Chapter 2 Solids, Liquids, and Gases

Study Guide

1. States of Matter
    a. **Solids**
        i. Particles in a Solid
        ii. Types of Solids
            1. **Crystalline solids**
            2. **Melting point**
            3. **Amorphous solids**
    b. **Liquids**
        i. Particles in a Liquid
        ii. **Viscosity**
    c. **Gases**
2. Gas Behavior
    a. Measuring Gases
        i. Volume
        ii. **Temperature**
        iii. **Pressure**
    b. Relating Pressure and Volume
        i. **Boyle's Law**
    c. Relating Pressure and Temperature
        i. Raising Temperature Raises Pressure
        ii. Pressure and Temperature in Action
    d. Relating Volume and Temperature
        i. **Charles's Law**
        ii. Charles's Law in Action
3. **Graphing** Gas Behavior
    a. Temperature and Volume
        i. Collecting Data
        ii. Graphing the Results
            1. **Directly proportional**

b. Pressure and Volume
    i. Collecting Data
    ii. Graphing Results
        1. **Vary inversely**

4. Changes in State
    a. Energy and Changes in State
        i. **Thermal energy**
    b. Changes Between Liquid and Solid
        i. **Melting**
        ii. **Freezing**
    c. Changes Between Liquid and Gas
        i. **Vaporization**
            1. **Evaporation**
            2. **Boiling**
            3. **Boiling point**
        ii. Boiling Point and Air Pressure
        iii. **Condensation**
    d. Changes Between Solid and Gas
        i. **Sublimation**
    e. Identifying Substances Through Changes of State

5. Questions
    a. What are crystalline solids?
    b. State Boyle's Law.
    c. What are the characteristics of a solid, liquid, and gas?
    d. Graphing
    e. Why is it important to monitor your tires during long car trips?

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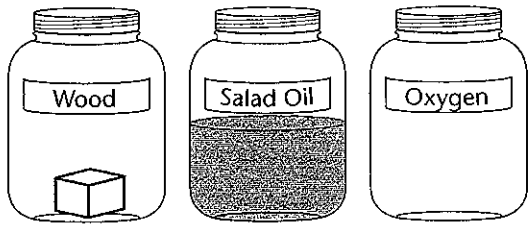
SECTION 2-1 **REVIEW AND REINFORCE**

States of Matter

◆ Understanding Main Ideas

Use the diagram to answer Questions 1 through 3. Write your answers on a separate sheet of paper.



1. Identify the physical state of the substances pictured.
2. What would happen to the shape of each substance if the jars were broken? Use the differences in the physical state of the substances to explain your answer.
3. Would the volume of each substance change if each were moved into a larger container? Explain.

◆ Building Vocabulary

Write a definition for each of the following terms in the spaces provided.

4. solid _____

5. liquid _____

6. gas _____

7. viscosity _____

8. amorphous solid _____

9. crystalline solid _____

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SECTION 2-2 REVIEW AND REINFORCE

Gas Behavior

◆ Understanding Main Ideas

Complete the following compare and contrast table.

Law	When temperature of a gas...	If you...	Then you observe...
Boyle's Law	stays constant	decrease volume	**1.**
Boyle's Law	stays constant	increase pressure	**2.**
Charles's Law	increases	keep pressure constant	**3.**

Answer the following questions in the spaces provided.

4. A gas barbecue grill uses propane gas. The propane is stored in a rigid tank. What happens to the pressure of the propane when the tank is left outside on a very hot summer day? What about on a cold winter day?

_____

_____

5. What is the formula relating pressure, force, and area?

_____

6. How does the speed of the molecules of a gas change when the gas is heated?

_____

◆ Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term.

_____ **7.** temperature

_____ **8.** Charles's Law

_____ **9.** pressure

_____ **10.** Boyle's Law

a. explains the relationship of volume and pressure of an amount of gas at a constant temperature

b. explains the relationship of temperature and volume of an amount of gas at a constant pressure

c. a measure of the average energy of motion of the particles of a substance

d. a measure of the force exerted by the movement of particles of a gas

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SECTION 2-3 **REVIEW AND REINFORCE**

Graphing Gas Behavior

◆ Understanding Main Ideas

Use the graphs and tables to answer the following questions. Write your answers on a separate sheet of paper.

