

**US110 Exam 2. October 14, 2005**

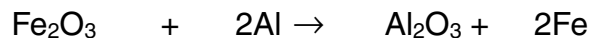
Name \_\_\_\_\_ **Note: You must show all work for credit.**

I certify that I have neither given nor received unauthorized aid on this assignment.

$$M = \frac{\text{moles}}{L}$$

Useful information: \_\_\_\_\_, LEO says GER

(1)(6 points) A flask containing 5.00 g of Al and 14.1 g of Fe<sub>2</sub>O<sub>3</sub> were reacted according to the following equation.



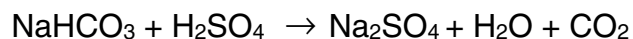
(a) Which reagent is the limiting reagent?

(b) How much Al<sub>2</sub>O<sub>3</sub> should form?

(c) If the amount of Al<sub>2</sub>O<sub>3</sub> formed was 7.62 g, what is the % yield?

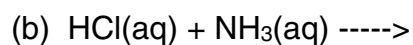
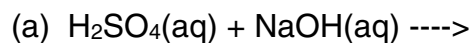
(2)(2 points) How would you make a 500.0 mL, 0.100 M solution of HCl from a 6.80 M stock solution?

(3)(4 points) If it takes 22.1 mL of 0.108 M  $\text{H}_2\text{SO}_4$  to fully react with the  $\text{NaHCO}_3$  (according to the unbalanced reaction below) in a 15.00 mL sample of water. How much  $\text{NaHCO}_3$  was present (in grams)?

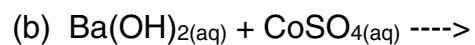


(4)(4 points) Aspirin is acetylsalicylic acid,  $\text{C}_9\text{H}_8\text{O}_4$ . It is derived from salicylic acid ( $\text{C}_7\text{H}_6\text{O}_3$ ) which is found in willow tree bark. What is the elemental composition of aspirin (in mass %)?

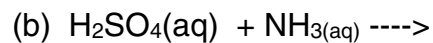
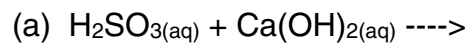
(5)(4 points) Write the net acid-base reactions for the following neutralizations



(6)(4 points) Write the balanced molecular, ionic and net ionic equations for the following reactions



(7)(4 points) Complete the following neutralization reactions and balance them for complete neutralization (all acidic protons neutralized, all basic units neutralized).



(8)(2 points) Label the following strong electrolytes, weak electrolytes, or nonelectrolytes

(a)  $\text{PBr}_3$

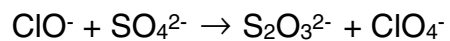
(b)  $\text{HBr}$

(c)  $\text{NH}_3$

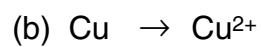
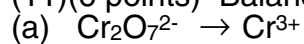
(d)  $\text{MgS}$

(9)(4 points) The active component in cannabis is tetrahydrocannabinol (THC) which has a chemical formula of  $\text{C}_{21}\text{H}_{30}\text{O}_2$ . This is produced as a prescription drug called Dronabinol (or Marinol). Some unknown powder was collected by police (who suspected it was THC) although they are told it is a headache powder. If the results of the elemental analysis are 60.0% C, 4.49% H, and 35.6 % O, what is the empirical formula for the sample? Can it be THC (remember to show work)?

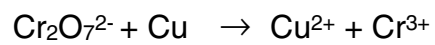
(10)(4 points) Break the following reaction into an oxidation and a reduction 1/2 reaction. Show all work and the oxidation states of the species being oxidized and reduced. You don't have to balance the 1/2 reactions.



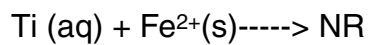
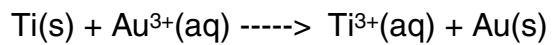
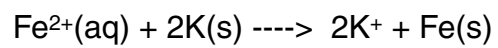
(11)(6 points) Balance the following half-reactions in base



(12)(4 points) Balance the following oxidation-reduction reaction in base



(13)(4 points) Construct an activity series based on the following experimental results



(14)(4 points) Name a reagent that you could use to separate the  $\text{Ni}^{2+}$  and  $\text{Ba}^{2+}$  from a solution of  $\text{Ni}(\text{NO}_3)_2$  and  $\text{Ba}(\text{NO}_3)_2$  by a precipitation. Write out the precipitation reaction and list which metal will be in the precipitate and which will be left in solution.

(15)(4 points) Write out the ground state electron configurations for the following atoms. Do not use the noble gas shortcut.

(d) Na

(c)  $\text{Cl}^-$

(b) S

(a)  $\text{N}^{3-}$

Extra credit (2 points): On problem #5, if you found that it could be THC, could you list anything other than THC that has that formula? If you found that it could not be THC, what could it be?