CHM 151 Quiz 2a 25 Pts Spring 2009 Name: _____Key_____

$G = 10^9$, $M = 10^6$, $k = 10^3$, $c = 10^{-2}$, $m = 10^{-3}$, $\mu = 10^{-6}$, $n = 10^9$, 2.54 cm = 1 in,
12 in = 1 ft, 5280 ft = 1 mile, 3 feet = 1 yd, 60 sec = 1 min, 1 hr = 60 min, 4 quarts = 1 gal, 2 pints = 1 quart, 454 g = 1 lb.

1. (5 Pts) A car is traveling at a speed of 35 km/hr. Determine how fast the ~~train~~ car is going in miles/second.

$$\frac{35 \text{ km}}{\text{hr}} \left| \frac{10^3}{\text{k}} \right| \frac{\text{in}}{2.54 \times 10^{-2} \text{ m}} \left| \frac{1 \text{ ft}}{12 \text{ in}} \right| \frac{\text{mi}}{5280 \text{ ft}} \left| \frac{\text{hr}}{3600 \text{ s}} \right| = 6.04 \times 10^{-3} \frac{\text{mi}}{\text{s}}$$

2. (5 Pts) Chloroform, $CHCl_3$, has a density of 1.48 g/mL. How many mL of chloroform are needed to provide 165.0 grams?

$$\frac{165.0 \text{ g}}{} \left| \frac{\text{mL}}{1.48 \text{ g}} \right. = 111.5 \text{ mL} \quad \left(112 \text{ mL}\right)$$

3. (8 Pts) Complete the following table:

Element or ion name	Element or ion symbol	Number of Protons	Number of Electrons	Number of Neutrons
chlorine - 37	Cl-37	17	17	20
carbon-14	C-14	6	6	8
A magnesium-25 **cation**	Mg^{2+}-25	12	10	13
An fluorine-18 **anion**	F^{1-}-18	9	10	9

4. (2 Pts) Give the name and the symbol of an element that would be classified as a non-metal _____chlorine_____   _____Cl_____

Give the name and symbol of an element that would be classified as a metal
_____sodium_____   _____Na_____

5. (5 Pts) The recommended adult dose of Elixophyllin®, a drug used to treat asthma, is 6 mg/kg of body mass. Calculate the dose in milligrams for a 155 lb person.

$$\frac{155 \text{ lb}}{} \left| \frac{454 \text{ g}}{\text{lb}} \right| \frac{\text{k}}{10^3} \left| \frac{6 \text{ mg}}{\text{kg}} \right. = 422 \text{ mg}$$

$G = 10^9$, $M = 10^6$, $k = 10^3$, $c = 10^{-2}$, $m = 10^{-3}$, $\mu = 10^{-6}$, $n = 10^9$, 2.54 cm = 1 in, 12 in = 1 ft, 5280 ft = 1 mile, 3 feet = 1 yd, 60 sec = 1 min, 1 hr = 60 min, 4 quarts = 1 gal, 2 pints = 1 quart, 454 g = 1 lb.

1. (5 Pts) Chloroform, $CHCl_3$, has a density of 1.48 g/mL. How many mL of chloroform are needed to provide 265.0 grams?

$$\frac{265.0 \, g}{} \left| \frac{mL}{1.48 \, g} \right. = 179.1 \, mL$$

2. (5 Pts) A car is traveling at a speed of 45 km/hr. Determine how fast the train is going in miles/second.

$$\frac{45 \times 10^3 \, m}{hr} \left| \frac{in}{2.54 \times 10^{-2} \, m} \right| \frac{1 \, ft}{12 \, in} \left| \frac{mi}{5280 \, ft} \right| \frac{hr}{3600 \, s} = 7.77 \times 10^{-3} \frac{m}{s}$$

3. (8 Pts) Complete the following table:

Element or ion name	Element or ion symbol	Number of Protons	Number of Electrons	Number of Neutrons
chlorine-35	Cl-35	17	17	18
carbon-13	C-13	6	6	7
An fluorine-19 **anion**	F^{1-}-19	9	10	10
A magnesium-25 **cation**	Mg^{2+}-25	12	10	13

4. (2 Pts) Give the name and the symbol of an element that would be classified as a non-metal _chlorine_ _Cl_

Give the name and symbol of an element that would be classified as a metal

sodium _Na_.

5. (5 Pts) The recommended adult dose of Elixophyllin®, a drug used to treat asthma, is 6 mg/kg of body mass. Calculate the dose in milligrams for a 175 lb person.

$$\frac{175 \, lb}{} \left| \frac{454 \, g}{1 \, lb} \right| \frac{k}{10^3} \left| \frac{6 \, mg}{kg} \right. = 476.7 \, mg$$

SHOW ALL WORK TO RECEIVE CREDIT

Atomic masses: H 1.008; C 12.01; O 16.00; Na 22.99; K 39.10

1. (5 Pts) Calculate the percent carbon in sodium oxalate ($Na_2C_2O_4$)

$$\frac{24.02}{134.02} \times 100 = \underline{17.92\%}$$

$$
\begin{array}{l}
4 \times 16.00 = 64.00 \\
2 \times 12.01 = 24.02 \\
2 \times 23.00 = \underline{46.00} \\
 134.02
\end{array}
$$

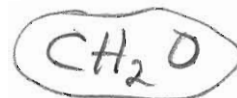2. A compound gave the following elemental analysis: 40.0% carbon, 6.71% hydrogen, and 53.3% oxygen.

a. (6 Pts) Determine the empirical formula of the compound.

