

Chem 105 Exam 3. November 17, 2004

Name Key

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(48)

(1)(4 points) Define the following

(a) Arrhenius acid a substance that forms  $H_3O^+$  in water

(b) Arrhenius base a substance that forms  $OH^-$  in water

(c) Brønsted-Lowry acid an  $H^+$  donor

(d) Brønsted-Lowry base an  $H^+$  acceptor

(2)(2 points) Name the following acids and bases

(a)  $HClO_2$  chlorous acid

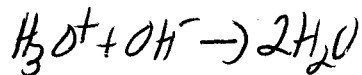
(b)  $NH_3$  ammonia

(c)  $KOH$  potassium hydroxide

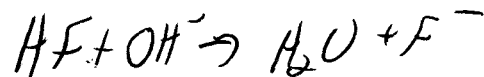
(c)  $HI$  hydroiodic acid

(3)(4 points) Write the net acid-base reactions for the following neutralizations

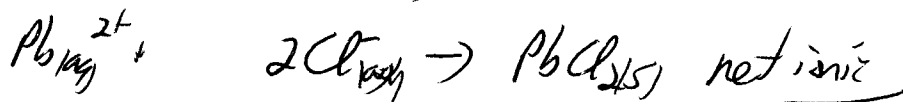
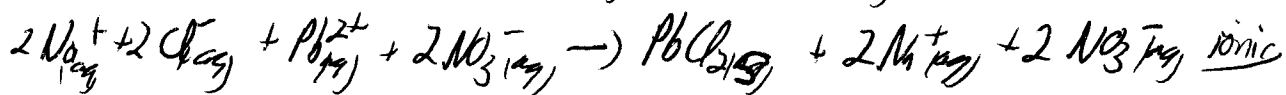
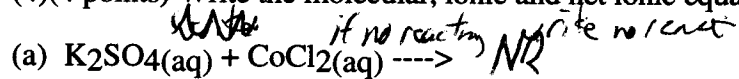
(a)  $H_3PO_4(aq) + NaOH(aq) \rightarrow$



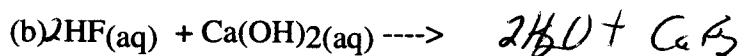
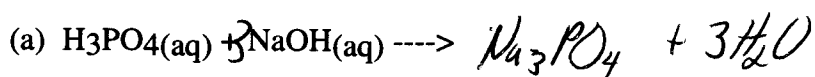
(b)  $HF(aq) + Ca(OH)_2(aq) \rightarrow$



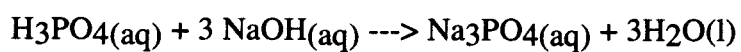
(4)(4 points) Write the molecular, ionic and net ionic equations for the following reactions



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



(5)(4 points) A 25.00 mL sample of cola was titrated with 0.100 M NaOH according to the equation below. If it took 16.11 mL of the NaOH to neutralize the cola, what was the concentration of  $\text{H}_3\text{PO}_4$  in the cola?



$$\frac{0.100 \text{ moles NaOH}}{\text{L}} \times 0.01611 \text{ L} = 1.611 \times 10^{-3} \text{ moles NaOH}$$

$$\frac{1.611 \times 10^{-3} \text{ moles NaOH}}{1} \times \frac{1 \text{ mole H}_3\text{PO}_4}{3 \text{ moles NaOH}} = 5.37 \times 10^{-4} \text{ moles H}_3\text{PO}_4$$

$$\frac{5.37 \times 10^{-4} \text{ moles H}_3\text{PO}_4}{0.02500 \text{ L}} = \boxed{2.15 \times 10^{-2} \text{ M H}_3\text{PO}_4}$$

→ (6)(2 points) Label the following strong electrolytes, weak electrolytes, or nonelectrolytes

(a)  $\text{SF}_6$  non electrolyte

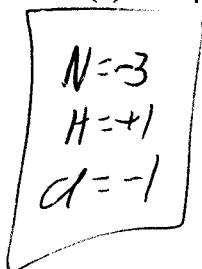
(b)  $\text{HBr}$  strong electrolyte

(c)  $\text{NaBr}$  strong electrolyte

(d)  ~~$\text{CaBr}_2$~~  strong electrolyte

(7)(4 points) List the oxidation state for each element in the following compounds

