Name: KEY Class: _____ Date: _____ ID: A

Chapter 6 & 7 Review

Multiple Choice
Identify the choice that best completes the statement or answers the question.

C 1. Which is NOT true of gas particles?
a. They are farther apart than in a liquid
b. They move more rapidly than in a liquid
c. They are larger than particles than in a liquid
d. They move in random fashion

A 2. As the temperature of a gas increases, the rate of motion of gas molecules
a. increases
b. decreases
c. remains the same
d. varies depending on pressure

A 3. Which of the following is the SI unit for pressure
a. Pa
b. atm
c. mm Hg
d. Torr

A 4. Which law decribes the relationship between the volume and the temperature of a gas?
a. Charles's Law
b. Avogadros's Principle
c. Boyle's Law
d. Dalton's Law

A 5. If the pressure and number of moles of a gas remains constant, the relationship between the volume and temperature, in kelvins, of the gas is a(n) _____.
a. Direct
b. Inverse
c. Designated
d. Reactive

B 6. If the temperature and number of moles of a gas remain constant, the relationship between the volume and pressure of the gas in a(n) proportion.
a. Direct
b. Inverse
c. Designated
d. Reactive

C 7. The conditions of STP are...
a. 0 K and 1 atm
b. 0 K and 1 kPa
c. 0 degrees Celsius and 1 atm
d. 0 degrees Celsius and 1 kPa

A 8. According to the kinetic moleuclar theory, molecules of an ideal gas are
a. constantly moving in a straight line until a collision occurs
b. Constantly moving in orbits around each other
c. Alternatley moving and stopping
d. Constantly changing direction to avoid collisions

D 9. In collisions between ideal gas molecules, the totatl kinetic energy of the molecules...
a. Decreases slightly
b. Increases slightly
c. Increases by a large amount
d. Remains the same

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Problem

10. A chemistry student took a reading of 176 mm Hg from the barometer. Convert this reading to kPa and atm.

$$\frac{176\ \text{mm Hg}}{760\ \text{mm Hg}} \times \frac{1\ \text{atm}}{} = 0.23\ \text{atm}$$

$$0.23\ \text{atm} \times \frac{101.3\ \text{kPa}}{1\ \text{atm}} = 23.3\ \text{atm}$$

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11. The toatl pressure of a mixture of three dry gases is 95.2 kPa. That partial pressure of oxygen is 30.1 kPa and the aprtial pressure of helium is 2.1 kPa. What is the partial pressure of the third gas, nitrogen?

$P_{TOT} = P_{O_2} + P_{He} + P_{N_2}$

$95.2\ \text{kPa} = 30.1\ \text{kPa} + 2.1\ \text{kPa} + P_{N_2}$

$P_{N_2} = 63\ \text{kPa}$

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12. A container of carbon dioxide has a volume of 340.0 cubic centimeters at a temperature of 22 degrees Celsius. If the pressure remains constant, what is the volume at 44 degrees Celsius.

$V_1 = 340\ \text{cm}^3 \quad V_2 = ?$

$T_1 = 22^\circ\text{C} \rightarrow 295\ \text{K} \quad T_2 = 44^\circ\text{C} \rightarrow 317\ \text{K}$

$$\frac{340\ \text{cm}^3}{295\ \text{K}} = \frac{V_2}{317\ \text{K}}$$

$V_2 = 365.4\ \text{cm}^3$

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13. Hydrogen gas is collected over water at 24 degrees Celius (water vapor pressure = 3.0 kPa). When the water level in the collecting bottle is the same as the water level in the surrounding trough, the bottle holds 240.0 cm3 of hydrogen. Atmospheric pressure is 98.5 kPa. Find the volume of the hydrogen gas at 0 degrees Celsius. HINT: you need to use the law of partial pressure first!

$V_1 = 240\ cm^3$

$T_1 = 24°C$

$V_2 = ?$

$T_2 = 0°C$

$$\frac{240.0\ cm^3}{297\ K} = \frac{V_2}{273\ K}$$

$V_2 = 220.6\ cm^3$

My hint was wrong don't worry about using partial pressure!

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14. If I place 3 moles of N2 and 4 moles of O2 in a 35 L container at a temperature of 25 degrees Celsius, what will the pressure of the resulting mixture of gases be?

