Chem 111 **Summer 2010** **Key I** **Whelan**

Question 1 (10 Points)

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

180: 2 2.30×10^{-3}: 3

b. Report the answer for the following operation to the **correct number** of **significant figures**: 23.46 – 1.1 = 22.4

c. When **58.6** is divided by **77.31**, the answer should be reported to 3 **significant digit(s)**.

d. How many **hours** are there in exactly **26 days**? 624

Question 2 (6 Points)

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

^{13}C ^{1}H ^{24}Mg ^{9}Be $^{40}Ca^{2+}$ ^{4}He

Question 3 (6 Points)

A piece of copper contains **5.4×10^{8}** atoms. What is the **mass** of the sample in **kilograms?**

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
9.5×10^{21} atoms Cu = 1 g Cu		1 cm^3 = 1 mL

$$5.4\times10^{8}\text{ atoms} \times \frac{1\text{ g}}{9.5\times10^{21}\text{ atoms}} \times \frac{1\text{ kg}}{1000\text{ g}} \times \_\_\_\_$$

Question 4 (6 Points)

How many protons, neutrons and electrons are there in $^{81}Br^-$

Protons: 35 Neutrons: 46 Electrons: 36

Question 5 (4 Points)

A certain element consists of **two** stable isotopes.

The first has an atomic mass of **107** amu and a percent natural abundance of **51.8%**.
The second has an atomic mass of **109** amu and a percent natural abundance of **48.2%**
Show Work

$0.518(107) + 0.482(109) = 108\text{ amu}$

108 **AMU**

Question 6 (10 Points)

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

1. **Formula** for the only **diatomic** in **Period 3** — Cl_2
2. **Symbol** for the **heaviest Alkali Earth** element. — Ra
3. **Symbol** for **transition metal** in **Group IB**, **Period 4**. — Cu
4. **Plutonium** (Pu) is a: (**metal**, **nonmetal**, **metalloid**) — Metal
5. Group **IA** are collectively **known** as the: — alkali metals

Question 7 (2 Points)

Circle the salt that has the **greatest** Coulombic **force** of **attraction**?

NaCl CsCl KCl (LiCl)

(3 Points)

Briefly justify your choice.

all have the same charges. All have the same anion. Thus the smallest cation, Na^+, would have the shortest radius (distance) thus > force of attraction

Question 8 (8 Points)

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

a. NH_4OH — Ammonium hydroxide

b. FeS — Iron(II) sulfide

c. $Cu(ClO_2)_2$ — Copper(II) chlorite

d. $CaSO_3$ — Calcium sulfite

Question 9 (9 Points)

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

a. Copper(II) nitrite — $Cu(NO_2)_2$

b. Sodium nitride — Na_3N

c. Calcium hydrogen carbonate — $Ca(HCO_3)_2$

Question 10 (6 Points)

Calculate the **mass percent** of **oxygen** in **dinitrogen tetraoxide**.

Show Work

N_2O_4

$2(14.01)+4(16.00) = 92.02$

$\left(\frac{64.00}{92.02}\right)100 = 69.55\%$

69.55 %

Question 11
6 Points

How many **ATOMS** of **nitrogen** are present in **2.56 moles** of **dinitrogen oxide**?
Show Work

N_2O

$2.56 \text{ mol } N_2O \left| \frac{2 \text{ N}}{1 N_2O} \right.$

$= 5.12 \text{ mol N}$

$5.12 \text{ mol N} \left| \frac{6.023 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right.$

$= 3.08 \times 10^{24} \text{ atoms N}$

3.08×10^{24} **atoms of N**

Question 12
6 Points

A **hydrocarbon** is a compound composed **purely** of **hydrogen** and **carbon**. If a particular hydrocarbon is found to be composed of **89.93% C** and has a molar mass of **120.21** g/mol. What is the **formula** of this hydrocarbon?

	C	H
	89.93%	10.07%
	89.93 g	10.07 g
	7.488 mol	9.970 mol
	$\frac{7.488}{7.488}$	$\frac{9.970}{7.488}$
	1	1.331
x3	3	3.99

Empirical formula: C_3H_4

C_3H_4: $3(12.01) + 4(1.01) = 40.07$

$\frac{120.21 \text{ g.mol}^{-1}}{40.07 \text{ g.mol}^{-1}} = 3$

C_9H_{12}

C_9H_{12}

Question 13
6 Points

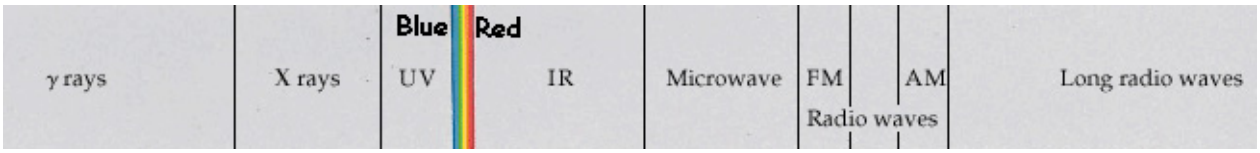
Balance the following chemical equations using the **smallest** whole number integers possible.

1. 2 $C_4H_{10}(g)$ + 13 $O_2(g)$ = 8 $CO_2(g)$ + 10 $H_2O(l)$

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

$H_2SO_4 + 2\,KOH = K_2SO_4 + 2\,H_2O$

Question 13
6 Points



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 **highest frequency**: Visible UV (γ Rays)

c. The **one** with the **smallest energy**: IR (AM) FM

Question 14
6 Points

If your eyes receive a signal consisting of blue light, λ = **4.66×10^{-7}m**. Determine the energy in **J.mol^{-1}** of this light?

$\lambda\nu = c$

$4.66 \times 10^{-7}\,m\,(\nu) = 2.998 \times 10^{8}\,m.s^{-1}$

$\nu = \frac{2.998 \times 10^{8}\,m.s^{-1}}{4.66 \times 10^{-7}\,m}$

$= 6.43 \times 10^{14}\,s^{-1}$

$E = h\nu$

$E = 6.626 \times 10^{-34}\,J.s\,(6.43 \times 10^{14}\,s^{-1})$

$= 4.26 \times 10^{-19}\,J$

$E = 6.023 \times 10^{23}\,(4.26 \times 10^{-19}\,J)$

$= 2.57 \times 10^{5}\,J.mol^{-1}$

2.57×10^{5} **J.mol^{-1}**

Do Not Write Below This

Exam I Score