(a)  $\text{NH}_4\text{Cl}$

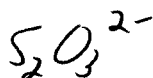
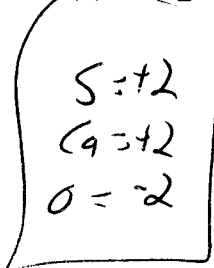


$$N + 4(H) = +1$$

$$N + 4(+1) = +1$$

$$N = -3$$

(b)  $\text{CaS}_2\text{O}_3$



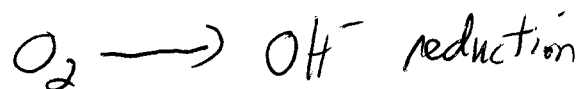
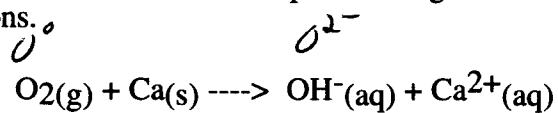
$$2(S) + 3(O) = -2$$

$$2S + 3(-2) = -2$$

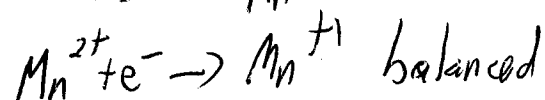
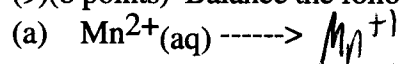
$$2S = +4$$

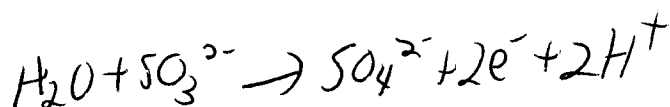
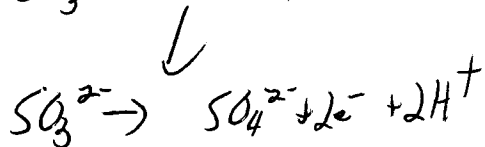
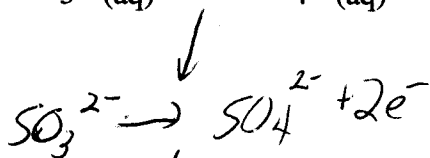
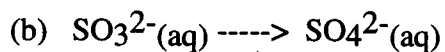
$$S = +2$$

(8)(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.

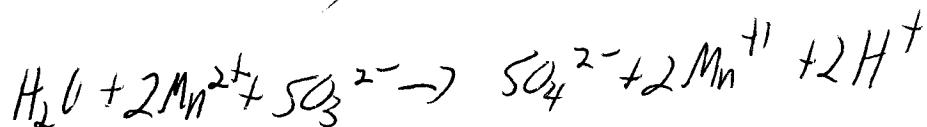
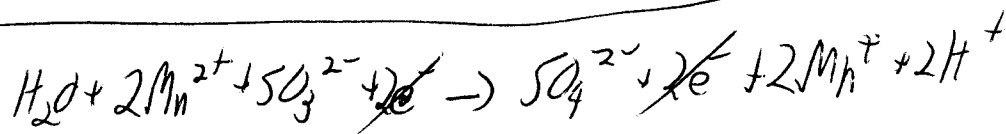
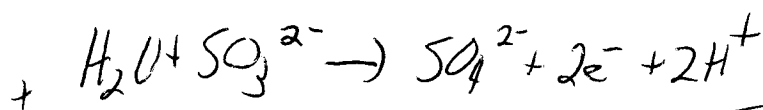
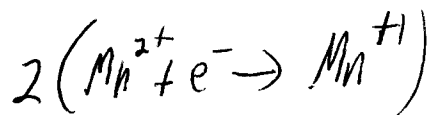
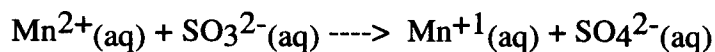


(9)(8 points) Balance the following half-reactions in acid

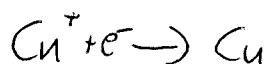
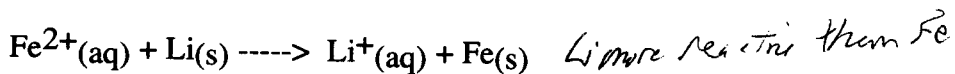




(10)(4 points) Balance the following oxidation-reduction reaction in acid



(11)(4 points) Construct an activity series based on the following experimental results



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

