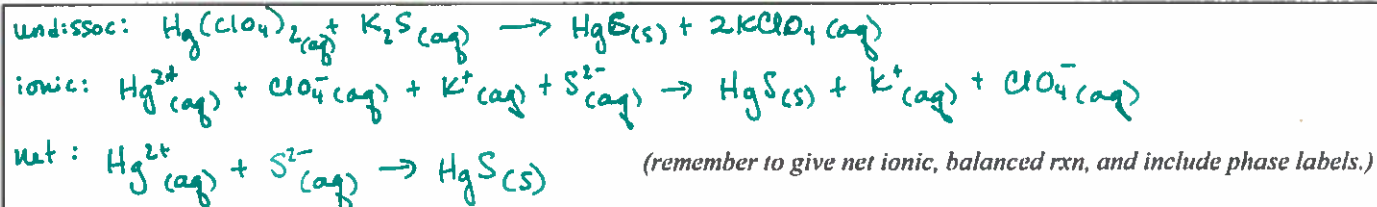


name Key

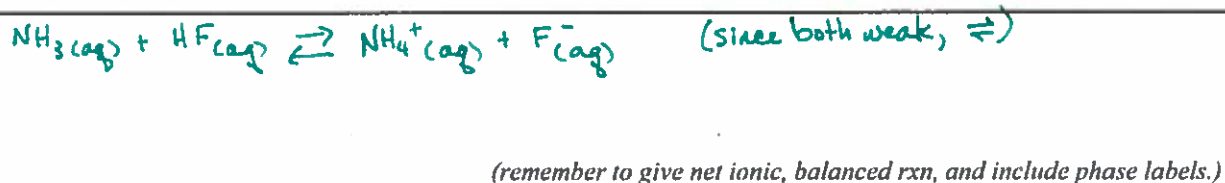
Scored grade (instructor use only!) _____

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.

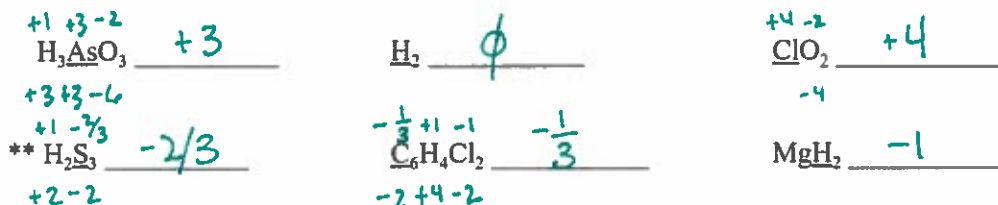
a. [10 pts] The reaction of **aqueous mercury(II) perchlorate and **aqueous potassium sulfide**.



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



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: oxalate: $\text{C}_2\text{O}_4^{2-}$ $\text{H}_2\text{C}_2\text{O}_4$

(b) give the formula of ammonium dihydrogen phosphate: NH_4^+ H_2PO_4^- $\text{NH}_4\text{H}_2\text{PO}_4$

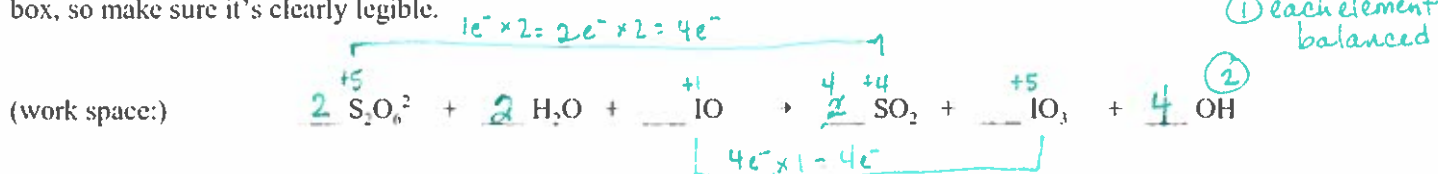
**c) give the name of HCN: hydrocyanic acid

(d) give the name of HIO_4 : periodic acid

(e) give an example of a weak electrolyte: HF ($\text{NH}_3, \text{HNO}_2, \text{HC}_2\text{H}_3\text{O}_2, \text{HCN}, \text{H}_2\text{C}_2\text{O}_4, \dots$)
 (any weak acid or weak base that is not a soluble ionic compound)

name Key

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? S the reducing agent? IO⁻an element whose oxidation number does not change in the reaction? H or O(c) [1 pt each] What is the highest (most positive) possible oxidation number for S? +6What is the lowest (most negative) possible oxidation number for S? -25. (a) [6 pts] In the list below, circle all substances that are **INSOLUBLE** in aqueous solution.NH₄HSFe(NO₃)₃Ag₂SIr(OH)₃Mg₃(PO₄)₂WO₂(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) nitrateH₂SO₄

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.

True ** Barium hydroxide is a strong electrolyte.False ** When zinc chloride dissolves in water, there are twice as many cations as there are anions present in the solution.
Handwritten: ZnCl₂, Zn²⁺, Cl⁻False ** When HF dissolves in water, water pulls apart all the molecules of HF.
Handwritten: weak acidFalse ** H⁺ is always a spectator ion in an acid/base reaction.True A solution of HClO₂ contains HClO₂ molecules, H⁺ ions, and ClO₂⁻ ions.
Handwritten: weak acidFalse 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.False In a balanced reaction, the total number of molecules must be the same in the reactants and products.

name Key

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)

$$\frac{1.00 \text{ mol}}{19.00 \text{ g/mol}} \times 5.00 \text{ L} \times \frac{1.00 \text{ mol}}{\text{L}} \times \frac{20.01 \text{ g HF}}{\text{mol}} = 100. \text{ g HF} \quad (\text{Answer: } \underline{100. \text{ g HF}})$$

(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)

$$(\text{Answer: } \underline{4.27 \text{ L HF}})$$

$$30.0 \text{ g Si} \times \frac{\text{mol}}{28.09 \text{ g}} \times \frac{4 \text{ mol HF}}{1 \text{ mol Si}} \times \frac{\text{L}}{1.00 \text{ mol}} =$$

(c) [5 pts] A 2.02-g sample of Si is added to 250.0 mL of 1.0 M HF. How much SiF₄ is produced? (Show work/round answer/include unit)

$$\begin{array}{l} \text{SiF}_4: \\ 28.09 \\ 76.00 \\ \hline 104.09 \text{ g/mol} \end{array} \quad 2.02 \text{ g Si} \times \frac{\text{mol}}{28.09 \text{ g}} \times \frac{1 \text{ mol SiF}_4}{1 \text{ mol Si}} \times \frac{104.09 \text{ g SiF}_4}{\text{mol SiF}_4} = 7.48 \text{ g SiF}_4$$

(Answer: 6.5 g SiF₄)

$$0.2500 \text{ L HF} \times \frac{1.0 \text{ mol}}{\text{L}} \times \frac{1 \text{ mol SiF}_4}{4 \text{ mol HF}} \times \frac{104.09 \text{ g SiF}_4}{\text{mol SiF}_4} = \boxed{6.51 \text{ g SiF}_4}$$

(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 Si Mass remaining 0.2 g

$$0.250 \text{ L HF} \times \frac{1.0 \text{ mol}}{\text{L}} \times \frac{1 \text{ mol Si}}{4 \text{ mol HF}} \times \frac{28.09 \text{ g Si}}{\text{mol Si}} = 1.76 \text{ g used} \quad 2.02 - 1.8 = 0.2 \text{ g remaining}$$

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.

