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Assessment

Chapter Test B

Chapter: Gases

PART I In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

_____ **1.** If the temperature of a gas remains constant, then the pressure of the gas will increase if the
- **a.** mass of the gas molecules decreases.
- **b.** diffusion of the gas molecules increases.
- **c.** size of the container is decreased.
- **d.** number of gas molecules in the container is decreased.

_____ **2.** When Gay-Lussac's law of combining volumes holds, which of the following can be expressed in ratios of small whole numbers?
- **a.** pressures before and after reaction
- **b.** volumes of gaseous reactants and products
- **c.** kelvin temperatures
- **d.** molar masses of products and molar masses of reactants

_____ **3.** Equal volumes of ideal gases at the same temperature and pressure contain equal numbers of
- **a.** protons.
- **b.** ions.
- **c.** particles.
- **d.** electrons.

_____ **4.** At constant temperature and pressure, the volume of a gas is directly proportional to its
- **a.** molar mass.
- **b.** number of moles.
- **c.** density at STP.
- **d.** rate of diffusion.

_____ **5.** To use the ideal gas law to determine the molar mass of a gas, you
- **a.** must determine the mass of a molar volume of that gas.
- **b.** may use the mass of any known volume of the gas.
- **c.** may not use a volume of less than 22.4 L.
- **d.** must make the volume measurement at STP.

_____ **6.** Suppose that two unlike gases are injected into opposite ends of a long tube at the same time and allowed to diffuse toward the center. They should begin to mix
- **a.** at the end that held the heavier gas.
- **b.** between the end where the heavier gas entered and the middle.
- **c.** between the end where the lighter gas entered and the middle.
- **d.** exactly in the middle.

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_____ **7.** The value of the gas constant is

a. $0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$.

b. $0.0281\ \text{L} \cdot \text{atm}$.

c. $0.0281 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$.

d. $0.0821\ \text{mol} \cdot \text{K}$.

PART II Write the correct term (or terms) in the space provided.

8. The ideal gas law combines Boyle's law, Charles's law, Gay-Lussac's law, and _____.

9. The pressure of a gas is directly proportional to the number of moles of the gas if both volume and _____ are constant.

10. If a fixed quantity and volume of a gas undergoes a change in temperature, it will also experience a change in _____.

11. To study the relationship between the pressure and volume of a fixed amount of gas, hold the _____ constant.

12. Standard pressure is the atmospheric pressure balanced by a column of mercury with a height of exactly _____.

13. When the temperature of a gas remains constant, the mathematical expression of Boyle's law is _____, where V and P represent the original volume and pressure, and V' and P' represent the new volume and pressure.

14. The process by which gas particles under pressure flow through a tiny opening is called _____.

15. The force per unit area on a surface is called _____.

16. The SI unit of force is the _____.

17. A device used to measure atmospheric pressure is a(n) _____.

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18. The pressure exerted by each gas in a mixture is called the _____ of that gas.

19. If the temperature and number of moles of a gas remain constant but the volume increases, the pressure of the gas will _____.

20. The lowest possible temperature, corresponding to zero on the kelvin scale, is referred to as _____.

PART III On the line to the left of each expression in the first column, write the letter of the expression in the second column that is most closely related.

_____**21.** The pressure of a fixed mass of gas varies directly with the kelvin temperature at constant volume.

_____**22.** The volume of a fixed mass of gas varies inversely with the pressure at constant temperature.

_____**23.** At constant temperature and pressure, the volumes of gaseous reactants and products can be expressed as ratios of small whole numbers.

_____**24.** Equal volumes of gases at the same temperature and pressure contain equal numbers of molecules.

_____**25.** The total pressure of a mixture of gases is equal to the sum of the partial pressures of the component gases.

_____**26.** The relationship between pressure, volume, and temperature is expressed by this law.

a. Dalton's law

b. Charles's law

c. Gay-Lussac's law

d. Boyle's law

e. combined gas law

f. Pascal's law

g. gas pressure law

h. ideal gas law

i. Gay-Lussac's law of combining volumes

j. Avogadro's law

k. Graham's law

_____**27.** Pressure times volume equals molar amount times 0.0821 L·atm/(mol·K) times temperature in kelvins.

_____**28.** The rates of effusion of gases at the same temperature and pressure are inversely proportional to their molar masses.

