Name: _____ **ID:** _____ - ____ - _____

Chem 110 Fall 2002 Exam I I

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

Solubility Rules for some ionic compounds in water

	Soluble Ionic Compounds
1.	All sodium (Na^+), potassium (K^+) and ammonium (NH_4^+) salts are SOLUBLE.
2.	All nitrate (NO_3^-), acetate ($CH_3CO_2^-$), chlorate (ClO_3^-), and perchlorate (ClO_4^-) salts are SOLUBLE.
3.	All chloride (Cl^-), bromide (Br^-), and iodide (I^-) salts are SOLUBLE - EXCEPT those also containing: lead, silver, or mercury (I), (Pb^{+2}, Ag^+, Hg_2^{+2}) which are NOT soluble.
4.	All fluoride (F^-) salts are SOLUBLE - EXCEPT those also containing: magnesium, calcium, strontium, barium, or lead (Mg^{+2}, Ca^{+2}, Sr^{+2}, Ba^{+2}, Pb^{+2}) which are NOT soluble.
5.	All sulfate (SO_4^{-2}) salts are SOLUBLE - EXCEPT those also containing: calcium, silver, mercury (I), strontium, barium, or lead (Ca^{+2}, Ag^+, Hg_2^{+2}, Sr^{+2}, Ba^{+2}, Pb^{+2}), which are NOT soluble.
	Not Soluble Ionic Compounds
6.	Hydroxide (OH^-) and oxide (O^{-2}) compounds are NOT SOLUBLE - EXCEPT those also containing: sodium, potassium or barium (Na^+, K^+, Ba^{+2}), which are soluble.
7.	Sulfide (S^{-2}) salts are NOT SOLUBLE - EXCEPT those also containing: sodium, potassium, ammonium, or barium (Na^+, K^+, NH_4^+, Ba^{+2}), which are soluble.
8.	Carbonate (CO_3^{-2}) and phosphate (PO_4^{-3}) salts are NOT SOLUBLE EXCEPT those also containing: sodium, potassium or ammonium (Na^+, K^+, NH_4^+) which are soluble.

Assigning Oxidation Numbers

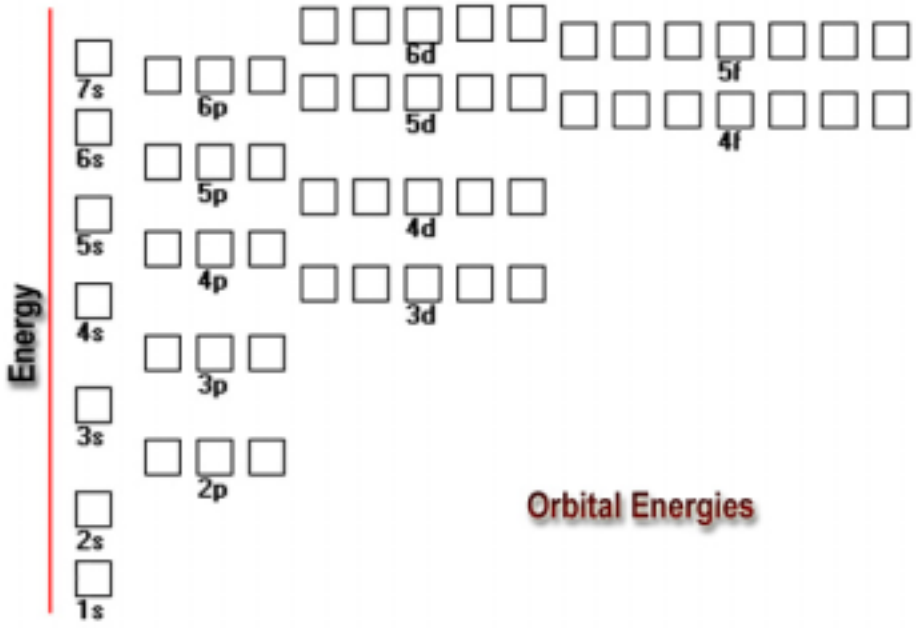
This is a more complete set of rules than your text book. It always works.

Use these rules in order.
The sum of all oxidation numbers of all elements = charge on substance

		Oxidation Number:
1.	**Atoms in their elemental state**	0
2.	**Monatomic ions**	Charge

IN COMPOUNDS

3.	**Group 1A**	+1
4.	**Group 2A**	+2
5.	**Fluorine**	-1
6.	**Hydrogen**	+1
7.	**Oxygen**	-2
8.	**Group 7A**	-1
9.	**Group 6A**	-2



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Some Average Single- and Multiple-Bond Energies*

Single Bonds

	H	C	N	O	F	Si	P	S	Cl	Br	I
H	436	414	389	464	569	293	318	339	431	368	297
C		347	293	351	439	289	264	259	330	276	238
N			159	201	272		209		201	243?	
O				138	184	368	351		205		201
F					159	540	490	285	255	197?	
Si						176	213	226	360	289	
P							213	230	331	272	213
S								213	251	213	
Cl									243	218	209
Br										192	180
I											151

Multiple Bonds

N=N	418	C=C	611
N≡N	946	C≡C	837
N=O	590	C=O (in O=C=O)	803
C≡N	891	C=O (as in $H_2C=O$)	745
O=O (in O_2)	498	C≡O	1075

*In kilojoules per mole.

