

October 13

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:

$$6.022 \times 10^{23}$$

Molar mass values:

NO 30.01

S₄N₄ 184.32

Ag₂O 231.8

Ag₂S 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)	2 (2A)																	18 (8A)
1 H 1.008																		
2 Li 6.941	4 Be 9.012																	
3 Na 22.99	12 Mg 24.31	3 (3B)	4 (4B)	5 (5B)	6 (6B)	7 (7B)	8 (8B)	9 (9B)	10 (10B)	11 (11B)	12 (12B)	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18	
4 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	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95	
5 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 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 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 mercury(II) perchlorate and aqueous potassium sulfide.

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

b. [10 pts] The reaction of **aqueous ammonia and aqueous hydrofluoric acid.

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

2. [2 pt each] Give the correct **oxidation number** for **the underlined element** in each chemical species below.



3. [2 pts each]

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

(b) give the formula of ammonium dihydrogen phosphate: _____

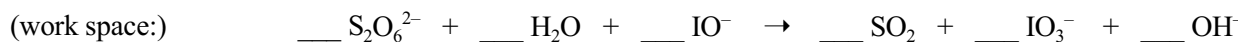
** (c) give the name of HCN: _____

(d) give the name of HIO_4 : _____

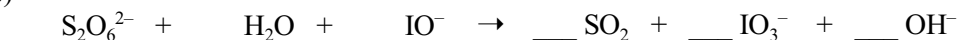
(e) give an example of a weak electrolyte: _____

name _____

4. ******(a) [6 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.



(final answer:)



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

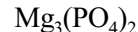
the element reduced? _____ the reducing agent? _____

an element whose oxidation number does not change in the reaction? _____

(c) [1 pt each] What is the highest (most positive) possible oxidation number for S? _____

What is the lowest (most negative) possible oxidation number for S? _____

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



(b) [6 pts] In the list below, **circle** all substances that are **strong** electrolytes. Draw a **rectangle** around any species that are **weak** electrolytes.

hypochlorous acid

methane

lead(IV) nitrate



aluminum hydroxide

barium hydroxide

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

_____ ****** Barium hydroxide is a strong electrolyte.

_____ ****** When zinc chloride dissolves in water, there are twice as many cations as there are anions present in the solution.

_____ ****** When HF dissolves in water, water pulls apart all the molecules of HF.

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

_____ A solution of HClO₂ contains HClO₂ molecules, H⁺ ions, and ClO₂⁻ ions.

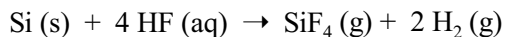
_____ In a redox reaction, the number of electrons lost by the reducing agent usually equals the number of electrons gained by the oxidizing agent, but this is not required.

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

name _____

7. In the problems that follow, **SHOW YOUR WORK** on this page (or clearly indicate where your setups can be found and evaluated). Write your answers, **rounded appropriately** and **with unit(s)**, in the spaces provided.

The following equation is balanced:



(a) [3 pts] What mass of HF is required to prepare 5.00 L of 1.00 M HF? (Show work/round answer/include unit)

(Answer: _____)

(b) [3 pts] What volume of 1.00 M HF is required to react completely with 30.0 g of Si? (Show work/round answer/include unit)

(Answer: _____)

(c) [5 pts] A 2.02-g sample of Si is added to 250.0 mL of 1.0 M HF. How much SiF_4 is produced? (Show work/round answer/include unit)

(Answer: _____)

(d) [4 pts] In the reaction in Part (c), which reactant is in excess, and what is the **mass** of the excess reactant remaining after the reaction? (Show work/round answer/include unit)

Reactant in excess _____ Mass remaining _____

8. [3 pts] In the space provided, draw a simple sketch showing the interaction between an aqueous **aluminum ion** and a **water molecule**. Represent relevant charges accurately.