_____**29.** The volume of a fixed mass of gas varies directly with the kelvin temperature at constant pressure.

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PART IV Write the answers to the following questions on the line to the left, and show your work in the space provided.

_____ **30.** Convert 0.75 atm to mm Hg.

_____ **31.** The pressure of a sample of helium in a 200. mL container is 2.0 atm. If the helium is compressed to a volume of 10. mL without changing the temperature, what would be the pressure of the gas?

_____ **32.** The volume of a gas at 7.00°C is 49.0 mL. If the volume increases to 74.0 mL and the pressure is constant, what will the temperature of the gas be?

_____ **33.** The pressure of a 70.0 L sample of gas is 600. mm Hg at 20.0°C. If the temperature drops to 15.0°C and the volume expands to 90.0 L, what will the pressure of the gas be?

_____ **34.** The volume of a gas is 120. L at 0.500 atm and 15.0°C. What volume will it occupy at 0.250 atm and 10.0°C?

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_____ **35.** The mass of a 1.0 L sample of a gas is 0.716 g at STP. What is the molar mass of the gas?

_____ **36.** What is the density at STP of NO_2 gas (molar mass = 46.01 g/mol) in grams per liter?

_____ **37.** What is the volume of 2.0 g of CS_2 vapor (molar mass = 76.15 g/mol) at 70.°C and 726 mm Hg?

_____ **38.** When calcium carbonate is heated, it produces calcium oxide and carbon dioxide. The equation for the reaction is $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$. How many grams of calcium carbonate (molar mass = 100.09 g/mol) must be decomposed to produce 5.00 L of carbon dioxide at STP?

_____ **39.** How many times greater is the rate of effusion of fluorine gas, F_2 (molar mass = 38.00 g/mol), than that of bromine gas, Br_2 (molar mass = 159.80 g/mol), at the same temperature and pressure?

26. According to the kinetic-molecular theory, the particles in a liquid can change relative positions but still are influenced by attractive forces. Their ability to move about explains the fluidity of liquids and their ability to diffuse. As some particles at the surface of a liquid gain energy, they overcome the attractive force and vaporize.

27. In ionic crystals, monatomic or polyatomic positive and negative ions are arranged in a regular pattern. In metallic crystals, metal atoms are surrounded by a sea of valence electrons. The electrons are donated by the metal atoms and belong to the crystal as a whole.

28. a. 10.7 kJ b. 28.9 kJ

29. 9.83 kJ

30. 0.766 kJ

Equilibrium vapor pressure is the pressure exerted by a vapor in equilibrium with its corresponding liquid at a given temperature.

a. A liquid boils when its equilibrium vapor pressure is equal to atmospheric pressure. At high elevations, there is lowered atmospheric pressure. This means that the equilibrium vapor pressure will equal the lowered atmospheric pressure at a lower temperature.

b. Increasing the temperature of a liquid increases its average kinetic energy. That in turn increases the number of molecules that have enough energy to escape from the liquid phase into the vapor phase. This increased evaporation rate increases the concentration of molecules in the vapor phase, which increases the equilibrium vapor pressure.

11 *Gases,* *pp. 93–103*

TEST A

1. b **2.** c
3. b **4.** d
5. d **6.** a
7. a **8.** a
9. a **10.** b
11. b **12.** b
13. d **14.** a
15. d **16.** c
17. c **18.** a
19. a **20.** d
21. c **22.** a
23. c **24.** a
25. c

TEST B

1. c **2.** b
3. c **4.** b
5. b **6.** b
7. a
8. Avogadro's law
9. temperature
10. pressure
11. temperature
12. 760 mm
13. $V'\ P' = VP$
14. effusion
15. pressure
16. newton
17. barometer
18. partial pressure
19. decrease
20. absolute zero
21. c
22. d
23. i
24. j
25. a
26. e
27. h
28. k
29. b
30. 5.7×10^2 mm Hg
31. 40. atm
32. 150.°C
33. 459 mm Hg
34. 236 L
35. 16 g/mol
36. 2.05 g/L
37. 0.77 L
38. 22.3 g
39. 2.051

12 *Solutions,* *pp. 104–113*

TEST A

1. c **2.** c
3. b **4.** c
5. a **6.** b
7. c **8.** c
9. c **10.** a