Table A

Relationship of Temperature and Volume of an Amount of Gas at Constant Pressure	
Temperature (K)	**Volume (cm^3)**
200	40
250	50
300	60
350	70

Graph A

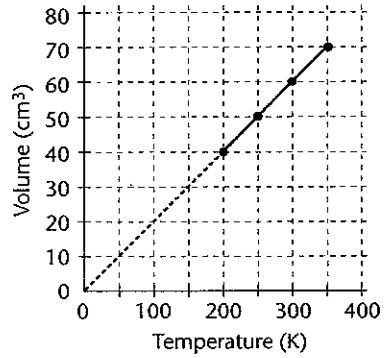
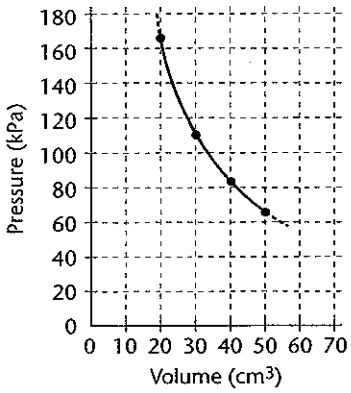


Table B

Relationship of Volume and Pressure of an Amount of Gas at Constant Temperature	
Volume (cm^3)	**Pressure (kPa)**
20	166.5
30	111.0
40	83.3
50	66.6

Graph B



1. Which law is represented in each graph above?

2. Are the variables in the graphs directly proportional or do they vary inversely? How can you tell?

3. Use the graphs to predict the following:

a. volume of the gas when the temperature is 400 K

b. pressure of the gas when the volume is 60 cm^3

◆ Building Vocabulary

Answer the following questions on a separate sheet of paper.

4. What is a graph?

5. Sketch a graph of two variables that vary inversely.

6. Sketch a graph of two variables that are directly proportional.

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SECTION 2-4 REVIEW AND REINFORCE

Changes in State

◆ Understanding Main Ideas

Check the type of change in the energy of the particles of matter that applies to each description.

Description	Thermal Energy Increases	Thermal Energy Decreases
1. As you breathe on a mirror, a film of water briefly forms on the mirror.		
2. "Dry ice" seems to disappear.		
3. A puddle dries up on a sunny day.		
4. Water freezes.		
5. Butter melts.		

◆ Building Vocabulary

From the list below, choose the term that best completes each sentence.

melting	sublimation	thermal energy	freezing
vaporization	evaporation	boiling	condensation

6. The higher the temperature of something, the greater its _____.

7. The change in state from gas to liquid is called _____.

8. The change in state from liquid to gas is called _____.

9. Gas bubbles forming throughout the liquid is called _____.

10. Liquid changing to gas only at the surface is called _____.

11. The change in state from solid to liquid is called _____.

12. The change in state from liquid to solid is called _____.

13. In _____, particles pass directly from solid to gas.

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Name: _____ Class: Physical Science Ch. 2 Review

Choose the letter of the correct answer.

1. A solid is a state of matter that has a(n)
   [A] definite volume and a definite shape. [B] indefinite volume and an indefinite shape.
   [C] definite volume and an indefinite shape. [D] indefinite volume and a definite shape.

2. Which process involves a gas changing into a liquid?
   [A] freezing [B] condensation [C] melting [D] vaporization

3. Data plotted on a graph results in a line that slopes upward from left to right. This graph tells you that
   [A] both variables are decreasing.
   [B] when one variable increases, the other variable remains the same.
   [C] when one variable increases, the other variable decreases.
   [D] when one variable increases, the other variable increases.

4. In which state of matter would a substance have the least thermal energy?
   [A] gas. [B] liquid. [C] vapor. [D] solid.

5. The force of outward push of a gas divided by the area of the walls of the container is the gas's
   [A] pressure. [B] volume. [C] temperature. [D] density.

6. Which term describes a liquid changing into a solid?
   [A] condensing [B] vaporizing [C] melting [D] freezing

7. Water boils at a lower temperature at higher altitudes because
   [A] the air pressure is higher. [B] the volume is higher.
   [C] the volume is lower. [D] the air pressure is lower.

8. According to Charles's law, when the temperature of a gas increases at constant pressure, its
   [A] volume increases. [B] volume decreases.
   [C] particles move more slowly. [D] mass increases.

9. The energy a substance has from the movement of its particles is called
   [A] thermal energy. [B] chemical energy. [C] light energy. [D] potential energy.

Choose the letter of the correct answer.

10. When an inflated balloon is exposed to cold air,

    [A] the volume of the balloon decreases. [B] the volume of the balloon increases.

    [C] the temperature inside the balloon rises. [D] the pressure inside the balloon rises.

Fill in the word or phrase that best completes the statement(s).

11. The resistance of a liquid to flowing is called _____.

12. Sublimation is the change of a solid directly into a _____.

13. Glass and plastic are examples of solids in which the particles are NOT arranged in _____.

14. When a graph of two variables shows a straight line passing through the point (0, 0), the two variables are _____ proportional to each other.

