



Lesson Plan: Solids, Liquids and Gases

Grade Level: 6

Subject: Physical Science

Duration: 45–60 min

NGSS MS-PS1-4: Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Learning Objectives

By the end of this lesson, students will be able to:

- **Identify** the three states of matter (solid, liquid, gas) and describe the defining properties of each, including shape, volume, and particle arrangement.
- **Explain** how intermolecular forces and particle motion differ among solids, liquids, and



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of whatever container it is poured into.

- **Gas:** A state of matter that has neither a definite shape nor a definite volume. The particles in a gas are far apart and move freely in all directions, so a gas expands to fill any container it occupies and can be compressed.
- **Sublimation:** A change of state in which a solid converts directly into a gas without passing through the liquid phase. Dry ice (solid carbon dioxide) is a common example — it turns straight into CO₂ vapor at room temperature.



- **Evaporation:** A change of state in which particles at the surface of a liquid gain enough energy to escape and become a gas. It occurs at temperatures below the boiling point and is how puddles dry up on a warm day.
- **Condensation:** A change of state in which a gas loses energy, slows down, and becomes a liquid. Fog forming on a cold mirror or dew collecting on grass in the morning are everyday examples of condensation.
- **Charles's Law:** A scientific law stating that the volume of a gas increases as its temperature increases, and decreases as its temperature decreases, as long as pressure stays the same. This explains why a hot air balloon expands and rises when the air inside is heated.
- **Boyle's Law:** A scientific law stating that the volume of a gas decreases as pressure on it increases, and increases as pressure decreases, as long as temperature stays the same. Squeezing a sealed syringe to compress the air inside is a direct demonstration of Boyle's Law.



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(compressing gas reduces volume)

Lesson Procedure

Step 1: Introduction (7 minutes)

- Ask students: 'If you leave an ice cube on your desk, what happens to it — and why? What would happen if you then heated the water in a pot?' Use responses to surface prior knowledge about states of matter and change.



- Hold up an ice cube in a sealed plastic bag and ask students to predict what will happen to its shape and volume as it melts. Record predictions on the board to revisit during Direct Instruction.

Step 2: Direct Instruction (15 minutes)

- Use the Study Guide to introduce the three states of matter, emphasizing particle arrangement: solids have tightly packed, vibrating particles; liquids have close but mobile particles; gases have widely spaced, freely moving particles.
(<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-solids-liquids-and-gases-2.pdf>)
- Demonstrate Boyle's Law physically: press the plunger of a sealed air-filled syringe and ask students to observe and explain why the volume decreases as pressure increases. Then release to show the reverse.
- Use the Study Guide to explain Charles's Law (hot air balloon example) and walk through the changes of state — melting, freezing, evaporation, condensation, and sublimation — connecting each to particle energy. (<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-solids-liquids-and-gases-2.pdf>)



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Step 4: Independent Practice (13 minutes)

- Students complete Practice Worksheet 1 independently, which covers Boyle's Law and Charles's Law graphs, changes of state, and particle behavior questions.
(<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-solids-liquids-and-gases-2-1.pdf>)
- Students use the color-and-cut Activity Lesson pages to sort images of everyday objects (baseball, balloon, milk, ice cube, steam kettle) into solid, liquid, or gas categories and paste them into the correct column of the graphic organizer.



(<https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-solids-liquids-and-gases-2-solids-liquids-gases-3.pdf>)

Step 5: Assessment (10 minutes)

- Students complete Practice Worksheet 0, a 10-question multiple-choice quiz covering fog formation (condensation), changes of state on a heating curve, Boyle's Law graphs, sublimation, and particle behavior during melting.

(<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-solids-liquids-and-gases-2-0.pdf>)

- Ask students to classify each of the following as solid, liquid, or gas and explain their reasoning using particle-level language: a wooden desk, orange juice, the air in a balloon, and dry ice vapor. Discuss responses as a class to check for understanding.

💡 Differentiation Strategies



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everyday objects before moving to graph-based questions.

🎨 Extension Activities

- Build a states-of-matter model: use small craft beads in a sealed zip-lock bag to represent particles — pack them tightly for solid, shake loosely for liquid, and spread them across a larger bag for gas. Observe and sketch how particle spacing changes with each state.



- Conduct a sublimation observation: place a small piece of dry ice (teacher-handled) in a clear container and observe it converting directly to gas vapor, then draw and label a particle diagram explaining why no liquid phase appears.
- Investigate Charles's Law with a balloon: place an inflated balloon in a bowl of warm water, then transfer it to a bowl of ice water, and measure the circumference each time to collect data showing how gas volume responds to temperature change.