Assume 100 g so % = grams

C: $\dfrac{40.0\,g}{} \left| \dfrac{mol}{12.01\,g} \right. = 3.33 \div 3.33 = 1$

H: $\dfrac{6.71\,g}{} \left| \dfrac{mol}{1.01\,g} \right. = 6.64 \div 3.33 = 2$

O: $\dfrac{53.3\,g}{} \left| \dfrac{mol}{16.00\,g} \right. = 3.33 \div 3.33 = 1$

$\boxed{CH_2O}$
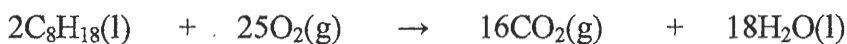
b. (3 Pts) The compound's molar mass was determined to be 90.8 g/mol. Determine the molecular formula.

empirical mass = 30.03

90.8 ÷ 30.03 = 3   so $\boxed{C_3H_6O_3}$
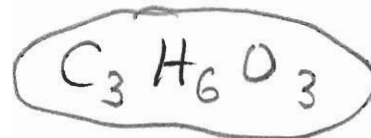
3. Octane undergoes the following combustion reaction:

$$2C_8H_{18}(l) \quad + \quad 25O_2(g) \quad \rightarrow \quad 16CO_2(g) \quad + \quad 18H_2O(l)$$

a. (5 Pts) If 14.7 moles of octane are burned, how many moles of carbon dioxide are produced?

$$2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$$

14.7 mol   ? moles
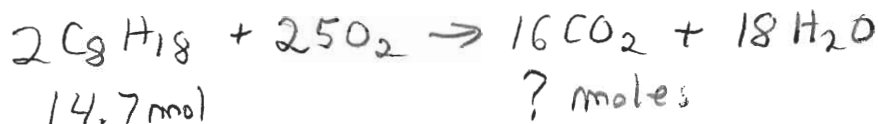
$$\frac{14.7\,mol\ C_8H_{18}}{} \left| \frac{16\ mol\ CO_2}{2\ mol\ C_8H_{18}} \right. = \underline{117.6}\ mol\ CO_2$$

b. (6 Pts) If 45.0 grams of octane are burned, how many grams of carbon dioxide are produced?

$$2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$$

45.0 g   ? g

$$\frac{45.0\,g\ C_8H_{18}}{} \left| \frac{C_8H_{18}}{114.26\,g\ C_8H_{18}} \right| \frac{16\ mol\ CO_2}{2\ mol\ C_8H_{18}} \left| \frac{44.0\,g\ CO_2}{mol\ CO_2} \right. = \underline{138.7}\,g\ CO_2$$

SHOW ALL WORK TO RECEIVE CREDIT

Atomic masses: H 1.008; C 12.01; O 16.00; Na 22.99; K 39.01

1. (5 Pts) Calculate the percent carbon in ~~sodium~~ *potassium* oxalate ($K_2C_2O_4$)

$$\frac{24.02}{166.22} \times 100 = \underline{14.45\ \%\ C}$$

$$\begin{array}{l} 4 \times 16.00 = 64.00 \\ 2 \times 12.01 = 24.02 \\ 2 \times 39.10 = \underline{78.20} \\ \hspace{2.5cm} 166.22 \end{array}$$

2. A compound gave the following elemental analysis: 40.0% carbon, 6.71% hydrogen, and 53.3% oxygen.

a. (6 Pts) Determine the empirical formula of the compound.   (*See Quiz 3a*)

$$CH_2O$$

b. (3 Pts) The compound's molar mass was determined to be 90.8 g/mol. Determine the molecular formula.

$$C_3H_6O_3$$

3. Octane undergoes the following combustion reaction:

$$2C_8H_{18}(l) \quad + \quad 25O_2(g) \quad \rightarrow \quad 16CO_2(g) \quad + \quad 18H_2O(l)$$

a. (5 Pts) If 14.7 moles of octane are burned, how many moles of water are produced?

$$2\ C_8H_{18} + 25O_2 \rightarrow 16\ CO_2 + 18\ H_2O$$
$$14.7\ mol \hspace{5cm} ?\ mole$$

$$\frac{14.7\ mol\ C_8H_{18}}{} \bigg| \frac{18\ mol\ H_2O}{2\ mol\ C_8H_{18}} = \underline{132.3\ mol\ H_2O}$$

b. (6 Pts) If 75.0 grams of octane are burned, how many grams of carbon dioxide are produced?

$$2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$$
$$75.0\ g \hspace{5cm} ?\ g$$

$$\frac{75.0\ g\ C_8H_{18}}{} \bigg| \frac{mol\ C_8H_{18}}{114.26\ g\ C_8H_{18}} \bigg| \frac{16\ mol\ CO_2}{2\ mol\ C_8H_{18}} \bigg| \frac{44.01\ g\ CO_2}{mol\ CO_2} = 231.1\ g\ CO_2$$