3 mol + 4 mol = 7 mol in total in the container

$n = 7\ mol$

$V = 35\ L$

$T = 25°C \rightarrow 298\ K$

$P = ?$

$R = 0.0821\ \frac{L \cdot atm}{mol \cdot K}$

$P(35L) = (7\ mol)(0.0821)(298\ K)$

$P = 4.89\ atm$

$$\frac{(85.4\ kPa)(25.0\ mL)}{318\ K} = \frac{(16\ mL)(126.1\ kPa)}{T_2}$$

$T_2 = 300.5\ K$

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15. A sample of nitrogen gas has a temperature of 45 degrees Celsius, a pressure of 85.4 kPa, and a volume of 25.0 mL. What is the temperature of the gas if the volume is changed to 16.0 mL and the pressure is changed to 126.1 kPa?

$T_1 = 45°C$ $\quad T_2 = ?$

$P_1 = 85.4\ kPa$ $\quad V_2 = 16\ mL$

$V_1 = 25.0\ mL$ $\quad P_2 = 126.1\ kPa$

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16. When a cyclinder of helium gas is left standing in the sun, the temperature of the helium reaches 31.5 degrees Celsius. the cylinder has a volume of 50.0 L and contains 42.0 g of helium. What is the pressure inside the cylinder?

$T_1 = 31.5°C$

$V = 50\ L$

$n = 42\ g\ He \left| \frac{1\ mol}{4\ g} \right. = 10.5\ mol$

$P =$

$P(50L) = (10.5\ mol)(0.0821)(304.5$

$P = 5.25\ atm$

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17. A 4.00 L sample of carbon dioxide gas at 280 K and 16.0 atm pressure has a mass of 122 grams. CAlculate the mass of a 4.00 L sample of helium under the same conditions. Which sample contained more particles?

$V = 4.00\ L$

$T = 280\ K$

$P = 16.0\ atm$

About the same amount of particles

$n = 122\ g\ CO_2 \left| \frac{1\ mol}{44\ g} \right. = 2.77\ mol\ CO_2$

$(4.00L)(16\ atm) = n\ (0.0821)(280\ K)$

$n = 2.78\ mol\ He$

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18. Because some gases are colored, their diffusion can be observed. Samples of bromine gas, which is brown, and an unkown purple gas are placed in identical tubes. In the time it takes the bromine to diffuse 1.00 m, the unkonwn gas diffuses 0.79 m. What is the molar mass of the unknown gas?

Br_2 unk

$r_1 = 1.00m$ $r_2 = 0.79m$

$M_1 = 159.8\ g/mol$ $M_2 = ?$

$$\frac{1.00m}{0.79m} = \frac{\sqrt{M_2}}{\sqrt{159.8}}$$

$$M_2 = 256\ g/mol$$

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19. Vinegar contains acetic acid, CH3COOH. Ammonia is NH3. Both liquids will vaporize and diffuse into the room when their containers are opened. If a container of each is opened at a distance of 5.0 m from you, which will you smell first? Explain your answer.

NH_3 will be smelt first because the lightest gas will have the quickest effusion/diffusion rate.

$n = 0.24\ mol$

$V = 2.9\ L$

$P = ?$

$T = 300K$

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$V = ?$

$P_{CO_2} = 755\ torr$

$n = 0.24\ mol\ CO_2$

$T = 300K$

20. CHALLENGE: Consider the following equation:

2 HNO3 (aq) + Na2CO3 (aq) --> 2 NaNO3 (aq) + CO2 (g) + H2O (l)

The experiment was performed and measured at 755 torr of carbon dioxide and at 27 degrees Celsius.

(a) If we started with 30 grams of HNO3, how many L of carbon dioxide are formed?

$$30g\ HNO_3 \left| \frac{1\ mol\ HNO_3}{63g\ HNO_3} \right| \frac{1\ mol\ CO_2}{2\ mol\ HNO_3} = 0.24\ mol\ CO_2$$

$$\frac{755\ torr}{760\ torr} \left| \frac{1\ atm}{} \right. = 0.99\ atm$$

$$(0.99\ atm)(V) = (0.24\ mol)(0.0821)(300K)$$

$$V = 5.97\ L\ CO_2$$

(b) If we captured 2.9 L of water, what is the partial pressure of water in kPa? We are still starting with 30 grams of HNO3.

$$30g\ HNO_3 \left| \frac{1\ mol\ HNO_3}{63g\ HNO_3} \right| \frac{1\ mol\ H_2O}{2\ mol} = 0.24\ mol\ H_2O$$

$$P(2.9L) = (0.24\ mol)(0.0821)(300K)$$

$$P = 2.04\ atm$$

(c) What will be the total pressure of the carbon dioxide and water vapor on the container?

$$P_{TOT} = P_{CO_2} + P_{H_2O}$$

$P_{CO_2} = 755\ torr$ or $0.99\ atm$

$P_{H_2O} = 2.04\ atm$

$$0.99 + 2.04\ atm = P_{TOT}$$

$$P_{TOT} = 3.03\ atm$$