Complete List of Available Resources:

- NewPathWorksheets: Solids, Liquids and Gases (<https://newpathworksheets.com/science/grade-6/solids-liquids-and-gases-2>)
- Study Guide: Solids, Liquids and Gases (<https://newpathworksheets.com/api/guide/study-guide-science-grade-6-solids-liquids-and-gases-2.pdf>)
- Activity Lesson: Solids, Liquids & Gases (<https://newpathworksheets.com/api/activity->



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SOLIDS, LIQUIDS AND GASES

Three States of Matter

Matter exists in three different states or phases: solid, liquids and gases or vapors.

- A **solid** has a definite shape and volume,
- A **liquid** has a definite volume but no definite shape and
- A **gas** has neither a definite volume nor shape.



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*Describe the physical changes possible in the three
states of matter.*



Behaviors of Gases

Gases or vapors are influenced by three factors: **temperature**, **volume** and **pressure**. The behavior of a gas is directly related to the effect of these factors on the gas. Temperature affects the speed at which the gas particles move. An increase in temperature causes more movement in the particles and a decrease makes them slow down.

In a hot air balloon the flame heats the air, and as the temperature goes up so does the volume of the gas. As its volume increases, some of the air leaves through the bottom of the balloon. This lowers the density of the air in the balloon and allows the balloon to rise.

In an opposite manner, if you wanted to convert a vapor to a liquid



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Boyle's Law

On the other hand, according to Boyle's Law, the pressure of a gas is inversely related to its volume. What this means is that as the pressure on a gas goes up and thus its gas particles are brought closer together, its volume goes down.

In an opposite manner, as the pressure on a gas decreases, its particles spread out and the volume increases.

These laws can be represented graphically. Check the graphs shown below.

Boyle's Law

Charles's Law



A row of twelve diverse children standing on a green grassy field. Above them are four thought bubbles containing various science and math icons: a cube, a microscope, a triangle, a globe, a flask, a pie chart, a bar graph, and mathematical symbols like plus, minus, multiply, and divide.

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What are the three factors that affect the behavior of gases?



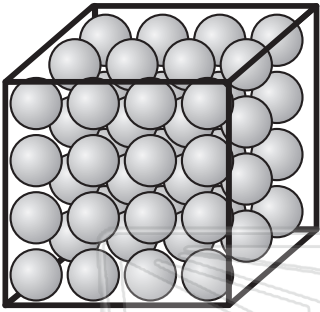
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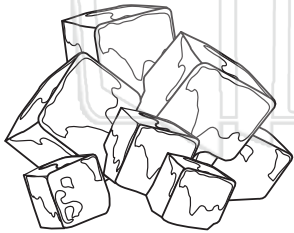
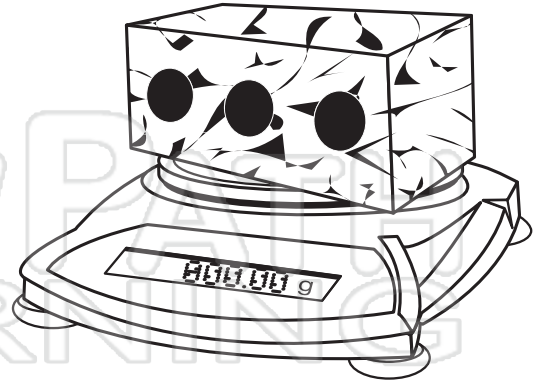
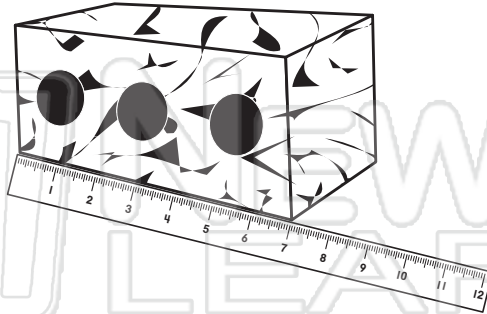
Solids, Liquids & Gases

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Particles that make up a **solid** are packed very closely together in a set position. Solid materials have a **definite shape** and **volume**.

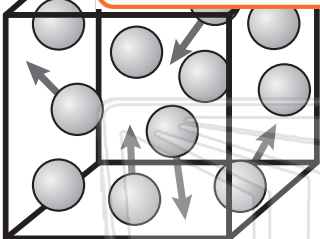


Particles of **crystalline solids** such as salt or sugar, are arranged in a regular pattern.

