Do not open the exam until you are told to do so.

Cell phones and other electronic devices must be turned off and stowed out of sight (your sight and mine). Calculator policy is in effect. Infractions will cost you points!

ALL outside paper must be stowed out of sight. Unauthorized materials will result in your exam being removed and a score of 0 assigned. If you reach a point where you need more scratch paper than the space available, ask a proctor.

Please clearly and legibly write your name, in ink, at the top of both pages of your answer sheet. Your score will not be recorded and your exam will not be returned if this is not done.

All answers should be rounded to the appropriate precision (correct significant figures.)

Atomic weights are provided in the Periodic Table. These values must be used.

Be certain your answers are clear. If an answer is not clear, it will probably be considered wrong.

Use your time effectively.

When authorized to open your exam, you may carefully remove this cover sheet. When you are finished with your exam, please turn in **the two answer sheets.** Make sure your name is clearly written on every page.

Time is up at 12:15!!

Potentially useful information:
6.022×10^{23}

Molar mass values:
NO 30.01 S_4N_4 184.32 Ag_2O 231.8 Ag_2S 247.9

Solubility trends:
1. Group 1 (1A) compounds, ammonium compounds, and acids are soluble.
2. All nitrates, acetates, chlorates, and perchlorates are soluble.
3. Silver, lead, mercury(I) and copper(I) compounds are INSOLUBLE.
4. Chlorides, bromides, and iodides are soluble.
5. Sulfates are soluble except calcium sulfate and barium sulfate.
6. Compounds with anions of 2– or 3– charge are INSOLUBLE.
7. Hydroxides are INSOLUBLE except calcium hydroxide and barium hydroxide.

THE PERIODIC TABLE

	1 (1A)																	18 (8A)
1	1 H 1.008	2 (2A)											13 (3A)	14 (4A)	15 (5A)	16 (6A)	17 (7A)	2 He 4.003
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31	3 (3B)	4 (4B)	5 (5B)	6 (6B)	7 (7B)	8	9 (8B)	10	11 (1B)	12 (2B)	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.96	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
6	55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
7	87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (265)	105 Db (268)	106 Sg (271)	107 Bh (272)	108 Hs (277)	109 Mt (276)	110 Ds (281)	111 Rg (280)	112 Cn (285)	113 Uut (284)	114 Uuq (289)	115 Uup (288)	116 Uuh (293)	117 Uus (294)	118 Uuo (294)

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

Based on IUPAC 2007 (publ 2009).

name_____

Scored grade (instructor use only!)_____

1. Write **balanced, net ionic chemical equations**, with appropriate **phase labels**, for the following reactions. In both cases, you may use as much scratch space as you need, but write your final answer **legibly** in the box.

a. [10 pts] The reaction of **aqueous silver nitrate and aqueous zinc bromide.

(remember to give net ionic, balanced rxn, and include phase labels.)

b. [10 pts] The reaction of **aqueous sodium hydroxide and aqueous chlorous acid.

(remember to give net ionic, balanced rxn, and include phase labels.)

2. [2 pts each] Give the correct **oxidation number** for **sulfur** in each chemical species below.

calcium sulfate_____ sulfur tetrachloride _____

** $S_4O_3^{2-}$ _____ S_8 _____ hydrogen sulfide _____

3. [2 pts each]

**(a) give the formula of hydrofluoric acid: _____

(b) give the formula of sodium hydrogen sulfite: _____

**(c) give the name of HNO_2: _____

(d) give the name of H_3PO_4: _____

(e) give an example of an amphoteric species: _____

name_____

4. **(a) [5 pts] Balance the following redox reaction, occurring in aqueous solution. We'll grade the answer in the box, so make sure it's clearly legible.

(work space:) ___ H^+ + ___ Cl^- + ___ HNO_2 → ___ HClO + ___ N_2O + ___ H_2O

(final answer:)
___ H^+ + ___ Cl^- + ___ HNO_2 → ___ HClO + ___ N_2O + ___ H_2O

(b) [2 pts each] In the above reaction, what is:

the element reduced? _____ the reducing agent? _____

5. (a) [6 pts] In the list below, circle all substances that are INSOLUBLE in aqueous solution.

K_3PO_4 $Al(OH)_3$ CuCl CaC_2O_4 AgBr MoO_3

(b) [6 pts] In the list below, circle all substances that are strong electrolytes.

HF ammonia $AgClO_4$ potassium hydroxide H_2O CO_2

(c) [6 pts] In the list below, circle all substances that would react with acids to form gaseous products.

$K_2C_2O_4$ $CaCO_3$ $NaHSO_3$ LiOH $(NH_4)_2SO_4$ ammonia

6. [2 pts each] **Clearly** label each statement as TRUE or FALSE. If we can't tell which you mean, it's wrong.

_____ **Only ionic compounds can dissociate in water.

_____ **A nonelectrolyte dissociates completely when dissolved in water.

_____ **If a reaction is done at stoichiometric amounts of all reactants, then no reactant is in excess.

_____ Strong acids are strong electrolytes.

_____ **H^+ is always a spectator ion in an acid/base reaction.

_____ H_2O is always a product in an acid/base reaction.

_____ CH_3OH is a strong base.

_____ In a balanced reaction, the total charge must be the same in the reactants and products.

name_____

**7. [5 pts] You need to prepare 150.0 mL of 2.7 M potassium nitrate. How many grams of potassium nitrate are needed? SHOW YOUR WORK below and write your final answer in the space.

Answer: _____g

8. The following equation is balanced.

$$S_4N_4 + 4\ Ag_2O \rightarrow 4\ Ag_2S + 4\ NO$$

**(a) [5 pts] The reaction is conducted beginning with 26.37 g S_4N_4 and 69.23 g Ag_2O. How many grams of NO can be made? SHOW YOUR WORK below and write your final answer in the space.

Answer: _____g NO

(b) [4 pts] After the reaction described above, 6.90 g of NO are actually recovered. What is the percent yield in this experiment? SHOW YOUR WORK and write the answer in the space.

Answer: _____%

9. [3 pts] In the space provided, draw a simple sketch showing the interaction between an aqueous bromide ion and a water molecule. Represent relevant charges accurately.