Name ____________________________ Test 3
PHYS 0107 (Intro Chem) Fall 2006

1. ________
2. ________
3. ________
4. ________
5. ________
6. ________
7. ________
8. ________
9. ________
10. _______
11. _______
12. _______
13. _______
14. _______
15. _______

1. (10 pts.) a. A shot of vodka, 45 mL of 80 proof vodka, which is 40% alcohol by volume, contains how many mL of alcohol?

b. How many mL of beer, which is 5% alcohol by volume, would contain the same amount of alcohol?

2. (10 pts) a. When chemists talk concentration, they often use molarity. What is the definition of molarity.

b. If 0.43 mol of a substance is dissolved in a total volume of 0.500 L what is the molarity of the solution?

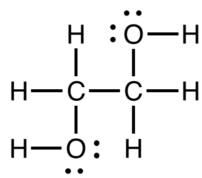
3. (4 pts. each) Acids react with bases in neutralization reactions. Complete and balance the following chemical equations.

a. $NaOH\ (aq) + H_2SO_4\ (aq) \longrightarrow$

b. $KOH\ (aq) + HCl\ (aq) \longrightarrow$

c. $Ca(OH)_2\ (s) + HCl\ (aq) \longrightarrow$

4. (12 pts.) Which of the following compounds are bases? Circle the ones that are bases.

NaOH sodium hydroxide	$Ba(OH)_2$ barium hydroxide	CH_3CH_2OH ethanol
NaCl sodium chloride	 ethylene glycol	Na_2CO_3 sodium carbonate

5. (10 pts.) In order to determine the strength of an antacid tablet, you add 0.505 mol of HCl to an antacid tablet and titrate the excess acid with LiOH. You determine that 0.325 mol of LiOH were required to neutralize the excess HCl. Considering that LiOH and HCl react according to the following balanced chemical equation, determine the amount of acid neutralized by the antacid tablet.

$$LiOH\ (aq) + HCl\ (aq) \longrightarrow H_2O\ (l) + LiCl\ (aq)$$

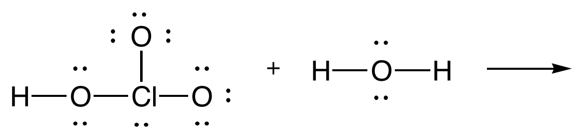
6. (10 pts.) $CaCO_3$ reacts with HCl to produce $CaCl_2$, H_2O, and CO_2 according to the balanced chemical equation below.

$$CaCO_3(s) + 2\ HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

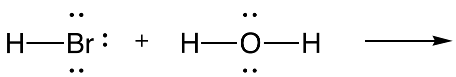
The mass of 1 mole of $CaCO_3$ is 100.07 g, and the mass of 1 mole of HCl is 36.46 g. 1.5 g of a $CaCO_3$-based antacid could absorb (react with) how many grams of HCl?

7. (10 pts.) Complete the following reaction; that is, finish the balanced chemical equation for the reaction that occurs when the acids are dissolved in water.

a.



b.

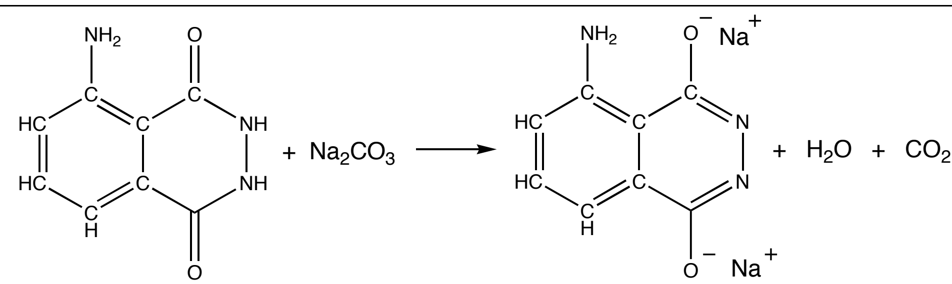
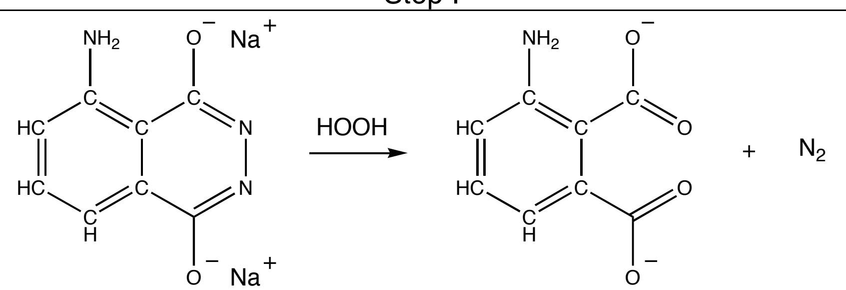


8. (10 pts.) The following scheme shows the reactions that occur when luminol is used to test for bloodstains. One reaction is an oxidation-reduction reaction, and the other reaction is an acid-base reaction.