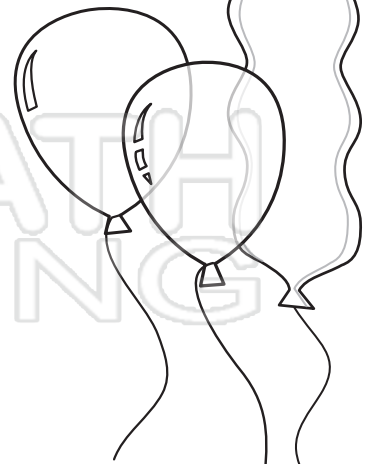
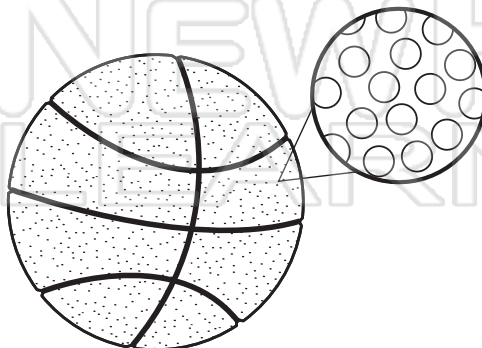


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Particles of a gas can be squeezed together or spread apart in a container **filling** all the space available.





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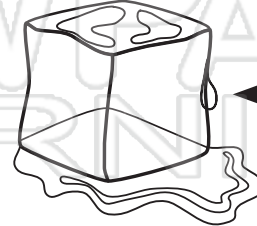
Changes of State

Solid to Liquid

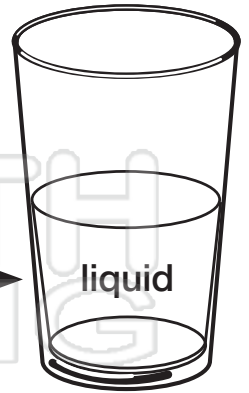
At its **melting point**, particles of a solid vibrate so fast that they break free from their closely packed arrangement.

Freezing is the reverse process of melting. At its **freezing point**, the particles of a liquid slow down and form regular patterns.

solid



liquid



Solid to Gas

During



a gas.

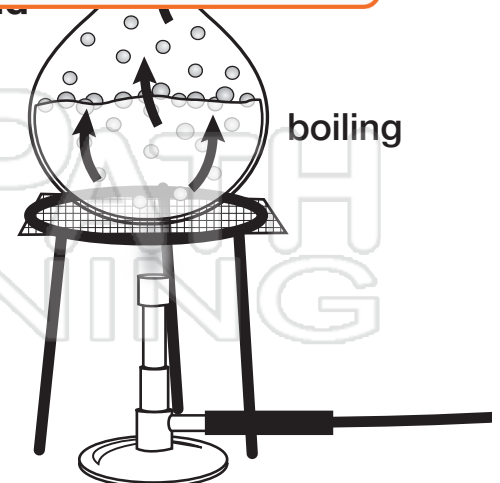
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ion

Evaporation takes place when the particles in a liquid gain enough heat energy to form a gas.

Boiling takes place when a liquid changes to a gas just below and above its surface.





Solids, Liquids & Gases

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Name _____ Class _____ Date _____

Make a chart or poster similar to the one shown below. Color and cut out images of objects. Place them in the correct category – solid, liquid or gas.

solids	liquids	gases
		
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Solids, Liquids & Gases

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Name _____ Class _____ Date _____

Color the objects and cut them out. Is it a solid, liquid or gas?
Make a chart or poster.



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Solids, Liquids & Gases

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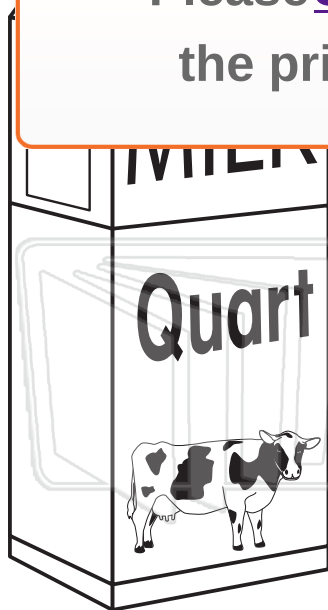
Name _____ Class _____ Date _____

