

Life

Physical

Earth and Space

LESSON 37

Observing and describing cohesion, surface tension, and adhesion

Lesson Preparation

Program Materials

- Child's Booklet C *Investigating Matter and Its Interactions* (pp. 6–8)
- Lesson 37 Slide Show (see website, Lesson 37)
- Lesson Activity 37
- Science Word List C (see inset)
- Lesson Review 37

Tool Kit Materials

- Pipette

Collected Materials

- Yellow highlighter
- Cup with water
- Sandwich-size plastic bags
- Small piece of aluminum foil
- Paper towel
- Penny

Science
Word List C

cohesion

surface tension

adhesion

The Lesson

“In your last science lessons, you learned about matter changing state.”

“Let’s review what you learned.”

“Take out your chemistry booklet and highlighter.”

- Allow time for your child to do this.

“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 Lesson 37 Slide Show—Photo A.

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

- Show Photo B.

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

- Show 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 you observed in the photos.”

“Paragraph 1 describes cohesion.”

- Ask your 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 you 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 your 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 you 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 your 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 you 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 your child 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 your child 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 your child to do this.

“Let’s observe cohesion and adhesion.”

- Hand a cup of water, pipette, plastic bag, and a paper towel to your child.

“Use the pipette to put a drop of water on the plastic bag.”

- Allow time for your child to do this.

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

“What caused the water to form a spherical drop on the plastic bag?” *cohesion*

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

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

- Allow time for your child 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.*

- Hand a piece of aluminum foil to your child.

“Now use the pipette to put a drop of water on the aluminum foil.”

- Allow time for your child to do this.

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

“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*

“What do you think will happen if you put two more drops of water on the aluminum foil?”

“Put two more drops of water on the aluminum foil.”

“What did you observe?” *The drops of water on the aluminum foil spread out.*

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

- Allow time for your child to do this.
- Collect the plastic bag and aluminum foil.

“Now you will conduct an experiment using drops of water and a penny.”

- Hand Lesson Activity 37 to your child.

“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?”

“Write your prediction on your paper.”

- Allow time for your child to do this.

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

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

- Ask your 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.

- Hand a penny to your child.

“When you use the pipette to put drops of water on the penny, do not touch the penny with the pipette.”

- Allow time for your child to conduct the three trials.

“What is the greatest number of drops of water you were able to put on the penny?”

“Now you will find the average for your three trials.”

“To find the average, you will add the three numbers and divide by 3.”

- Assist your child as he/she finds the average of the three trials.

“What was the average of your three trials?”

“Use your results to answer the questions at the bottom of the paper.”

- Allow time for your child 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?”

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

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

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

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

“What is something you learned?”

“Let’s look at the new vocabulary words.”

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

- Write the word cohesion on Science Word List C.

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

- Write the words surface tension on Science Word List C.

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

- Write the word adhesion on Science Word List C.

“In your next science lesson, you will learn about physical changes of matter.”

- Collect the pipette, penny, plastic cup, and paper towel.
- **Optional:** Post the word cards cohesion, surface tension, and adhesion on the Science Word Wall.

Lesson Review

- Hand Lesson Review 37 to your child.
- Ask your child to read the title and directions.
- Discuss the “Use What You Have Learned” question with your child.
- Allow your child to use his/her booklet to answer the questions.
- Correct your child’s paper. Review incorrect answers with your child.

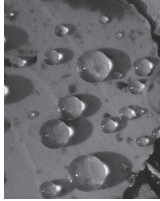
Cohesion, Surface Tension, Adhesion

Lesson 37

¹ 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.

² 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.

³ 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.



Spherical water drops are an example of

cohesion



A water strider can walk on water because of

surface tension



Water drops are attracted to the spider web because of

adhesion

8

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Science 5

Name _____

Lesson Activity 37
Science 5 Lesson 37

Date _____

Drops of Water on a Penny

Question: How many drops of water will fit on the heads side of a penny?

Prediction: I estimate that _____ drops of water will fit on the heads side of a penny.

Materials: Penny, pipette, water, paper towel

- Procedure:**
- 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.

Data:

Trial 1	Trial 2	Trial 3	Average

Analysis: What attracted the water molecules to the metal penny? _____

What caused the round shape of the water on the top of the penny? _____

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

Do you think your group's average would change if you repeated the activity? Explain why or why not. _____

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

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Name _____ **Answer Key**

Lesson Review 37
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Date _____

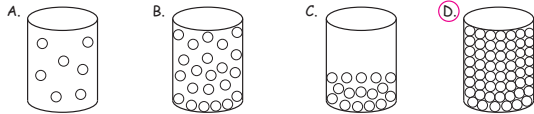
Cohesion, Surface Tension, Adhesion

Circle the letter of the correct answer.

- What causes water molecules to form spherical drops?
 A. cohesion B. adhesion C. surface tension D. gravity
- What causes water drops to be attracted to aluminum foil?
 A. surface tension B. cohesion C. adhesion D. gravity
- 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?



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?

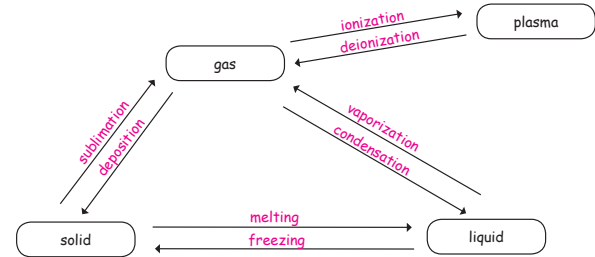
- A. Water evaporates from the ice cream.
 B. Oxygen is added to the ice cream.
 C. Heat is removed from the ice cream.
 D. Heat is added to the ice cream.

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Lesson Review 37
Science 5 Lesson 37

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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