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CHAPTER 13 STUDY GUIDE FOR CONTENT MASTERY

States of Matter

Section 13.1 Gases

In your textbook, read about the kinetic-molecular theory.

Complete each statement.

1. The kinetic molecular theory describes the behavior of gases in terms of particles in ___motion___.
2. The kinetic-molecular theory makes the following assumptions.
   - **a.** In a sample of a gas, the volume of the gas particles themselves is very ___small___ compared to the volume of the sample.
   - **b.** Because gas particles are far apart, there are no significant attractive or repulsive ___forces___ between gas particles.
   - **c.** Gas particles are in constant and ___random___ motion.
   - **d.** The collisions between gas particles are ___elastic___; that is, no ___kinetic___ energy is lost.
3. The kinetic energy of a particle is represented by the equation ___$KE = 1/2mv^2$___.
4. ___Temperature___ is a measure of the average kinetic energy of the particles in a sample of matter.

In your textbook, read about explaining the behavior of gases.

For each statement below, write *true* or *false*.

___true___ 5. Gases are less dense than solids because there is a lot of space between the particles of a gas.

___true___ 6. The random motion of gas particles causes a gas to expand until it fills its container.

___false___ 7. The density of a gas decreases as it is compressed.

___true___ 8. A gas can flow into a space occupied by another gas.

___true___ 9. The diffusion of a gas is caused by the random motion of the particles of the gas.

___false___ 10. Lighter gas particles diffuse less rapidly than do heavier gas particles.

___true___ 11. During effusion. a gas escapes through a tiny opening into a vacuum.

___false___ 12. Graham's law of effusion states that the rate of effusion for a gas is directly related to the square root of its molar mass.

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Section 13.1 *continued*

In your textbook, read about gas pressure.

Circle the letter of the choice that best completes the statement or answers the question.

13. Pressure is defined as force per unit
(a.) area. **b.** mass. **c.** time. **d.** volume.

14. What is an instrument designed to measure atmospheric pressure?
(a.) barometer **b.** manometer **c.** sphygmomanometer **d.** thermometer

15. The height of the liquid in a barometer is affected by all of the following EXCEPT the
a. altitude. **c.** density of the liquid in the column.
b. atmospheric pressure. (d.) diameter of the column tube.

16. The pressure of the gas in a manometer is directly related to which of the following quantities?
a. height of the mercury column in the closed-end arm
b. height of the mercury column in the open-end arm
c. a + b
(d.) a − b

17. One atmosphere is equal to a pressure of
a. 76 mm Hg. (b.) 101.3 kPa. **c.** 147 psi. **d.** 706 torr.

18. The partial pressure of a gas depends on all of the following EXCEPT the
a. concentration of the gas. **c.** size of the container.
(b.) identity of the gas. **d.** temperature of the gas.

19. The pressure of a sample of air in a manometer is 102.3 kPa. What is the partial pressure of nitrogen (N_2) in the sample if the combined partial pressures of the other gases is 22.4 kPa?
a. 62.4 kPa (b.) 79.9 kPa **c.** 102.3 kPa. **d.** 124.7 kPa

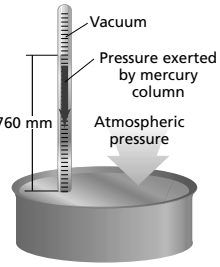
Use the figure to answer the following questions.

20. What instrument is illustrated in the figure? ___barometer___

21. Who invented this instrument? ___Evangelista Torricelli___

22. What are the two opposing forces that control the height of the mercury in the column?
___gravity and atmospheric pressure___

23. What does it mean when the level of mercury rises in the column?
___The atmospheric pressure has increased.___



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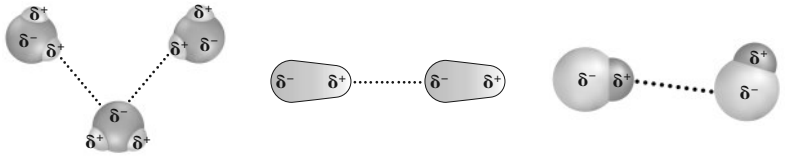
CHAPTER 13 STUDY GUIDE FOR CONTENT MASTERY

Section 13.2 Forces of Attraction

In your textbook, read about forces of attraction.

Answer the following questions.

