Secondary Review: States of Matter

1. a. A 1 liter balloon filled with helium is brought from and outdoor temperature of 5°C to indoor temperature of to 20°C. Describe what is occurring with the molecules using the kinetic molecular theory.

The molecules gain energy as the temperature increases & hit the sides of the balloon more often, increasing the volume of the balloon.

b. Determine the volume of the balloon in the 20°C room.

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{1.00}{278K} = \frac{V_2}{293K}$ $\quad V_2 = \frac{293(1.00)}{278} = 1.05L$

c. if the atmospheric pressure is 1.01atm, how many moles are in the balloon?

$PV=nRT$ $\quad n = \frac{PV}{RT} = \frac{(1.01)(1.00)}{(0.0821)(278K)} = 0.443\ mol$ OR $n = \frac{PV}{RT} = \frac{(1.01)(1.05)}{(0.0821)(293)} = 0.441\ mol$

d. What is the mass of the helium in the balloon.

$0.044\ mol \left| \frac{4.0g}{1\ mol} \right. = 0.18g\ He$

2. a. In a large beaker, 25.0 grams of Na_2SO_4 is dissolved in 1,550 mL. Determine the concentration of the solution.

Na $2\times23 = 46.0$
S 32.1
O $4\times16.0 = 64.0$
$142.1\ g/mol$

$25.0g \left| \frac{1\ mol}{142.1g} \right. = 0.176\ mol$ $\quad 1550mL \left| \frac{1L}{1000mL} \right. = 1.550L$

$\frac{0.176\ mol}{1.55L} = 0.114\ M$

b. Write out the dissolving equation of sodium sulfate.

$Na_2SO_4 \rightarrow 2Na^{+1} + SO_4^{-2}$
$0.114M \quad 0.228M \quad 0.114M$

c. What is the concentration of each ion?

$[Na^{+1}] = 0.228M$ ← twice the amount $\quad [SO_4^{-2}] = 0.114\ M$

d. The solution is diluted when 450 mL of water are added to the large beaker.

↳ $450 + 1550 = 2000mL$ total

$M_1V_1 = M_2V_2$ $\quad (0.114)(1550) = M_2(2000)$ $\quad M_2 = 0.0884M$

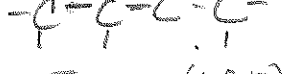
3. a. What is the percent by mass for each element of butene, C_4H_8?

C $4\times12.0 = 48.0$
H $8\times1.0 = 8.0$
56.0

$\frac{48}{56}\times100 = 85.7\%$ carbon $\quad \frac{8}{56}\times100 = 14.3\%$ hydrogen

2-butene

b. Draw a molecule of butene. Is butene polar or nonpolar? → no N, O, or F



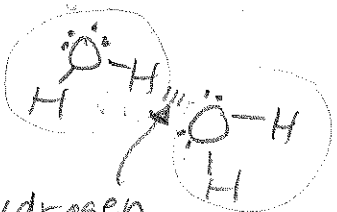
c. What type of intermolecular force is found between these molecules?

London Dispersion Forces (LDF)

4. a. What is the percent by mass for each element of water, H_2O?

H $2\times1.0 = 2.0$
O $1\times16.0 = 16.0$
18.0

$\frac{2}{18}\times100 = 11.1\%$ hydrogen $\quad \frac{16}{18}\times100 = 88.9\%$ oxygen



b. Draw a molecule of water. Is water polar or nonpolar?

c. What type of intermolecular force is found between these molecules? hydrogen bonds

5. a. What is the percent by mass for each element of Carbon Monoxide, CO?

C 12.0
O 16.0
28.0

$\frac{12.0}{28.0}\times100 = 42.9\%$ carbon $\quad \frac{16.0}{28.0}\times100 = 57.1\%$ oxygen

CO
$4+6=10e^-$

b. Draw a molecule of carbon monoxide. Is carbon monoxide polar or nonpolar?

c. What type of intermolecular force is found between these molecules? dipole dipole