Chem 111 Summer 2015 Exam I Whelan

The Periodic Table

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB	VIIIB	VIIIB	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
H 1 1.01																	He 2 4.00
Li 3 6.94	Be 4 9.01											B 5 10.81	C 6 12.01	N 7 14.01	O 8 16.00	F 9 19.00	Ne 10 20.18
Na 11 22.99	Mg 12 24.31											Al 13 26.98	Si 14 28.09	P 15 30.97	S 16 32.07	Cl 17 35.45	Ar 18 39.95
K 19 39.10	Ca 20 40.08	Sc 21 44.96	Ti 22 47.88	V 23 50.94	Cr 24 52.00	Mn 25 54.94	Fe 26 55.85	Co 27 58.93	Ni 28 58.69	Cu 29 63.55	Zn 30 65.39	Ga 31 69.72	Ge 32 72.61	As 33 74.92	Se 34 78.96	Br 35 79.90	Kr 36 83.80
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 263)	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)	Ds 110 (271)	Rg 111 (272)	Uub 112 (285)	Uut 113 (284)	Uuq 114 (289)	Uup 115 (288)			

Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97
Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11

Some Formula and Constants:

$c = 2.998\times10^{8}$ m.s^{-1}

$h = 6.626\times10^{-34}$ J.s

$N = 6.023\times10^{23}$ mol^{-1}

1 nm = 1×10^{-9} m

1 L = 1×10^{3} mL

SID | | | | | | | | | Last ______________ First ______________

Question 1 **4 Points**	A general chemistry student found a **chunk of metal** in the basement of a friend's house. To figure out what it was, the student tried the following experiment. The student measured the **mass of the metal** to be **188.8 g**. Then dropped the metal into a measuring cup and found that it displaced **17.8 mL** of water. This **metal is most likely**: ______________	**Densities of Some Substances** **Substance** — **Density (g/mL)** Water 1.00 Aluminum 2.72 Chromium 7.25 Nickel 8.91 Copper 8.94 Silver 10.50 Lead 11.34 Mercury 13.60 Gold 19.28 Tungsten 19.38 Platinum 21.46

Question 2 — **10 Points**

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

180: ______ 2.30×10^{-3}: ______

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

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

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

Question 3 — **6 Points**

A piece of copper contains **6.7×10^{8} atoms**. What is the volume of the sample in units of **liters**.

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

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

6.7×10^{8} atoms × ———— × ———— × ————

Question 4 — **4 Points**

The element **copper** has two stable isotopes, **copper-63** with an atomic mass of **62.93** amu and **copper-65** with an atomic mass of **64.93** amu. From the atomic weight of **Cu** = **63.54** one can conclude that:

- ❒ both isotopes have the same percent natural abundance
- ❒ **copper-65** has the highest percent natural abundance
- ❒ most **copper** atoms have an atomic mass of **63.54**
- ❒ **copper-63** has the highest percent natural abundance

