Name: Answer Key Hour: _____

Chapter 14 Review

Honors Chemistry

1. At a temperature of 24.26 °C, a dry gas occupies a volume of 4.588-mL. Assuming constant mass and pressure, what volume will the gas occupy at a temperature of 21.24 °C?

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\frac{.004588}{297.26} = \frac{V_2}{294.24}$ $V_2 = .004541\ L$

2. How many moles of gas are contained in a 50.0-L cylinder at a pressure of 10130.0-kPa and at a temperature of 35 °C?

$PV = nRT$

$n = \frac{PV}{RT} = \frac{(10130)(50)}{(8.31)(308)} = 197.9\ mol$

3. At conditions of 1.03 atm and 15.0 °C, a gas occupies a volume of 45.5-mL. What will the volume of the same gas be at 0.98 atm and 30.0 °C?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{(1.03)(.0455)}{288} = \frac{(.98)V_2}{303}$ $V_2 = .05\ L$

4. Ammonia gas occupies a volume of 575-ml at a pressure of 106-kPa. Assuming mass and temperature are constant, what volume will it occupy at STP?

$P_1V_1 = P_2V_2$

$(106)(.575) = (101.3)V_2$ $V_2 = 0.602\ L$

5. A sample of air contains O_2, N_2, and CO_2. The partial pressure of O_2 is 31.3-kPa, the partial pressure of N_2 is 57.8-kPa, and the partial pressure of CO_2 is 3.9-kPa. What will the partial pressures of the gases be if the total pressure of the air sample is increased to 356.0-kPa? Give answers in atm.

$O_2 = 31.3$

$N_2 = 57.8$

$CO_2 = 3.9$

total = 93 kPa

$\frac{31.3}{93} = \frac{x}{356}$ $\frac{57.8}{93} = \frac{x}{356}$ $\frac{3.9}{93} = \frac{x}{356}$

new Partial Pressures

$O_2 = 1.18\ atm$

$N_2 = 2.18\ atm$

$CO_2 = 0.15\ atm$

6. A gas has a pressure of 3939 Torr at 180 °C. Assuming that mass and volume remain constant, what will the pressure of the gas be in atm when the temperature drops to 75 °C?

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{5.18}{453} = \frac{P_2}{348}$ $\quad \boxed{P_2 = 3.98 \text{ atm}}$

7. How many grams of O_2 gas are contained in a 3.50-L tank where the temperature is 50.0 °C and the pressure is 455.85-kPa?

$PV = nRT$

$n = \frac{PV}{RT} = \frac{(455.85)(3.5)}{(8.31)(323)} = 0.59 \text{ moles}$

$\frac{0.59 \text{ mol}}{1} \times \frac{32 \text{ g } O_2}{1 \text{ mol}} = \boxed{19.0 \text{ g } O_2}$

8. A sample of CO_2 gas has a pressure of 4.3-atm and a temperature of 340 K. What is the density?

$D = \frac{MP}{RT} = \frac{(44)(4.3)}{(.0821)(340)} = \boxed{6.78 \text{ g/L}}$

9. A gas has a pressure of 6.7-atm at 70 °C. Assuming that mass and volume remain constant, what will the pressure of the gas in atmospheres be when the temperature increases to 135 °C?

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{6.7}{343} = \frac{P_2}{408}$ $\quad \boxed{P_2 = 8.0 \text{ atm}}$

10. A gas that has a volume of 12.9 liters, a temperature of 115 °C, and an unknown pressure has its volume increased to 16.3 liters and its temperature decreased to 95 °C. If I measure the pressure after the change to be 455.6-kPa, what was the original pressure of the gas?

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ $\quad \frac{P_1(12.9)}{388} = \frac{(4.5)(16.3)}{368}$ $\quad \boxed{P_1 = 6.0 \text{ atm}}$

Use the following equation to answer questions 11 and 12: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

11. Assuming STP, how many liters of methane (CH_4) will undergo complete combustion with 41.0-L of oxygen gas?

$$\frac{41\ L\ O_2}{1} \left| \frac{1\ mol\ O_2}{22.4\ L} \right| \frac{1\ mol\ CH_4}{2\ mol\ O_2} \left| \frac{22.4\ L\ CH_4}{1\ mol\ CH_4} \right. = \boxed{20.5\ L\ CH_4}$$

12. Assuming STP, how many grams of water will be produced from 20.0-L of oxygen gas?

$$\frac{20\ L\ O_2}{22.4\ L\ O_2} \left| \frac{1\ mol\ O_2}{2\ mol\ O_2} \right| \frac{2\ mol\ H_2O}{1\ mol\ H_2O} \left| \frac{18\ g\ H_2O}{} \right. = \boxed{16.1\ g\ H_2O}$$

13. A sample of neon gas at 102 °C and a volume of 3.7-L is cooled to 25 °C. Assuming pressure and mass are constant, what is the new volume?

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \frac{3.7}{375} = \frac{V_2}{298} \qquad \boxed{V_2 = 2.9\ L}$$

14. Air contains O_2, N_2, CO_2, and other gases. If the partial pressure of N_2= 81.1-kPa, CO_2= 0.058-kPa, and other gases= 1.01-kPa. At STP, what is the partial pressure of O_2? What is the percentage of O_2 in the air?

81.1
+ .058
+ 1.01
82.168

101.3 − 82.168 = P_{O_2} = 19.13 kPa (@STP)

$$\frac{19.13}{101.3} = 18.9\%$$

15. A sample of O_2 occupies a volume of 8.33-L at 135.5-kPa. What pressure would the gas exert if the volume were decreased to 6.17-L?

$P_1V_1 = P_2V_2$ $\quad (1.34)(8.33) = P_2(6.17)$

$$\boxed{P_2 = 1.81\ atm}$$

16. A 4.0 mol sample of gas has a pressure of 785-Torr, at a temperature of 279 K. What volume will it occupy?

$PV = nRT$

$V = \frac{nRT}{P} = \frac{(4)(.0821)(279)}{1.03} = \boxed{89\ L}$

17. A container of N_2 gas has a volume of 8.3 liters with a pressure of 3.17-atm and a temperature of 56 °C. The mass remained the same, but what is the new volume at STP?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\quad \frac{(3.17)(8.3)}{329} = \frac{(1)V_2}{273}$ $\quad \boxed{V_2 = 21.8\ L}$

18. An unknown gas at STP has a density of 0.179 g/L. Determine the unknown gas by calculating the molar mass.

$D = \frac{MP}{RT}$ $\quad \frac{0.179g}{L} = \frac{M(1)}{(.0821)(273)}$ $\quad \boxed{M = 4.09\ g/mol \rightarrow He}$

19. An air sample contains 2.1 mol O_2, 1.3 mol N_2, and 3.7 mol CO_2 at a temperature of 50 °C in a container with a volume of 9.0-L. What is the total pressure of the air sample and what are the partial pressures of each gas?

$P = \frac{nRT}{V}$

$O_2 = \frac{(2.1)(.0821)(323)}{9} = 6.2\ atm$

$N_2 = \frac{(1.3)(.0821)(323)}{9} = 3.8\ atm$

$CO_2 = \frac{(3.7)(.0821)(323)}{9} = 10.9\ atm$

$\boxed{total = 20.9\ atm}$

20. What pressure will be exerted by 22-g of CO_2 at a temperature of 22 °C and volume of 222-mL?

$PV = nRT$

$P = \frac{nRT}{V} = \frac{(0.5)(.0821)(295)}{.222} = \boxed{54.5\ atm}$