adding the three trials and dividing by 3.
- Distribute a penny to each group.
- Circulate and assist children as they complete the activity.

“What is the greatest number of drops of water someone in your group was able to put on the penny?”

“What was your group’s average?”

- Write the averages on the board.

“Now work together to answer the questions at the bottom of your paper.”

- Allow time for the children to do this.

“What attracted the water molecules to the metal penny?” *adhesion*

“What caused the round shape of the water on the top of the penny?”
cohesion

“What methods resulted in the greatest number of water drops on the penny?”

- Ask each group to share their answers.

“Do you think your group’s average would change if you repeated the activity?”

- Allow time for the children to share and explain their reasoning.

“What do you think would happen if you used the tails side of the penny?”

- Allow time for the children to share and explain their reasoning.

- **Optional:** Allow the children to repeat the experiment using the tails side of the penny.

“Let’s review what we learned in today’s science lesson.”

“Who would like to share something you learned in today’s lesson?”

- Allow time for the children to share.

“Let’s look at the vocabulary words on my word cards.”

“What word describes the attraction molecules of a substance have for one another?” *cohesion*

- Show children the word card cohesion.

“What words describe the strong attraction molecules at the surface of a liquid have for one another?” *surface tension*

- Show children the word card surface tension.

“What word describes the attraction between molecules of different substances?” *adhesion*

- Show children the word card adhesion.

“In our next science lesson, we will learn about physical changes of matter.”

- Collect the pipettes, pennies, plastic cups, and paper towels.
- Post the word cards **cohesion**, **surface tension**, and **adhesion** on the Science Word Wall.

Lesson Review

- Distribute Lesson Review 37.
- **Note:** Allow children to use their booklets to complete the lesson review.
- Circulate and assist children as they work.
- Review the answers with the children.

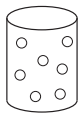
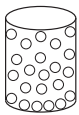

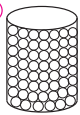
Name _____ *Answer Key* _____ Lesson Review 37
 Date _____ Science 5 Lesson 37

Cohesion, Surface Tension, Adhesion

Circle the letter of the correct answer.

1. What causes water molecules to form spherical drops?
 A. cohesion B. adhesion C. surface tension D. gravity
2. What causes water drops to be attracted to aluminum foil?
 A. surface tension B. cohesion C. adhesion D. gravity
3. A water strider can walk on water because of which of the following?
 A. cohesion B. adhesion C. gravity D. surface tension

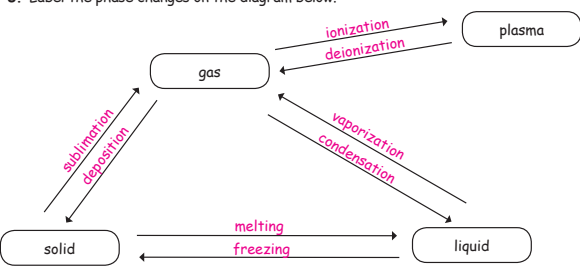
Look Back

4. Which of the following is the best representation of the atoms or molecules in a solid?
 A.  B.  C.  D. 
5. Heat was applied to a substance and it melted. Which state of matter was the substance in before it melted?
 A. solid B. liquid C. gas D. plasma
6. Which is the boiling point of water?
 A. 20 °C B. 70 °C C. 100 °C D. 212 °C
7. What causes ice cream to change from a solid to a liquid at room temperature?
 A. Water evaporates from the ice cream.
 B. Oxygen is added to the ice cream.
 C. Heat is removed from the ice cream.
 D. Heat is added to the ice cream.

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8. Label the phase changes on the diagram below.



9. In which states is matter able to flow?
 _____ *liquid, gas, plasma* _____
10. What causes water in a puddle to evaporate?
 _____ *Accept reasonable answers. When heat is added to the water, the water in the puddle vaporizes at the surface.* _____

Use What You Have Learned

11. Describe a time when you have observed cohesion.
 _____ *Accept reasonable answers.* _____

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