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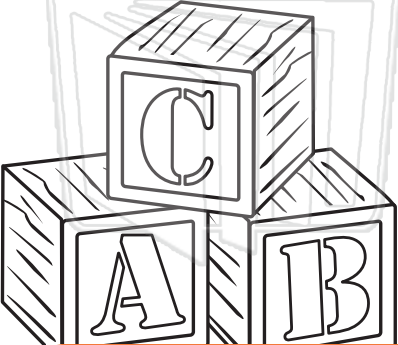
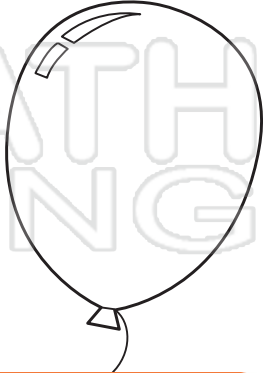
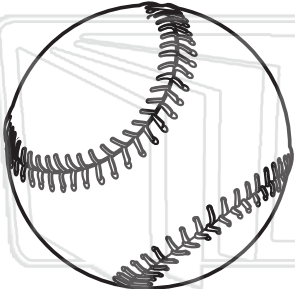
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Answer Key - Example

Make a chart or poster similar to the one shown below. Color and cut out images of objects. Place them in the correct category – solid, liquid or gas.

solids	liquids	gases
		
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Name _____ Class _____ Date _____

1

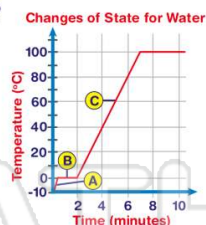
In this picture, what is the reason for **fog forming** on the mirror?

- A** Water vapor is condensing on the mirror.
- B** Water is melting on the mirror.
- C** Water is evaporating on the mirror.
- D** Water is dripping on the mirror.

**2**

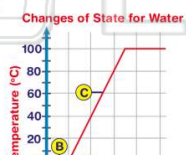
What is the state of water at **point C** as ice is **heated** to 100°C?

- A** Ice is melting.
- B** Water is boiling.
- C** Liquid water is heating up.
- D** Water vapor is condensing.

**3**

What is the state of water at **point B** as ice is **heated** to 100°C?

- A** Ice is melting.
- B** Water vapor is condensing.
- C** Liquid water is

**4**

Solids are **objects** that have a definite shape and _____.

- A** no definite volume
- B** volumes that are always changing
- C** definite volume
- D** just one color

5

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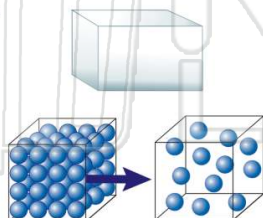
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9

The change from **solid** directly to a **gas** is called _____.

- A** melting
- B** boiling
- C** evaporation
- D** sublimation

**10**

In the **picture** below, _____.

- A** water is boiling
- B** water is evaporating
- C** water vapor is condensing
- D** water is freezing





Name _____ Class _____ Date _____

1

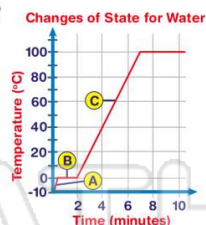
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- C** Water is evaporating on the mirror.
- D** Water is dripping on the mirror.

**A****2**

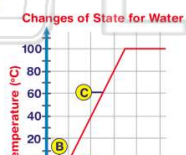
What is the state of water at **point C** as ice is **heated** to 100°C?

- A** Ice is melting.
- B** Water is boiling.
- C** Liquid water is heating up.
- D** Water vapor is condensing.

**C****3**

What is the state of water at **point B** as ice is **heated** to 100°C?

- A** Ice is melting.
- B** Water vapor is condensing.
- C** Liquid water is

**A****4**

Solids are **objects** that have a definite shape and _____.

- A** no definite volume
- B** volumes that are always changing
- C** definite volume
- D** just one color

C**5****C**

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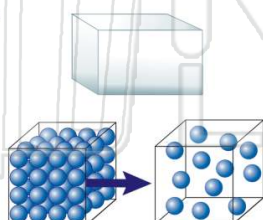
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C**9**

The change from **solid** directly to a **gas** is called _____.

- A** melting
- B** boiling
- C** evaporation
- D** sublimation

**D****10**

In the **picture** below, _____.

- A** water is boiling
- B** water is evaporating
- C** water vapor is condensing
- D** water is freezing

**B**



Name _____ Class _____ Date _____

1

When a Bunsen burner is used to **heat** water, the liquid _____.

- A** just evaporates
- B** condenses
- C** just boils
- D** boils and vaporizes

**2**

When ice cream **melts**, the particles of ice cream have _____.

