Chem 111, Exam I, Summer 2002

Name: _____ ID: _____ - ____ - _____

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)									

												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

Useful Information

- $N = 6.02 \times 10^{23}\ mol^{-1}$
- $h = 6.626 \times 10^{-34}\ J.s$
- $c = 2.998 \times 10^{8}\ m/s$
- $\lambda\nu = c$
- $E = h\nu$
- Density = m/v

Question 1
8 Points

Fill in the blanks in the following table:

Symbol	$^{32}S^{2-}$	$^{65}Cu^{2+}$
# Protons	16	29
# Neutrons	16	36
# Electrons	18	27

Question 2
5 Points

Lithium has two naturally occurring isotopes:

	Mass	Abundance
^{6}Li	6.0151 amu	7.50%
^{7}Li	7.0160 amu	92.50%

Determine the average Molar Mass of Lithium. **[Show Work]**

Molar Mass = (6.0151)(0.0750) + (7.0160)(0.9250) = 6.94

Question 3
10 Points

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

1. Name the element in the 2nd period of Group VIA. Oxygen
2. Name the lightest Alkali Earth element. Beryllium
3. Give the symbol of the Halogen in the 5th period. I
4. Group 11A Metals like to have what charge +2
5. Group VIIIA are collectively referred to as: Noble Gases

Question 4
5 Points

One of the salts given below is not soluble in water. Circle it and give a brief explanation as to why this might be so?

NaBr $CaCO_3$

$NaBr = Na^{+}, Br^{-}$
$CaCO_3 = Ca^{2+}, CO_3^{2-}$
Stronger Columbic Attraction holding $CaCO_3$ (+2, -2)

Question 5
4 Points

An experiment calls for the use of 0.125 moles of sodium. How many grams is this? **[Show Work]**

0.125 mol Na x (22.99 g/ 1 mol) = 2.87 g

Question 6
6 Points

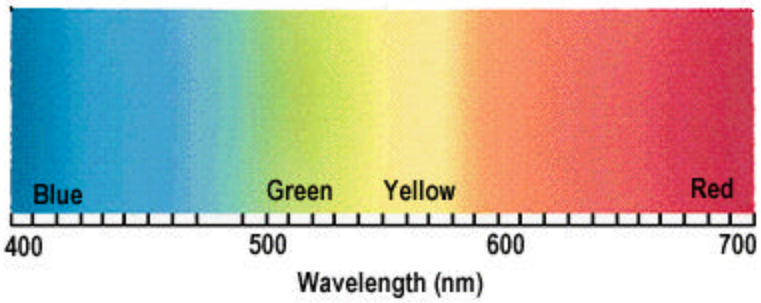
Analysis of Cr_xO_y showed that it contained 68.4% Cr. What is the charge on the Chromium in this oxide? **[Show Work]**

	Cr	O
	68.4 g	31.6 g
	1.315 mol	1.975 mol
	1.00	1.50
x2	2.00	3.00

Empirical Formula: Cr_2O_3

Charge on Cr = +3

Question 7
5 Points



With respect to the green region of the visible spectrum depicted above:
Circle those that apply.

1. The color(s) with a greater frequency is/are: Blue Yellow Red
2. The color(s) with a lower energy is/are: Blue Yellow Red
3. The color(s) with a longer wavelength is/are: Blue Yellow Red

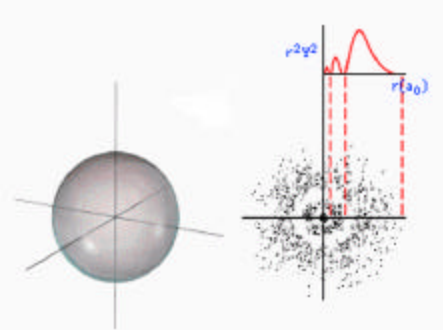
Question 8
6 Points

An FM radio broadcasts @ 8.89×10^7 Hz. What wavelength does this correspond to? **[Show Work]**

$$\lambda\nu = c$$
$$\lambda(8.89 \times 10^7\ s^{-1}) = 2.998 \times 10^8\ m.s^{-1}$$
$$\lambda = 3.37\ m$$

Question 9
9 Points

The following question refer to the orbital depicted below:



1. This is what type of orbital? s
   (I am looking for the letter designation)
2. What value of n is associated with this? 3
3. What is the total number of orbitals that can have this n value? 9

Question 10
6 Points

Aluminum emits light with a wavelength of 396.15 nm (1 nm = $1x10^{-9}$ m). What is the energy associated with one photon of this light.

[Show Work]

396.15 nm ($1x10^{-9}$ m/1 nm) = $396.15x10^{-9}$ m = $3.9615x10^{-7}$ m

$\lambda\nu = c$

$(3.9615x10^{-7}\ m)\nu = 2.998x10^{8}\ m.s^{-1}$

$\nu = [2.998x10^{8}/3.9615x10^{-7}]\ s^{-1} = 7.5678x10^{14}\ s^{-1}$

$E = h\nu$

$E = (6.626x10^{-34}\ J.s^{-1})(7.5678x10^{14}\ s^{-1}) = 5.0145x10^{-19}\ J$

Question 11
6 Points

An unknown organic compound is found to be 74.0% C, 8.70% H and 17.30% N. It's molar mass is 162.0 $g.mol^{-1}$. What is the molecular formula of this compound?

[Show Work]

C	H	N
74.0 g	8.70 g	17.30 g
6.16 mol	8.61 mol	1.23 mol
5.01	7.00	1.00

Empirical Formula: C_5H_7N

Empirical Molar Mass: $5(12.01) + 7(1.01) + 14.01 = 81.13\ g.mol^{-1}$

Molar Mass of Unknown: $162.0\ g.mol^{-1}$

Molecular Formula: $C_{10}H_{14}N_2$

Question 12 Give the correct name for each of the following ionic compounds.
8 Points

1. $Fe_2(SO_4)_3$ Iron(III) sulfate
2. $Al(OH)_3$ Aluminum hydroxide
3. $NaClO_2$ Sodium chlorite
4. K_3P Potassium phosphide

Question 13 Give the correct formula for each of the following ionic compounds.
8 Points

1. Ammonium chloride NH_4Cl
2. Iron(III) oxide Fe_2O_3
3. Potassium dichromate $K_2Cr_2O_7$
4. Magnesium cyanide $Mg(CN)_2$
   On the actual exam this was Lead cyanide. This name was somewhat unambiguous based on how I asked you to name transition metals. Thus full credit was given for all attempts at a formula.

Question 14 Give the correct formula for each of the following:
8 Points

1. Nitric acid HNO_3
2. Perchloric acid $HClO_4$
3. Lithium hydroxide $LiOH$
4. Sulfuric acid H_2SO_4

Question 15 Balance the following chemical equations:
6 Points

1. $2\ Cr(s) + 3\ Cl_2(g) = 2\ CrCl_3(s)$
2. $3\ Fe(s) + 4\ H_2O(g) = Fe_3O_4(s) + 4\ H_2(g)$
3. $C_2H_5OH(l) + 3\ O_2(g) = 2\ CO_2(g) + 3\ H_2O(g)$