Question 5 — **4 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 6 **4 Points**	A certain element consists of two stable isotopes: **Exact Mass (amu)** **Abundance (%)** #1 112.9043 4.28 #2 114.9041 95.72 What is the **average atomic mass** of this element? ***Give answer to 6 significant figures*** __________ **amu**
Question 7 **6 Points**	Decide if the following statements are true (**T**) or false (**F**): a) **Protons** and **neutrons** are approximately **equal in mass**. ____ b) The **charge on a proton** is **the same** as the **charge of an electron**. ____ c) The **electron** acts as a **buffer zone** in the **nucleus** ____
Question 8 **10 Points**	Use the Periodic Table accompanying this exam to answer the following questions: a) **Formula** for the only **diatomic** in **Period 3** ____ b) **Symbol** for the **lightest Alkali Metal**. ____ c) **Symbol** for **transition metal** in **Group IB**, **Period 4**. ____ d) **Plutonium** (Pu) is a: (**metal**, **nonmetal**, **metalloid**) ________ e) Group **IIA** are collectively **known** as the: ________
Question 9 **4 Points**	Columbs Law gives that the Force of Attraction (FA) : **FA** $\propto q_a q_b / r^2$ where q_a is the charge on **a** while q_b is the charge on **b** and **r** is the distance between them. 1. Which of the following have the **greatest force of attraction**: a. Mg^{2+} and O^{2-} separated by a distance of **419 pm** b. Mn^{2+} and Se^{2-} separated by a distance of **295 pm** ____ 2. Which of the following have the **greatest force of attraction**: a. Mg^{2+} and O^{2-} separated by a distance of **631 pm** b. K^{+} and Cl^{-} separated by a distance of **226 pm** ____
Question 10 **8 Points**	Give the correct **name** for the following **compounds**: a) Na_2S ________ b) $Mg(NO_2)_2$ ________ c) $Cu_3(PO_4)_2$ ________ d) NH_4Br ________

Question 11 8 Points	Give the correct **formula** for the following **compounds**: a) **Calcium hydroxide** ______________ b) **Aluminum chlorate** ______________ c) **Chromium(II) sulfide** ______________ d) **Potassium sulfite** ______________
Question 12 3 Points	How many **moles of Sr** are there in a sample that contains **1.10×10^{22} strontium atoms**? ***Show Work*** __________ **mol of Sr**
Question 13 5 Points	How many **moles of Cu_2SO_4** are present in **1.39 grams** of this compound? ***Show Work*** __________ **mol Cu_2SO_4**
Question 14 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? __________

Question 15
6 Points

Balance the following chemical equations using the **smallest possible integer coefficients**.

a) ___ C_4H_{10} (g) + ___ O_2 (l) $\longrightarrow$ ___ CO_2 (g) + ___ H_2O (l)

b) **chlorine** (g) + **sodium iodide** (s) $\longrightarrow$ **sodium chloride** (s) + **iodine** (s)

___ __________ + ___ ______________ $\longrightarrow$ ___ ________ + ___ ____________

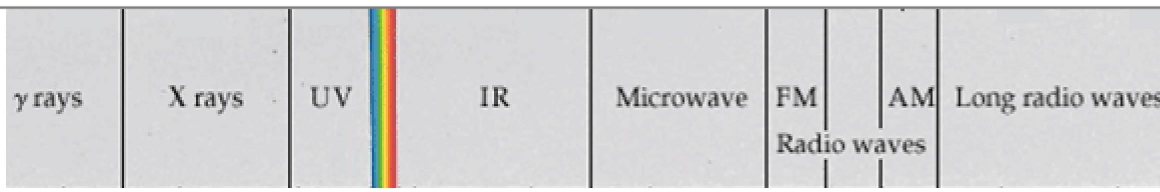
Question 16
4 Points

According to the following reaction, how **many moles of sulfurous acid** (H_2SO_3) will be formed upon the complete reaction of **0.260 moles sulfur dioxide** with **excess water**?

sulfur dioxide (g) + water (l) $\longrightarrow$ sulfurous acid (H_2SO_3) (g)

______________ **mol H_2SO_3**

Question 17
4 Points



a) Put the following forms of electromagnetic radiation in order of **increasing wavelength**?

____ Gamma ray	1. Shortest wavelength
____ Ultraviolet	2. Second shortest wavelength
____ Radio wave	3. Longest wavelength

b) Put the following forms of electromagnetic radiation in order of **increasing energy**?

____ AM	1. Smallest Energy
____ Microwave	2. Second Highest Energy
____ FM	3. Highest Energy

There is one more question on the next page

Question 18 8 Points	The wavelength of a particular color of light is **562 nm**. What is the **energy of this light** in **J.mol^{-1}**? ***Show Work***
	______ **J.mol^{-1}**

Do Not Write Below This

Exam I Score ______