NAME:_____ DATE:_____ PERIOD

AP CHEMISTRY REVIEW WORKSHEET
(Unit 5 – The Gas Laws)

1. Nitrogen gas has a pressure of 452 mmHg. What is this pressure in atmospheres? In kilopascals?

$$452\ mmHg \left| \frac{1\ atm}{760\ mmHg} \right. = 0.595\ atm$$

$$452\ mmHg \left| \frac{101.3\ kPa}{760\ mmHg} \right. = 60.2\ kPa$$

2. A sample of a certain gas has a volume of 452 mL at 711 mmHg and 26°C. What would be the volume of this same sample of gas if it were measured at STP?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{(711\ mmHg)(452\ mL)}{299\ K} = \frac{(760\ mmHg)(x)}{273\ K}$$

$$X = 386\ mL$$

3. What is the pressure exerted by 0.981 grams of sulfur dioxide gas placed in a 250. mL container at a temperature of 25°C?

$$0.981g\ SO_2 \left| \frac{1\ mol}{64.07\ g\ SO_2} \right. = 0.0153\ mol\ SO_2$$

$$PV = nRT$$

$$P = \frac{(0.0153)(.08206)(298)}{.250L} = 1.50\ atm$$

4. What is the molar mass of an unknown gas if the density of that gas is 0.762 g/L at a pressure of 0.634 atm and a temperature of 25°C?

$$D = \frac{mP}{RT} \qquad M = \frac{(.762\ g/L)(.08206)(298K)}{.634\ atm}$$

$$\frac{DRT}{P} = M \qquad = 29.4\ g/mol$$

5. For a given sample of gas molecules, the average kinetic energy depends only on the value of the
   a. pressure b. volume c. moles d. temperature

6. Van der Waal's equation includes terms that are intended to correct for which of the following aspects for non-ideal behavior? (Choose the best possible answer.)

a. The volume of real gas molecules is small but not negligible.
b. There are intermolecular attractions in real gases.
c. Van der Waals' equation corrects for both volume of gas molecules and intermolecular attractions.
d. Van der Waals' equation corrects for neither the volume of gas molecules nor intermolecular attractions.

7. A sample of an unknown gas is found to effuse at the rate of 17.7 mmol/hr. Under comparable conditions, gaseous iodine effuses at the rate of 15.0 mmol/hr. What Is the molar mass of the unknown gas?

$$\frac{17.7 \text{ mmol/hr}}{15.0 \text{ mmol/hr}} = \frac{\sqrt{253.82 \text{ g/mol}}}{\sqrt{x}} \qquad x = 182 \text{ g/mol}$$

8. What is the rms speed of argon molecules at 0°C?

$$Urms = \sqrt{\frac{3RT}{MM}} = \sqrt{\frac{3 \cdot 8.314 \cdot 273}{.03995}} = 413 \text{ m/s}$$

9. Diborane reacts with oxygen to give boric oxide and water vapor: $B_2H_6 + 3\,O_2 \rightarrow B_2O_3 + 3H_2O$

If you mix diborane and oxygen in the correct stoichiometric ratio (note the balanced equation above), and if the ***total*** pressure of the mixture is 200. mmHg, what are the partial pressures of the two gases?

molar ratio
$B_2H_6 : O_2$
1 : 3
.25 .75

$P_{B_2H_6}(200.\text{mmHg})(.25) = 50 \text{ mmHg}$
$P_{O_2}(200.\text{mmHg})(.75) = 150 \text{ mmHg}$

10. To determine the molecular formula for a boron hydrogen compound, you place 0.325 g of the gaseous compound in a 0.346-L flask. It exerts a pressure of 325 mmHg at 22°. What is the correct molecular formula of the compound?

27.668 53.32

a. B_2H_6 b. B_2H_5 c. B_4H_{10} d. B_5H_7 e. B_2H_3

$$D = g/L = \frac{0.325 \text{ g}}{0.346 \text{ L}} = .939 \text{ g/L} \qquad MM = \frac{DRT}{P} = \frac{(.939 \text{ g/L})(62.36)(295 \text{ K})}{325}$$

29 $MM = 53.14 \text{ g/mol}$

11. Whose law describes the following: *don't need to know the ~~so~~ names

*The relationship between volume and temperature Charles

*The relationship between temperature and pressure G-L

*The relationship between pressure and volume Boyles

12. A container with 50. grams of hydrogen and 50. grams of oxygen has a pressure of 1050 mmHg. What is the partial pressure of each gas?

$50.g\ H_2 \left| \frac{1\ mol}{2.016\ g} \right. = 25\ mol$

$50.0g\ O_2 \left| \frac{1\ mol}{32.00\ g\ O_2} \right. = 1.6\ mol$

total moles

$26.6\ mol$

$\chi = \frac{25}{26.6} = .94\ H_2$

$\chi = \frac{1.6}{26.6} = 0.060\ O_2$

$H_2 = (1050\ mm\ Hg \times .94) = 987\ mm\ Hg$

$O_2 = (1050\ mm\ Hg \times .060) = 63\ mm\ Hg$

13. Equal masses of helium and neon are placed in separate containers of equal volume at the same temperature. 4.00 20.18

*Pressure of the gases:

a. The pressure of helium is greater than the pressure of neon. b/c you have a greater # of moles of He
b. The pressure of neon is greater than the pressure of helium
c. The pressures of the gases are the same.

*Numbers of atoms:

a. There are more atoms of helium than of neon. b/c more moles
b. There are more atoms of neon than of helium.
c. There are as many atoms of helium as there are of neon.

*Energies of the atoms:

a. The average energy of the helium atoms is greater than that of the neon atoms.
b. The average energy of the neon atoms is greater than that of the helium atoms.
c. The average energy of the helium atoms is the same as that of the neon atoms.

temp