

Chem 104 - Test 1 Practice Problems

1. Circle the best answer to each of the following.

a. If c is a constant, the equation that is the basis for Avogadro's hypothesis is

$$V = c/P \quad V = cn \quad P = cT \quad KE = cT \quad V = cT$$

b. A gas sample initially at 1.00 atm is expanded at constant temperature from 50.0 L to 75.0 L. the final pressure is

$$3.33 \text{ atm} \quad 1.50 \text{ atm} \quad 1.00 \text{ atm} \quad 0.667 \text{ atm} \quad 0.200 \text{ atm}$$

c. At STP a 14.3-g sample of gas occupies 5.00 L. What is its molecular weight?

$$2.86 \quad 14.3 \quad 22.4 \quad 64.1 \quad 112$$

d. In a gas mixture of He, Ne, and Ar with a total pressure of 8.40 atm, the partial pressures of He and Ne are 1.50 atm and 2.00 atm, respectively. What is the mole fraction of Ar in the mixture?

$$0.179 \quad 0.714 \quad 0.238 \quad 0.417 \quad 0.583$$

e. A 0.100-mole sample of oxygen gas (m.w. = 32.0) effused through a pin hole in 5.00 seconds. Under the same conditions, how long would it take the same amount of CO_2 (m.w. = 44.0) to effuse?

$$1.17 \text{ s} \quad 3.64 \text{ s} \quad 4.26 \text{ s} \quad 5.86 \text{ s} \quad 6.88 \text{ s}$$

f. Of the following gases, which would deviate most from ideal behavior?



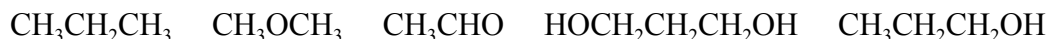
g. Which of the following is *least* soluble in methanol, CH_3OH ?



h. Which of the following solutions would have the highest osmotic pressure?



i. Which of the following has the highest boiling point?



2. Ferrocene, $\text{Fe}(\text{C}_5\text{H}_5)_2$ (m.w. = 186.0 u), is a molecular compound that is highly soluble in carbon tetrachloride (m.w. = 153.8 u). Consider a solution of 0.625 g of ferrocene dissolved in 12.0 g of CCl_4 .
- What is the molality, m , of the solution?
 - Carbon tetrachloride freezes at $-22.3\text{ }^\circ\text{C}$, and has a freezing point constant, K_f , of $28.8\text{ }^\circ\text{C}/m$. What is the freezing point of the solution?
 - What is the mole fraction of carbon tetrachloride in the solution?
 - The normal boiling point of pure CCl_4 is $76.8\text{ }^\circ\text{C}$. What is the vapor pressure in torr of the solution at $76.8\text{ }^\circ\text{C}$?

3. A 3.567-L sample of $\text{CO}_2(g)$ (m.w. = 44.01 u) is collected over water 35.40°C . The pressure inside the vessel is 772.2 torr. At 35.40°C the vapor pressure of water is 43.12 torr.

a. How many moles of $\text{CO}_2(g)$ does the sample contain?

b. What are the mole fractions of $\text{CO}_2(g)$ and $\text{H}_2\text{O}(g)$ in the sample?

4. A solution prepared by dissolving 0.525 g of an unknown non-electrolyte in enough water to make 125 mL of solution has an osmotic pressure of 1.10 atm at 27°C . What is the molar mass of the solute?