Chem 111 **Summer 2013** **Exam I** **Whelan**

Question 1 (3 Points)

If a **115 g** sample of the liquid chlorodibromomethane has a volume of **47.0 mL**, what is the **density** of the compound in **g/mL**?

$$d = \frac{\text{mass}}{V} = \frac{115\text{ g}}{47.0\text{ mL}} =$$

2.45 g/mL

Question 2 (7 Points)

a. When **32.979** is **added** to **85.71**, the result should be reported with **2** digit(s) after the decimal point.

b. When **11.788** and **37.09** are **multiplied**, the answer should be reported to **4** significant digit(s).

c. Identify the number of significant figures in the following numbers.

19.5400 **6** 0.0095 **2** 1030 **3**

Question 3 (4 Points)

How much will a student earn in **13 weeks** if she works for **11 hours each week** at a rate of **$9.00 / hour**?

No need to do the calculation – just set up the correct dimensional analysis conversions – **you may not need to fill in all the boxes**.

13 **weeks** x $\frac{11\text{ hours}}{1\text{ week}}$ x $\frac{\$9.00}{1\text{ hour}}$ x _____

Question 4 (4 Points)

The liquid ethyl acetate has a density of **0.900 g/mL** at 20 °C. If a sample of this liquid at 20 °C has a volume of **1.90 L**, how many **grams** of liquid are there in the sample?

Must show work using Dimensional Analysis

$$1.90\text{ L} \left| \frac{1000\text{ mL}}{1\text{ L}} \right. = 1.90 \times 10^3\text{ mL}$$

$$1.90 \times 10^3\text{ mL} \left| \frac{0.900\text{ g}}{1\text{ mL}} \right. =$$

1.71×10^3 g

Question 5 (6 Points)

How many protons, neutrons and electrons are there in $^{65}_{29}\mathbf{Cu}^{+}$

Protons: **29** Neutrons: **36** Electrons: **28**

Question 6 (6 Points)

The element **gallium** has an atomic weight of **69.7** amu and consists of two stable isotopes. Ga-69 has an atomic mass of **68.9** amu and a percent natural abundance of **60.4%**. Ga-71 has a percent natural abundance of **39.6%**. What is the **atomic mass** of **Ga-71**?

$$0.604(68.9) + 0.396(x) = 69.7$$
$$41.6 + 0.396x = 69.7$$
$$0.396x = 28.1$$
$$x = \frac{28.1}{0.396} =$$

70.9 amu

Question 7 (10 Points)

Use the Periodic Table accompanying this exam to answer the following questions:

1. **Al** is in **period** 3 and **group** IIIA.
2. The **symbol** for the lightest **alkaline earth metal**. Be
3. Element **59** is a(n) Lanthanide
4. Group **VIIA** are collectively **known** as the: Halogens / Halides
5. **Circle** those (if any) of the following that are **Main Group elements**

V **Ni** **(In)** **(Be)** **U**

Question 8 (8 Points)

Give the correct **name** for each of the following ionic compounds.

a. $Mg(NO_2)_2$ Magnesium nitrite

b. NH_4Br Ammonium bromide

c. $Fe_2(SO_4)_3$ Iron(III) sulfate

d. Mg_3N_2 Magnesium nitride

Question 9 (8 Points)

Give the correct **formula** for each of the following ionic compounds.

a. Sodium nitride Na_3N

b. Potassium sulfite K_2SO_3

c. Iron(II) chlorate $Fe(ClO_3)_2$

d. Potassium dichromate $K_2Cr_2O_7$

Question 10 (3 Points)

Assuming that the distance between the atoms that form the following salts are the same order them in increasing Force of Attraction?

Calcium sulfide	Potassium chloride	Aluminum phosphide
Potassium chloride	Calcium sulfide	Aluminum phosphide
Smallest Force of Attraction		Largest Force of Attraction

Question 11 (4 Points)

How many **atoms** of **sulfur** are present in **4.37 moles** of S_2F_{10}? ***Show Work***

$$4.37 \text{ mol } S_2F_{10} \left| \frac{2 \text{ S}}{1 \ S_2F_{10}} \right. = 8.74 \text{ mol S}$$

$$8.74 \text{ mol S} \left| \frac{6.023 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right. =$$

5.26×10^{24} **atoms of S**

Question 12 (4 Points)

How many **moles** of fluorine are present in 1.73×10^{22} **molecules** of O_2F_2? ***Show Work***

$$1.73 \times 10^{22} \text{ molecules } O_2F_2 \left| \frac{1 \text{ mol}}{6.023 \times 10^{23} \text{ molecules}} \right. = 0.0287 \text{ mol } O_2F_2$$

$$0.0284 \text{ mol } O_2F_2 \left| \frac{2 \text{ F}}{1 \ O_2F_2} \right. =$$

0.0574 **mol F**

Question 13
6 Points

A compound is found to contain **30.45 % nitrogen** and **69.55 % oxygen** by weight and a molecular weight of **92.02 g/mol**. What is the **formula** of this compound?

