Chem 111 **Summer 2007** **Key I** **Whelan**

Question 1 (4 Points)

When the following calculation is carried out the answer should be reported to how many **significant figures?**

$$(168)\left[\frac{11.564 - 11.32}{1.248\times10^{3}}\right]$$

Significant Figures 2

Question 2 (6 Points)

A nucleus has **78** protons and **117** neutrons. Fill in the blanks to complete the atomic symbol.

195

Pt

78

Question 3 (4 Points)

Lithium has two naturally occurring isotopes:

	Mass (amu)	Abundance
$^{6}_{3}Li$	6.015	7.42%
$^{7}_{3}Li$	7.016	92.58%

What is the average atomic mass of Lithium? (**Give your answer to 3 decimal places**)

$$6.015(0.0742) + 7.016(0.9258)$$

6.942 **amu**

Question 4 (12 Points)

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

1. **Formula** for the only **diatomic** in **Period 5** I_2
2. **Symbol** for the **heaviest Alkali Earth** element. Ra
3. **Symbol** for **transition metal** in **Group VIB**, **Period 6**. W
4. Group **IIIA** Metals like to have this **charge**. +3
5. **Uranium** (U) is a: (**metal**, **nonmetal**, **metalloid**) Metal
6. Group **VIIA** are collectively **known** as the: Halides

Question 5 (5 Points)

Assuming that the **distance** between the atoms are approximately **the same** which of the following ionic compounds would you expect to have the **strongest** force of attraction: (**Circle your choice**)

a) Sodium chloride b) Magnesium sulfide c) **Aluminum phosphide**

Briefly justify your **choice**:

AlP – Al^{3+} … P^{3-} has the greatest charges. MgS – Mg^{2+} … S^{2-}: NaCl – Na^{+} … Cl^{-}

Question 6 (8 Points)

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

1. CuS **Copper(II) sulfide**
2. $Ca(CO_3)_2$ **Calcium carbonate**
3. Na_3P **Sodium phosphide**
4. $Fe_3(PO_4)_2$ **Iron(II) phosphate**

Question 7 (8 Points)

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

1. Ammonium hydroxide **NH_4OH**
2. Iron(II) sulfate **$FeSO_4$**
3. Potassium chlorate **$KClO_3$**
4. Aluminum chromate **$Al_2(CrO_4)_3$**

Question 8 (8 Points)

Morphine, **$C_{17}H_{19}O_3N$**

A. **0.25** mol of Morphine **weighs** how many **grams?**

$$17(12.01) + 19(1.01) + 3(16.00) + 14.01 = \mathbf{285.37}\ g/mol$$

$$\frac{0.25\ mol\ C_{17}H_{19}O_3N \mid 285.37\ g}{1\ mol} = \mathbf{71g}$$

71 **grams**

B. How many **grams** of **Carbon** is there in **0.25** mol of Morphine?

$$\frac{0.25\ mol\ C_{17}H_{19}O_3N \mid 17\ C}{1\ C_{17}H_{19}O_3N} = \mathbf{4.25\ mol\ C}$$

$$\frac{4.25\ mol\ C \mid 12.01\ g}{1\ mol} = \mathbf{51\ g}$$

51 **grams**

Question 9 (4 Points)

What is the **mass percent** of **N** in **N_2O_5**

$2(14.01) + 5(16.00) = 108.02\ g/mol$ | $(28.02/108.02)\times100$

25.94 **%**

Question 10 (6 Points)

Butyric acid is composed of **carbon** (**54.52%**), **hydrogen** (**9.15%**) and oxygen (**36.31%**). Its molar mass is **88.11** g/mol. Determine the **molecular formula** of the compound.

C	H	O
54.52 g	9.15 g	36.31 g
4.539 mol	**9.059 mol**	**2.269 mol**
$\frac{4.539}{2.269}$	$\frac{9.059}{2.269}$	$\frac{2.269}{2.269}$
2.000	3.992	1
2	**4**	**1**

C_2H_4O

$2(12.01) + 4(1.01) + 16 = \mathbf{44.08}\ g/mol$

$C_4H_8O_2$

Question 11 (9 Points)

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

1. **1** $H_2(g)$ + **1** $Cl_2(g)$ = **2** $HCl(g)$
2. **2** $C_2H_6(g)$ + **7** $O_2(g)$ = **6** $H_2O(l)$ + **4** $CO_2(g)$
3. **3** $KOH(aq)$ + **1** $H_3PO_4(aq)$ = **1** $K_3PO_4(aq)$ + **3** $H_2O(l)$

Question 12 (6 Points)

In the visible region of the electromagnetic spectrum, **red** and **blue** light lie at the extremes. Which of these has:

1. The **longest** wavelength: **Red**
2. The **least** energy: **Red**
3. The **smallest** frequency: **Red**

Question 13 (4 Points)

What is the **frequency** of ultraviolet light with a wavelength of **291** nm?

$$291\ \text{nm}\ \frac{1\times10^{-9}\ \text{m}}{1\ \text{nm}} = 2.91\times10^{-7}\ \text{m}$$

$$\nu = \frac{c}{\lambda} = \frac{2.998\times10^{8}\ \text{m.s}^{-1}}{2.91\times10^{-7}\ \text{m}} = 1.03\times10^{-15}\ \text{s}^{-1}$$

1.03x10-15 **Hz**

Question 14 (6 Points)

A chemical reaction can be initiated by light that carries energy of **2.44×10^{5}** $J.mol^{-1}$. Only light less than a certain wavelength will initiate the reaction.
What is the longest **wavelength**, in **meters**, that can deliver the required energy?
[Show All Work]

$$E = \frac{2.44\times10^{5}\ \text{J.mol}^{-1}}{6.023\times10^{23}\ \text{mol}^{-1}} = 4.051\times10^{-19}\ \text{J}$$

$$\nu = \frac{E}{h} = \frac{4.051\times10^{-19}\ \text{J}}{6.626\times10^{-34}\ \text{J.s}} = 6.114\times10^{14}\ \text{s}^{-1}$$

$$\lambda = \frac{c}{\nu} = \frac{2.998\times10^{8}\ \text{m.s}^{-1}}{6.114\times10^{14}\ \text{s}^{-1}} = 4.90\times10^{-7}\ \text{m}$$

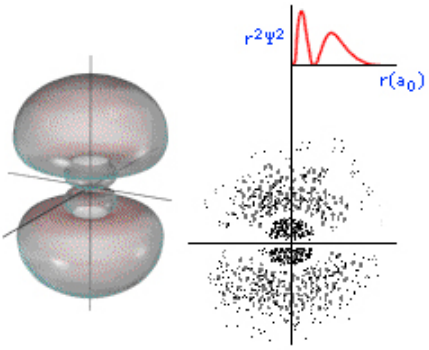
4.90x10-7 **m**

Question 15
10 Points

1. How many orbitals are there with an **n** value equal to 3? **9**
2. How many **nodal** surfaces are associated with a **3p** orbital? **2**

The orbital depicted on the left is:

4. What **type** of orbital? **p**
5. Its **n** value is? **3**
6. What is the **smallest n** value for this type of orbital? **2**



Do Not Write Below This

Exam I Score