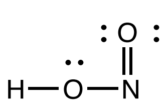
a. Label the reactions as acid-base or oxidation-reduction reactions.

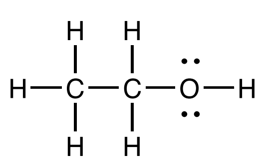
b. In the acid-base reaction step, determine whether the luminol is acting as an acid or a base.

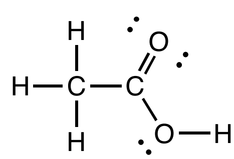
c. In the redox reaction step, determine whether the luminol is being oxidized or reduced.

	 Step I
	 Step II

9. (12 pts.) Which of the following are acids. (Circle the acidic proton).

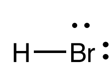






CsOH

HCl



10. (8 pts.) For each of the reactions below, determine whether the reaction is an oxidation-reduction reaction (label the reactions "redox" or "not redox").

a. ____________________ $2\ AgNO_3(aq) + Zn(s) \longrightarrow Zn(NO_3)_2(aq) + 2\ Ag(s)$

b. ____________________ $2\ AgNO_3(aq) + ZnBr_2(aq) \longrightarrow 2\ AgBr(s) + Zn(NO_3)_2(aq)$

c. ____________________ $H_2SO_4(aq) + Mg(s) \longrightarrow H_2(g) + MgSO_4(aq)$

d. ____________________ $H_2SO_4(aq) + Mg(OH)_2(s) \longrightarrow 2\ H_2O(l) + MgSO_4(s)$

11. (10 pts.) The following reaction is a redox reaction. It is the reaction that occurs inside a Nickel-Cadmium battery.

$$2\ NiO(OH)(s) + Cd(s) + 2\ H_2O(l) \longrightarrow 2\ Ni(OH)_2(s) + Cd(OH)_2(s)$$

a. Which element is losing electrons.

b. Which element is gaining electrons.

c. Describe in words what is happening.

12. (2 pts. each) Determine whether the underlined atom in the following reactions is being oxidized or reduced.

$2\ \underline{Mg}(s) + O_2(g) \longrightarrow 2\ MgO\ (s)$	$\underline{C}H_4(g) + 2\ O_2(g) \longrightarrow CO_2(g) + 2\ H_2O(g)$
$4\ \underline{Fe}(OH)_2(s) + O_2(g) + H_2O(l) \longrightarrow 4\ Fe(OH)_3(s)$	$\underline{Cu}O(s) + H_2(g) \longrightarrow H_2O(l) + Cu(s)$
$2\ \underline{Hg}O(s) \longrightarrow 2\ Hg(l) + O_2(g)$	$\underline{C}O_2(g) \longrightarrow C(s) + O_2(g)$

13. (10 pts.) Explain why the following combustion reaction can be used to construct a fuel cell. Remember to indicate which element is losing electrons and which is gaining electrons. (Hint: the oxidation numbers for each of the C and H atoms in CH_4 are –4 and +1 respectively. You should be able to determine the oxidation numbers of the other elements if you *pretend* the compounds are ionic.)

$$CH_4(g) + 2\ O_2(g) \longrightarrow CO_2(g) + 2\ H_2O(g)$$

14. (10 pts.) The combustion of graphite (a form of carbon) releases 394 kJ of energy per mole of graphite burned.

$$C(s) + O_2(g) \longrightarrow CO_2(g) \qquad \Delta H = -394\ \text{kJ/mol}$$

Determine the amount of energy released by the combustion of 8.8 g of carbon. The mass of 1 mole of C and 1 mole of O are 12.01 and 16.00 g respectively.

15. (10 pts.) A reasonably fuel-efficient car consumes approximately 6 lbs (or 2,727 g) of gasoline to travel 38 miles. Determine the mass of CO_2 in grams released for each mile the car travels. Assume that the following balanced chemical equation accurately represents the reaction that occurs when gasoline is burned. The mass of 1 mole of C, 1 mole of O, and 1 mole of H are 12.01, 16.00, and 1.01 g respectively.

$$2\ C_8H_{18}(g) + 25\ O_2(g) \longrightarrow 16\ CO_2 + 18\ H_2O(g)$$