Show Work

N	O
30.45 g	69.55 g
$\frac{30.45}{14.01}$	$\frac{69.55}{16.00}$
2.173 mol	4.347 mol
$\frac{2.173 \text{ mol}}{2.173 \text{ mol}}$	$\frac{4.347 \text{ mol}}{2.173 \text{ mol}}$
1	2

NO_2

NO_2: $14.01 + 2(16.00) = 46.01 \text{ g.mol}^{-1}$

$$\frac{92.02 \text{ g.mol}^{-1}}{46.01 \text{ g mol}^{-1}} = 2$$

N_2O_4

Question 14
6 Points

When the following molecular equations are balanced using the **smallest possible integer coefficients**, the values of these coefficients are:

a) ___ $Cl_2(g)$ + 2 $NaI(s)$ = 2 $NaCl(s)$ + ___ $I_2(s)$

b) 2 $BrF_3(g)$ = ___ $Br_2(g)$ + 3 $F_2(g)$

c) 4 $NH_3(g)$ + 5 $O_2(g)$ = 4 $NO(g)$ + 6 $H_2O(g)$

Question 15
4 Points

An iron nail rusts when exposed to oxygen. According to the following reaction, how many **moles of oxygen** gas are necessary to form **0.632 moles iron(III) oxide?**

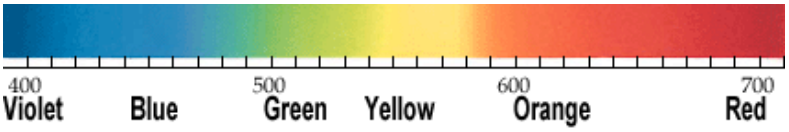
iron (s) + oxygen (g) = iron(III) oxide (s)

$4\,Fe(s) + 3\,O_2(g) = 2\,Fe_2O_3(s)$

$$0.632 \text{ mol } Fe_2O_3 \left| \frac{3\,O_2(g)}{2\,Fe_2O_3(s)} \right. =$$

0.948 **mol oxygen gas**

Question 16
6 Points



a) Put the following forms of visible light in order of **increasing frequency**

3	Violet	1. Lowest Frequency
1	Yellow	2. Second Highest Frequency
2	Green	3. Highest Frequency

b) Put the following forms of visible light in order of **increasing energy**:

2	Green	1. Smallest Energy
3	Blue	2. Second Highest Energy
1	Orange	3. Highest Energy

Question 17
4 Points

A local AM radio station broadcasts at a frequency of **565 kHz**. Calculate the wavelength in meters at which it is broadcasting.

Show Work

$$565\ kHz \left| \frac{1\times10^{3}\ Hz}{1\ kHz} \right. = 5.65\times10^{5}\ Hz$$

$$\lambda\nu = c$$
$$\lambda(5.65\times10^{5}\ s^{-1}) = 2.998\times10^{8}\ m.s^{-1}$$
$$\lambda = \frac{2.988\times10^{8}\ m.s^{-1}}{5.65\times10^{5}\ s^{-1}} =$$

531 **m**

Question 18
7 Points

The wavelength of a particular color of red light is **672 nm**. What is the **energy** of this light in **J.mol^{-1}**?

Show Work

$$672\ nm \left| \frac{1\times10^{-9}\ m}{1\ nm} \right. = 6.72\times10^{-7}\ m$$

$$\lambda\nu = c$$
$$6.72\times10^{-7}\ m\,(\nu) = 2.98\times10^{8}\ m.s^{-1}$$
$$\nu = \frac{2.98\times10^{8}\ m.s^{-1}}{6.72\times10^{-7}\ m}$$
$$= 4.46\times10^{14}\ s^{-1}$$

$$E = h\nu$$
$$= 6.626\times10^{-34}\ J.s\,(4.46\times10^{14}\ s^{-1})$$
$$= 2.96\times10^{-19}\ J$$

$$E = 2.96\times10^{-19}\ J\,(6.023\times10^{23}\ mol^{-1})$$
$$=$$

1.78×10^{5} **J.mol^{-1}**

Do Not Write Below This

Exam I Score