- A** more volume
- B** less volume
- C** more mass
- D** less mass

**3**

Solid carbon dioxide sublimates directly into a **vapor**. This property is useful when _____.

- A** building campfires
- B** lighting matches
- C** saving rainforests

**4**

Using the **data table** shown below, estimate the pressure of the gas if the volume was **225 mL**.

- A** 24 kPa
- B** 27 kPa
- C** 30 kPa

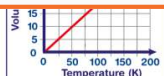
Volume (mL)	Pressure (kPa)
300	20
250	24
200	30

5

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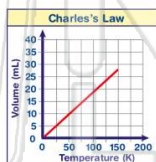
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D 75 mL**9**

Using the graph below, estimate the **volume** of the gas if the temperature of the gas was raised to **175 K**.

- A** between 40 mL and 45 mL
- B** between 25 mL and 30 mL
- C** between 30 mL and 35 mL
- D** between 150 mL and 200 mL

**10**

A hot air balloon **rises** from the ground because the **hot air** inside the balloon _____.

- A** cannot push the cool air out of the balloon
- B** traps the cool air near the top of the balloon
- C** is more dense than the air outside of the balloon
- D** is less dense than the air outside of the balloon





Name _____ Class _____ Date _____

1

When a Bunsen burner is used to **heat** water, the liquid _____.

- A just evaporates
- B condenses
- C just boils
- D boils and vaporizes

**D****2**

When ice cream **melts**, the particles of ice cream have _____.

- A more volume
- B less volume
- C more mass
- D less mass

**A****3**

Solid carbon dioxide sublimates directly into a **vapor**. This property is useful when _____.

- A building campfires
- B lighting matches
- C saving rainforests

**D****4**

Using the **data table** shown below, estimate the pressure of the gas if the volume was **225 mL**.

- A 24 kPa
- B 27 kPa
- C 30 kPa

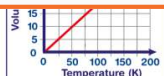
Volume (mL)	Pressure (kPa)
300	20
250	24
200	30

B**5****A**

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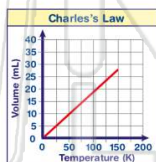
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B**D 75 mL****9**

Using the graph below, estimate the **volume** of the gas if the temperature of the gas was raised to **175 K**.

- A between 40 mL and 45 mL
- B between 25 mL and 30 mL
- C between 30 mL and 35 mL
- D between 150 mL and 200 mL

**C****10**

A hot air balloon **rises** from the ground because the **hot air** inside the balloon _____.

- A cannot push the cool air out of the balloon
- B traps the cool air near the top of the balloon
- C is more dense than the air outside of the balloon
- D is less dense than the air outside of the balloon

**D**



Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Gas

Evaporation

Solid

Boyle

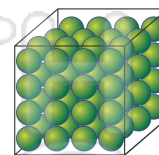
Vapor

Condensation

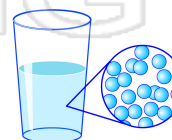
Liquid

Sublimation

1. - a state of matter that has its own shape and never changes shape; an object with definite mass and volume



2. - a substance that has a definite volume, but no definite shape; a state of matter in which molecules are not as tightly packed as those in a solid; liquids take the shape of whatever they are poured in



3. can take mass a

4. related

5. become

6. evaporation

water changes into water vapor which then goes into the air

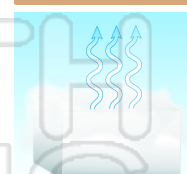
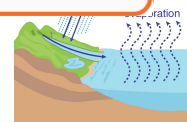
7. into a vapor

8. - the gaseous state of matter



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Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Gas

Evaporation

Solid

Boyle

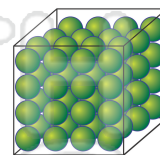
Vapor

Condensation

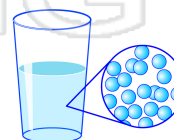
Liquid

Sublimation

1. solid - a state of matter that has its own shape and never changes shape; an object with definite mass and volume



2. liquid - a substance that has a definite volume, but no definite shape; a state of matter in which molecules are not as tightly packed as those in a solid; liquids take the shape of whatever they are poured in



3. gas
the shape
volume

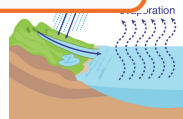


4. Boyle
tempe

5. con
becom

6. eva
evapo

water changes into water vapor which then goes into the air



7. sublimation - the phase change that occurs when a solid goes directly into a vapor



8. vapor - the gaseous state of matter