Other Information For Your Use:

Zinc = Zn Lead = Pb Copper = Cu Silver = Ag

Question 1
(6 points)

1. When aqueous solutions of **zinc(II) sulfate** and **lead(II) nitrate** are combined a precipitate results. What is the formula for the precipitate?

_____

Do Not Write Here

2. When aqueous solutions of **copper(II) iodide** and **silver(I) acetate** are combined a precipitate results. What is the formula for the precipitate?

_____

Question 2
(16 Points)

1. Consider the reaction when aqueous solutions of **$NiNO_3$** and **$Ba(OH)_2$** are combined. The net ionic equation for this reaction is:

_____

2. Consider the reaction when aqueous solutions of **sodium sulfide** and **copper(II) nitrate** are combined. The net ionic equation for this reaction is:

Do Not Write Here

_____

3. Write a net ionic equation for the reaction that occurs when aqueous solutions of **NaOH** and **HCl** are combined.

_____

4. Write a net ionic equation for the reaction that occurs when aqueous solutions of **KOH** and **HF** are combined.

_____

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Question 3 (9 Points) What is the oxidation state of:

Do Not Write Here

nitrogen in NO_3^- ? _____ **carbon** in $H_2C_2O_4$? _____

oxygen in O_2 ? _____

Question 4 (12 Points) Identify the species oxidized, the species reduced, the oxidizing agent and the reducing agent in the following electron transfer reaction.

$$Cl_2 + 2\ Cr^{2+} = 2\ Cl^- + 2\ Cr^{3+}$$

Do Not Write Here

1. species oxidized: _____
2. species reduced: _____
3. oxidizing agent: _____
4. reducing agent: _____
5. During the reaction, electrons are transferred from _____ to _____.

Question 5 (16 Points)

1. What is the **complete** electron configuration for the **lithium** atom?

   _____

2. What is the **complete** electron configuration for the **aluminum ion**?

   _____

3. What is the **valence** electron configuration for the **silicon** atom?

   _____

Do Not Write Here

4. What is the **valence** electron configuration for the **chloride ion**?

   _____

5. A main group element with the valence electron configuration $2s^2 2p^3$ is in periodic group _____. It forms a monatomic ion with a charge of _____.

6. A main group element with the valence electron configuration $2s^1$ is in periodic group _____. It forms a monatomic ion with a charge of_____.

Question 6 (8 Points)

Consider the following elements:

Sb, **As**, **Bi**, **P**

1. Which would you expect to have the smallest atomic radius? _____
2. Which would you expect to be most metallic? _____
3. Which would you expect to have the largest ionization energy? _____
4. Which would you expect to be least electronegative? _____

Do Not Write Here

Consider the following elements:

Se, **Ge**, **As**, **Br**

1. Which would you expect to have the smallest atomic radius? _____
2. Which would you expect to be most metallic? _____
3. Which would you expect to have the smallest ionization energy? _____
4. Which would you expect to be most electronegative? _____

Question 7 (8 Points)

From the Lewis diagrams of the species given, pick all of those in which the central atom obeys the octet rule.

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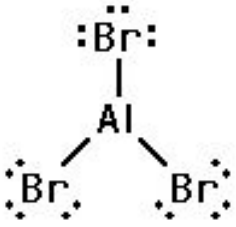
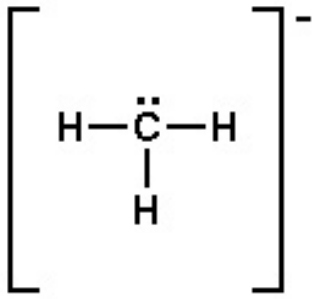
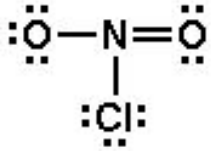


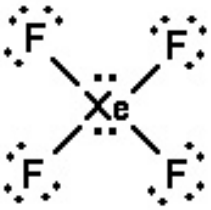
Yes No



Yes No



Yes No



Yes No

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Question 8 (8 Points) Draw Lewis structures for **ClO_3^-** and **NO^+**.

Do Not Write Here

ClO_3^-	NO^+

Question 9 (9 Points) Draw Lewis structure for **Ozone** and any resonance structures that it may have?

Do Not Write Here

O_3

Question 10 (8 Points) Using average bond energies estimate the enthalpy change for the following reaction:

$2H_2(g) + O_2(g) = 2H_2O(g)$

Do Not Write Here

The reaction is (Circle One): Exothermic Endothermic

Score:	**Note:**
Do Not Write Here	Do Not Write Here