15. If a gas-filled balloon is placed in a freezer, the volume of the balloon will _____.

16. In a _____, the particles are packed closely together, but they can move past one another freely.

17. Solids that have particles arranged in a regular, repeating pattern are known as _____ solids.

18. A rigid container allows you to study changes in the temperature and _____ of a gas.

19. When a substance cools, it loses _____ energy to its surroundings.

If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

20. In a rigid container, as the temperature of a gas decreases, the pressure of the gas will <u>decrease</u>.

21. If a scientist changes the temperature of a gas and measures the resulting change in volume, the values for volume would be plotted on the <u>*y*-axis</u> of a graph of the data.

22. A <u>liquid</u> does not have a definite shape, but it does have a definite volume.

If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

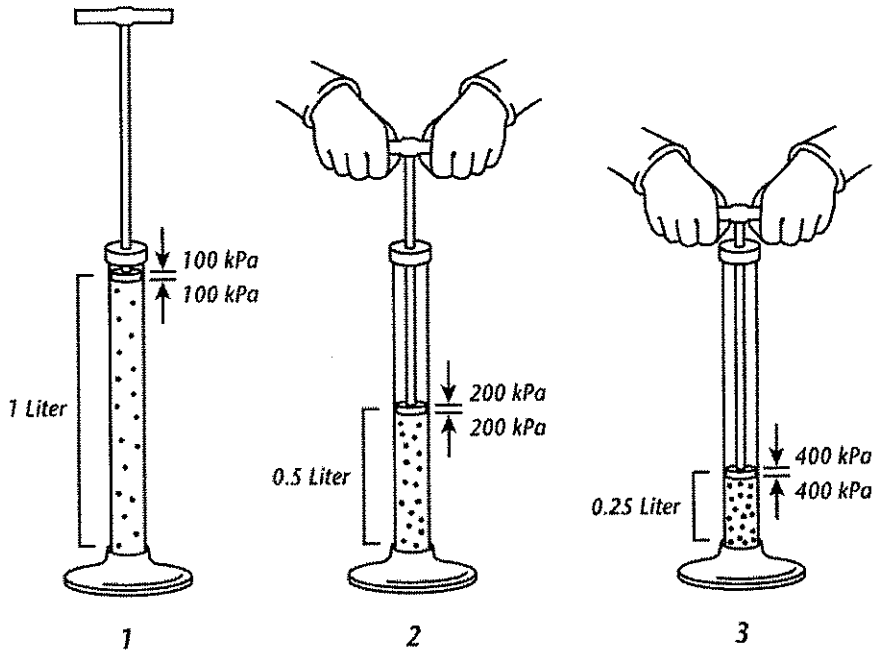
23. A substance becomes <u>cooler</u> when it absorbs thermal energy.

24. <u>Sublimation</u> occurs when particles on the surface of a liquid gain enough energy to become a gas.

25. In a flexible container, when the temperature of a gas increases, the volume of the gas will <u>increase</u>.

Use the diagram to answer the question(s).

Air Pressure and Volume



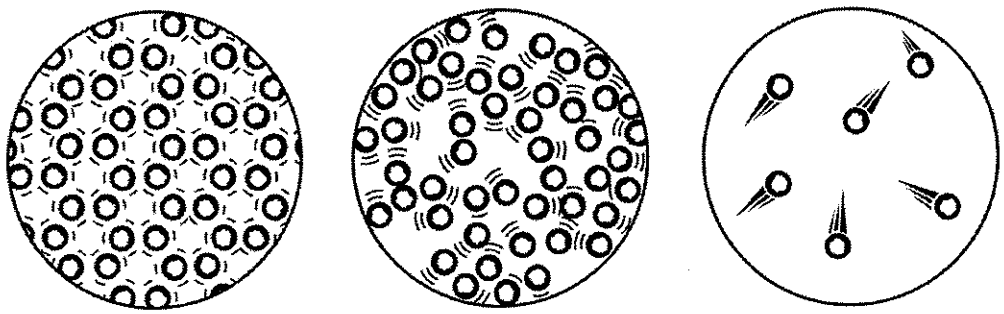
26. Predict what would happen if the original volume of the gas in Step 1 was increased to 2 liters.
27. What is the name of the scientific law illustrated in this diagram? Summarize that law.

Write an answer to the following question(s).

30. Compare solids, liquids, and gases in terms of their shapes and volumes.

Use the diagram to answer the question(s).

Three States of a Substance



State A *State B* *State C*

28. If each substance modeled in the diagram were removed from its container, which state would be most affected? Explain.

29. Which of the three states modeled would not have a definite volume or a definite shape? Explain.