

CHEM 1104 Exam 2. October 10, 2007

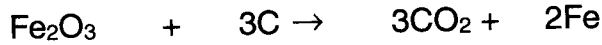
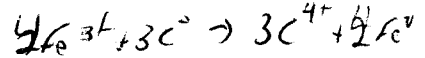
Name Key Note: You must show all work for credit.

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

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

Useful information: L, LEO says GER

(1)(6 points) A flask containing 5.00 g of C and 14.1 g of Fe₂O₃ were reacted according to the following equation.



(a) Which reagent is the limiting reagent?

$$5.00g \times \frac{1 \text{ mole}}{12.01g} = 0.416 \text{ moles}$$

$$14.1g \times \frac{1 \text{ mole}}{159.7g} = 0.0902 \text{ moles Fe}_2\text{O}_3$$

$$0.0902 \text{ mol Fe}_2\text{O}_3 \times \frac{3 \text{ moles C}}{1 \text{ mole Fe}_2\text{O}_3} = 0.271 \text{ moles C needed}$$

∴ Fe₂O₃ limiting

(b) How much Fe should form?

$$0.0902 \text{ moles Fe}_2\text{O}_3 \times \frac{2 \text{ moles Fe}}{1 \text{ mole Fe}_2\text{O}_3} = 0.180 \text{ moles Fe}$$

$$= 0.180 \text{ moles Fe} \times 55.85 \frac{g}{\text{mole}}$$

$$= 10.07g \text{ Fe} \approx 10.1g \text{ Fe}$$

→ (c) If the amount of ^{Fe}Al₂O₃ formed was 3.62 g, what is the % yield?

$$\frac{3.62g}{10.1g} \times 100\% = 35.9\%$$

(2)(2 points) How would you make a 500.0 mL, 0.100 M solution of NaClO from a 7.80 M stock solution? M₁V₁ = 6.500L (0.100 M) = 0.0500 moles NaClO needed

$$M_2 V_2 = 7.80 M V_2 = 0.0500 \text{ moles NaClO}$$

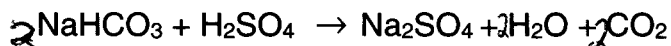
$$V_2 = 6.41 \times 10^{-3} L$$

6.41 mL of 7.80 M stock solution was diluted to 500.0 mL,

0.5 pts for M₁V₁

(3)(4 points) If it takes 22.1 mL of 0.98 M H_2SO_4 to fully react with the NaHCO_3 (according to the unbalanced reaction below) in a 15.00 mL sample of water. How much NaHCO_3 was present (in grams)?

11 for
balanced



$$(0.0221 \text{ L}) / (0.98 \text{ mol/L}) = 2.2 \times 10^{-2} \text{ moles } \text{H}_2\text{SO}_4$$

$$2.2 \times 10^{-2} \text{ moles } \text{H}_2\text{SO}_4 \times \frac{2 \text{ moles } \text{NaHCO}_3}{1 \text{ mole } \text{H}_2\text{SO}_4} = 0.0433 \text{ moles } \text{NaHCO}_3$$

$$0.0433 \text{ moles} \times 84.01 \frac{\text{g}}{\text{mole}} = 3.64 \text{ g} = \boxed{3.6 \text{ g } \text{NaHCO}_3}$$

(4)(4 points) Aspirin is acetylsalicylic acid. It is derived from salicylic acid which is found in willow tree bark. The elemental composition of aspirin (in mass %) is 60.00% C, 4.49% H, and 35.52% O. What is the empirical formula for aspirin?

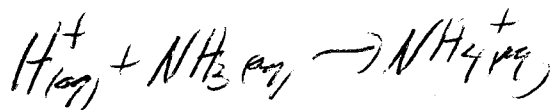
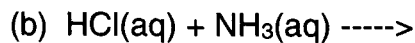
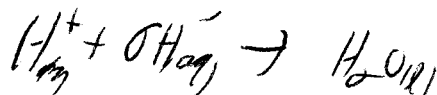
$$60.0\% \text{ C} \div 12.01 \frac{\text{g}}{\text{mole}} = 5.00 \text{ moles C} \quad 5.00 \text{ moles} \div 2.22 \text{ moles} = 2.25$$

$$4.49\% \text{ H} \div 1.01 \frac{\text{g}}{\text{mole}} = 4.44 \text{ moles H} \quad 4.44 \text{ moles} \div 2.22 \text{ moles} = 2$$