1. Ionic, metallic, and covalent bonds are examples of what type of forces? **intramolecular forces**
2. Dispersion forces, dipole–dipole forces, and hydrogen bonds are examples of what type of forces? **intermolecular forces**
3. Describe dispersion forces.
   Dispersion forces are weak forces that result from temporary shifts in the density of electrons in electron clouds.
4. Dispersion forces are greatest between what type of molecules?
   identical nonpolar molecules
5. Describe a permanent dipole.
   A permanent dipole contains regions that always have a slightly negative charge and regions that always have a slightly positive charge.
6. Describe dipole–dipole forces.
   Dipole–dipole forces are attractions between oppositely charged regions of polar molecules.
7. Describe a hydrogen bond.
   A hydrogen bond is a dipole–dipole attraction that occurs between molecules, each containing a hydrogen atom bonded to a small, highly electronegative atom with at least one lone electron pair.
8. Identify each of the diagrams below as illustrating dipole–dipole forces, dispersion forces, or hydrogen bonds.



a. **hydrogen bonds**

b. **dispersion forces**

c. **dipole–dipole forces**

9. Rank dipole–dipole forces, dispersion forces, and hydrogen bonds in order of increasing strength.
   dispersion forces → dipole–dipole forces → hydrogen bonds

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CHAPTER 13 STUDY GUIDE FOR CONTENT MASTERY

Section 13.3 Liquids and Solids

In your textbook, read about liquids and solids.

In the space at the left, write *true* if the statement is true; if the statement is false, change the italicized word or phrase to make it true.

true 1. The constant *motion* of the particles in a liquid causes the liquid to take the shape of its container.

true 2. At room temperature and one atmosphere of air pressure, the density of a liquid is much *greater* than that of its vapor.

tightly 3. Liquids are not easily compressed because their particles are *loosely* packed.

intermolecular 4. A liquid is less fluid than a gas because *intramolecular* attractions interfere with the ability of particles to flow past one another.

true 5. Liquids that have stronger intermolecular forces have *higher* viscosities than do liquids with weaker intermolecular forces.

decreases 6. The viscosity of a liquid *increases* with temperature because the increased average kinetic energy of the particles makes it easier for the particles to flow.

true 7. Liquids that can form hydrogen bonds generally have a *high* surface tension.

true 8. A liquid that rises in a narrow glass tube shows that the adhesive forces between the particles of the liquid and glass are *greater* than the cohesive forces between the particles of the liquid.

true 9. Solids have a definite shape and volume because the motion of their particles is limited to *vibrations* around fixed locations.

more 10. Most solids are *less* dense than liquids because the particles in a solid are more closely packed than those in a liquid.

an amorphous 11. Rubber is *a crystalline* solid because its particles are not arranged in a regular, repeating pattern.

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CHAPTER 13 STUDY GUIDE FOR CONTENT MASTERY

Section 13.4 Phase Changes

In your textbook, read about phase changes.

Complete the table by writing the initial and final phases for each phase change and making a check (✔) in the correct energy column.

Phase Change	Phase		Energy	
	initial	final	required	released
1. Condensation	Gas	Liquid		✓
2. Deposition	Gas	Solid		✓
3. Freezing	Liquid	Solid		✓
4. Melting	Solid	Liquid	✓	
5. Sublimation	Solid	Gas	✓	
6. Vaporization	Liquid	Gas	✓	

For each item in Column A, write the letter of the matching item in Column B.

Column A

b **7.** Temperature at which a liquid is converted into a crystalline solid

c **8.** Temperature at which the forces holding a crystalline lattice together are broken

a **9.** Temperature at which the vapor pressure of a liquid equals the external or atmospheric pressure

Column B

a. boiling point

b. freezing point

c. melting point

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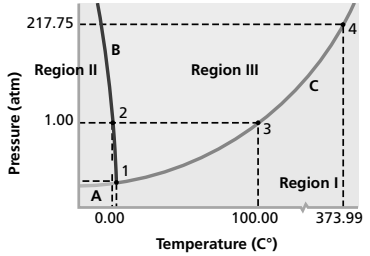
Section 13.4 *continued*

In your textbook, read about phase diagrams.

Use the phase diagram for water to answer the following questions.



10. What variables are plotted on a phase diagram?
temperature and pressure

11. What phase of water is represented by each of the following regions?

a. Region I vapor

b. Region II solid

c. Region III liquid

12. What does point 2 represent?
the normal freezing point of water

13. What is the temperature at point 3?
100.00°C

14. What does line A represent?
the temperatures and pressures at which solid water and water vapor coexist

15. What is point 4 called? What does it represent?
Critical point; the pressure and temperature above which water cannot exist as a liquid