Chem 111 **Summer 2012** **Key I** **Whelan**

Question 1 (10 Points)

a. Give the **correct** number of **significant figures** for each of the following:

0.038 : 2 611.0 : 4

b. Report the answer for the following operation to the **correct number** of **significant figures**: 23.46 + 1.106 = 24.57

c. When **58.6** is divided by **1.90x10^{-2}**, the answer should be reported to 3 **significant digit(s)**.

d. Reported to the correct number of significant figures, how many **hours** are there in **exactly 13** days? 312

e. Write the following number in non-exponential notation. 4.94x10^{4} 49,400

Question 2 (6 Points)

Circle those of the following (**if any**) that have the **same number** of **neutrons** and **electrons**.

^{13}C $^{1}H^{+}$ $^{24}Mg^{2+}$ $^{19}F^{-}$ $^{40}Ca^{2+}$ $^{4}He^{2+}$

Question 3 (6 Points)

A piece of copper contains **1x10^{7} atoms** of **copper**. What is its **volume** in **L**?

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

1 cm^3 Cu = 8.8 g Cu	1 kg = 1000 g	1 L = 1000 cm^3
9.5 x 10^{21} atoms Cu = 1 g Cu		1 cm^3 = 1 mL

$$1.0\times10^{7}\text{ atoms} \times \frac{1\text{ g Cu}}{9.5\times10^{21}\text{ atoms Cu}} \times \frac{1\text{ cm}^3\text{ Cu}}{8.8\text{ g Cu}} \times \frac{1\text{ L}}{1000\text{ cm}^3}$$

Question 4 (6 Points)

How many protons, neutrons and electrons are there in $^{63}_{29}Cu^{2+}$

Protons: 29 Neutrons: 34 Electrons: 27

Question 5 (10 Points)

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

1. **Mn** is in **period** 4 and **group** VII B.
2. The **symbol** for the lightest **alkaline metal**. Li
3. Element **102** is a(n) Actinide
4. Group **VIIIA** are collectively **known** as the: Noble gases
5. The **symbol** of the **heaviest period 4 transition metal**: Zn

Question 6
4 Points

The element copper has an atomic weight of **63.5 amu** and consists of two stable isotopes **copper-63** and **copper-65**.

- The isotope **copper-63** has an atomic mass of **62.9 amu** and a percent natural abundance of **69.1%**.
- The isotope **copper-65** has a percent natural abundance of **30.9%**.

What is the atomic mass of **copper-65**? ***Show Work***

$$0.691(62.9) + 0.309(x) = 63.5$$

$$43.5 + 0.309x = 63.5$$

$$0.309x = 63.5 - 43.5$$

$$x = \frac{63.5 - 43.5}{0.309}$$

64.8 **amu**

Question 7
2 Points

It is a general trend that as **one goes down a group** the **atomic radius** (*distance from nucleus to outermost electron*) increases. From the list below circle the salt that you would **predict** to have the **weakest columbic force of attraction**?

- NaCl
- KBr
- RbI
- LiF

2 Points

Briefly justify your choice.

FA depends on charge and distance. Since the magnitude of the charge is the same in all four, then the salt with the largest radius will have the weakest FA .. RbI

Question 8
8 Points

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

a. Na_2S Sodium sulfide

b. $CrSO_3$ Chromium (II) sulfite

c. $Al_2(SO_4)_3$ Aluminum sulfate

d. $MgCrO_4$ Magnesium chromate

Question 9
8 Points

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

a. Calcium hydroxide $Ca(OH)_2$

b. Magnesium oxide MgO

c. Iron(II) perchlorate $Fe(ClO_4)_2$

d. Ammonium phosphate $(NH_4)_3PO_4$

Question 10 (4 Points) Calculate the **percent by weight** of **carbon** in CH_4O. ***Show Work***