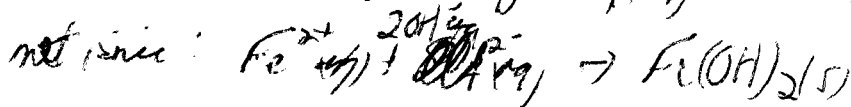
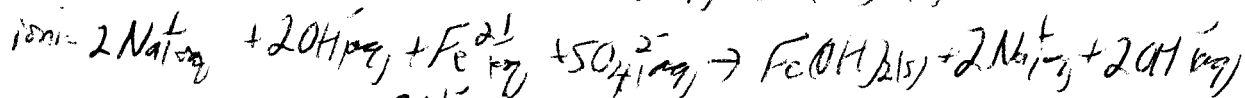
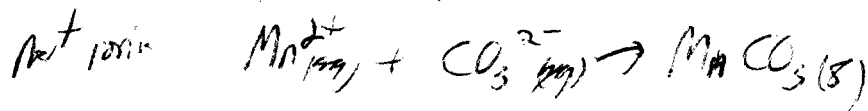
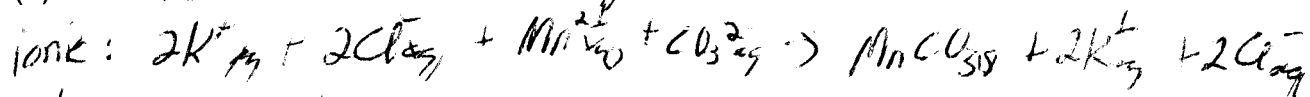
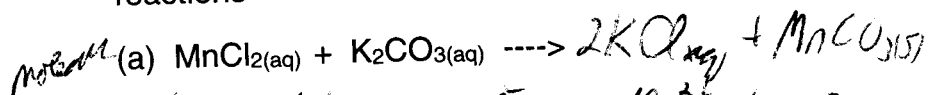
$$35.52\% \text{ O} \div 16.00 \frac{\text{g}}{\text{mole}} = 2.22 \text{ moles O} \quad 2.22 \text{ moles} \div 2.22 \text{ moles} = 1$$

$$4(\text{C}_{2.25}\text{H}_2\text{O}) = \boxed{\text{C}_9\text{H}_8\text{O}_4}$$

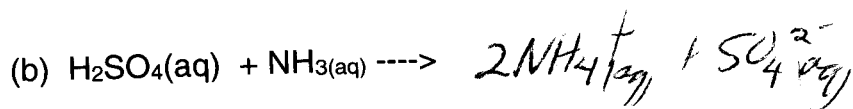
(5)(4 points) Write the net acid-base reactions for the following neutralizations



(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) PCl_3 nonelectrolyte

(b) HF weak electrolyte

(c) NaOH strong

(d) MgCl_2 strong

(9)(2 points) Name the following compounds

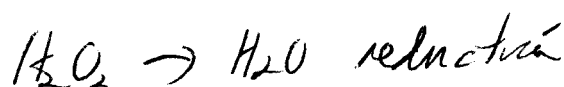
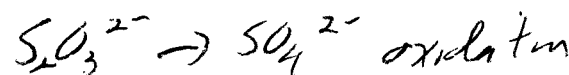
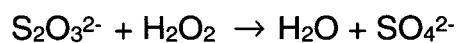
(a) $\text{Mg}(\text{OH})_2$ magnesium hydroxide

(b) HClO hypochlorous acid

(c) HCl hydrochloric acid

(d) NH_3 ammonia

(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.



$$2(5) + 3(0) = -2$$

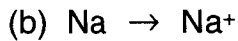
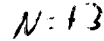
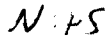
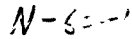
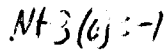
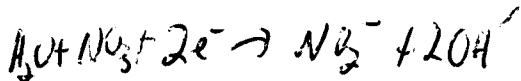
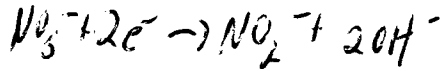
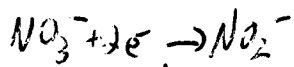
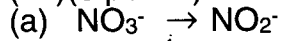
$$2(5) + 6 = -2$$

$$2(5) = -4$$

$$5^{+2} \rightarrow 5^{+6}$$

$$0^{-} \rightarrow 0^{2-}$$

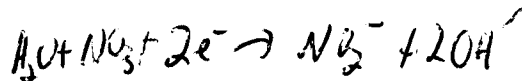
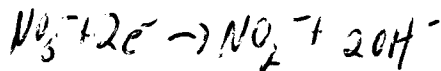
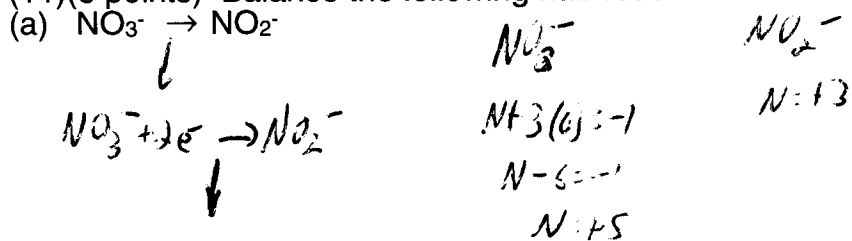
(11)(6 points) Balance the following half-reactions in base



Nobel Prizes (3pts) Gerhard Ertl
Chem Surface Chemistry

Physics Albert Fert + Peter Gruber
Giant magnetoresistance

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(b) $\text{Na} \rightarrow \text{Na}^+$



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