Quiz 5.1–5.6 (A)

Name KEY

NEEDS F to C Formula for # 4

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Three identical flasks contain three different gases at standard temperature and pressure. Flask A contains C_2H_4, flask B contains O_3, and flask C contains F_2. Which flask contains the largest number of molecules?

STP 1 mol = 22.4 L

A) flask A
B) flask B
C) flask C
D) All contain same number of molecules.

2) Place the following gases in order of increasing density at STP.

F_2 NH_3 N_2O_4 Ar

Small to Large

increasing mass

A) $F_2 < Ar < N_2O_4 < NH_3$
B) $N_2O_4 < Ar < F_2 < NH_3$
C) $Ar < F_2 < NH_3 < N_2O_4$
D) $Ar < N_2O_4 < F_2 < NH_3$
E) $NH_3 < F_2 < Ar < N_2O_4$

$\frac{70.9 g Cl_2}{1 mol} \times \frac{1 mol}{22.4 L} = 3.16 g/L$

3) The density of a gas is 3.16 g/L at STP. What is the gas?

A) Cl_2
B) H_2
C) Ar
D) Br_2
E) Kr

4) Given three cylinders containing O_2 gas at the same volume and pressure. Cylinder A is at –15°C, cylinder B is at –5°F, cylinder C is at 255 K. Which cylinder contains the **largest** mass of oxygen?

A) cylinder A
B) cylinder B
C) cylinder C
D) All cylinders contain the same mass of O_2.

A: -15°C, 258 K; B: -5°C, 252 K; C: 255 K, 255 K

KE is lower, therefore has more mass.

5) A gas is at 35.0°C and 3.50 L. What is the temperature at 7.00 L?

35.0°C, 3.50 L | Temp @ 7.00 L | $\frac{T_1}{V_1} = \frac{T_2}{V_2}$

35.0°C + 273 = 308 K

$\frac{308 K}{3.50 L} = \frac{T_2}{7.00 L}$

T_2 = 616 K or 343°C

6) How many molecules of He are contained in a 10.0 L tank at 7.53 atm and 485 K?

10.0 L, 7.53 atm, 485 K | Molecules of He | PV = nRT

PV = nRT

$\frac{PV}{RT} = n$

$n = \frac{7.53 atm \cdot 10.0 L}{0.08206 \frac{L \cdot atm}{mol \cdot K} \cdot 485}$

n = 1.892002583 mol

$1.892002583 \text{ mol He} \times \frac{6.02 \times 10^{23} \text{ molecules He}}{1 \text{ mol He}} = 1.138855 \times 10^{24}$ molecules He

1.14×10^{24} molecules He

7) A 4.00–L flask contains nitrogen gas at 25°C and 1.00 atm pressure. What is the final pressure in the flask if an additional 2.00 g of N_2 gas is added to the flask and the flask cooled to –55°C?

$V_1 = 4.00\text{ L } N_2$

$T_1 = 25.0\,^\circ C\ (298\text{ K})$

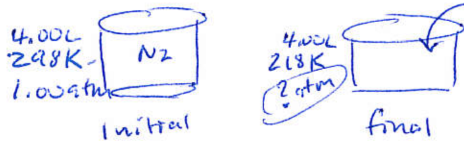
$P_1 = 1.00\text{ atm}$

add 2.00 g N_2

Temp changed to: $-55\,^\circ C$

Final Pressure (P_2)

$PV = nRT$



2.00 g N_2 (# of mol change in the system)

$2.00\text{ g } N_2 \times \frac{1\text{ mol } N_2}{28.02\text{ g } N_2} = 0.07138\text{ mol } N_2$ ← # mols added to the system

Find n_1:

$$n_1 = \frac{(1.00\text{ atm})(4.00\text{ L})}{(0.0821\ \frac{L\cdot atm}{mol\cdot K})(298\text{ K})}$$

$n_1 = 0.163411\text{ mol } N_2$ ← mol in the initial system

initial: 0.163411 mol N_2
added: + 0.07138 mol N_2
total mol in final system: 0.234789 mol N_2

$$P = \frac{(0.234789\text{ mol})(0.0821\ \frac{L\cdot atm}{mol\cdot K})(218\text{ K})}{4.00\text{ L}}$$

$P = 1.05\text{ atm}$

8) A gas mixture contains CO, Ar and H_2. What is the total pressure of the mixture, if the mole fraction of H_2 is 0.350 and the pressure of H_2 is 0.480 atm?

$X_{H_2} = 0.350$

$P_{H_2} = 0.480\text{ atm}$

P_{tot}

$P_a = X_a \cdot P_{tot}$

$P_{tot} = \frac{P_a}{X_a}$

$$P_{tot} = \frac{0.480\text{ atm}}{0.350} = 1.37143\text{ atm}$$

$= 1.37\text{ atm}$

9) A balloon contains 0.76 mol N_2, 0.18 mol O_2, 0.031 mol He and 0.026 mol H_2 at 749 mm Hg. What is the partial pressure of O_2?

$n_{N_2} = 0.76\text{ mol}$

$n_{O_2} = 0.18\text{ mol}$

$n_{He} = 0.031\text{ mol}$

$n_{H_2} = 0.026\text{ mol}$

$P_{tot} = 749\text{ mm Hg}$

P_{O_2}

$X_a = \frac{n_a}{n_{tot}}$

$P_a = X_a \cdot P_{tot}$

$$P_{tot} = 749\text{ mm Hg} \times \frac{1\text{ atm}}{760\text{ mm Hg}} = 0.985526\text{ atm}$$

$$X_{O_2} = \frac{\text{mol } O_2}{n_{total}} = \frac{0.18\text{ mol } O_2}{0.997\text{ mol}} = 0.180542 = X_{O_2}$$

0.76 mol N_2
0.18 mol O_2
0.031 mol He
+ 0.026 mol H_2
0.997 mol = n_{total}

$P_{O_2} = X_{O_2} \cdot P_{tot}$

$= 0.180542 \cdot 0.985526\text{ atm}$

$= 0.177929\text{ atm}$

$P_{O_2} = 0.18\text{ atm}$