CH_4O: $C + 4(H) + O$

$12.01 + 4(1.01) + 16.00 = 32.05$

$C: \left(\frac{12.01}{32.05}\right)100 = 37.5\%$

37.5 %

Question 11 (4 Points) How many **atoms** of xenon are present in **4.44** moles of **xenon trioxide**? ***Show Work***

$4.4 \text{ mol } XeO_3 \left| \frac{1 \text{ Xe}}{1 XeO_3} \right. = 4.4 \text{ mol Xe}$

$4.4 \text{ mol Xe} \left| \frac{6.023 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right.$

2.67×10^{24} **atoms**

Question 12 (4 Points) How many **moles** of carbon are present in **5.17×10^{22}** molecules of **C_2H_5**? ***Show Work***

$5.17 \times 10^{22} \text{ molecules } C_2H_5 \left| \frac{1 \text{ mol}}{6.023 \times 10^{23} \text{ molecules}} \right.$

$= 8.56 \times 10^{-2} \text{ mol } C_2H_5$

$8.56 \times 10^{-2} \text{ mol } C_2H_5 \left| \frac{2 C}{1 C_2H_5} \right.$

0.172 **moles**

Question 13 (6 Points)

γ rays	X rays	Blue UV	Red IR	Microwave	FM Radio waves	AM Radio waves	Long radio waves

Circle the **correct answer** to each of the following:

a. The **one** with the **shortest wavelength**: (X rays) IR AM

b. The **one** with the **smallest frequency**: X rays (UV) γ Rays

c. The **one** with the **greatest energy**: (FM) AM Long radio waves

Question 14 (6 Points)

A compound is found to contain **46.68% nitrogen** and **53.32% oxygen** by weight and has a molar mass of **60.02** g/mol. What is the **formula** of this compound? ***Show Work***

N: 46.68 g → $\frac{46.68\ g}{14.01\ g.mol^{-1}} = 3.33\ mol$ → $\frac{3.33\ mol}{3.33\ mol}$

O: 53.32 g → $\frac{53.32\ g}{16.00\ g\ mol^{-1}} = 3.33\ mol$ → $\frac{3.33\ mol}{3.33\ mol}$

Empirical formula: NO

NO: $14.01 + 16.00 = 30.01\ g.mol^{-1}$

$\frac{60.02\ g.mol^{-1}}{30.01\ g.mol^{-1}} = 2$

N_2O_2

Question 15 (6 Points)

Balance the following chemical equations using the **smallest** whole number integers possible.

1. 2 $Fe_2O_3(s)$ + 3 $C(s)$ = 4 $Fe(s)$ + 3 $CO_2(g)$

2. Sulfuric acid (H_2SO_4) + sodium hydroxide = Sodium sulfate + water

$H_2SO_4 + 2\ NaOH = Na_2SO_4 + 2\ H_2O$

Question 16 (8 Points)

If your eyes receive a signal consisting of yellow light corresponding to an energy of **2.13×10^5** $J.mol^{-1}$. Determine the **wavelength** of this light in **nm**? ***Show Work***

$2.13 \times 10^5\ J.mol^{-1} \left| \frac{1\ mol}{6.023 \times 10^{23}} \right. = 3.54 \times 10^{-19}\ J$

$E = h\nu$

$3.54 \times 10^{-19}\ J = 6.626 \times 10^{-34}\ J.s\ (\nu)$

$\nu = \frac{3.54 \times 10^{-19}\ J}{6.626 \times 10^{-34}\ J.s}$

$\nu = 5.34 \times 10^{14}\ s^{-1}$

$\lambda\nu = c$

$\lambda(5.34 \times 10^{14}\ s^{-1}) = 2.998 \times 10^8\ m.s^{-1}$

$\lambda = \frac{2.998 \times 10^8\ m.s^{-1}}{5.34 \times 10^{14}\ s^{-1}}$

$= 5.62 \times 10^{-7}\ m$

$5.62 \times 10^{-7}\ m \left| \frac{1\ nm}{1 \times 10^{-9}\ m} \right. = 562\ nm$

562 nm

Do Not Write Below This

Exam I Score