

CHEM 101 Exam 2

Student: _____

I Multiple Choice (20 points)

1. Which of these compounds is a *strong electrolyte*?

- A. H_2O
 - B. N_2
 - C. CH_3COOH (acetic acid)
 - D. $\text{C}_2\text{H}_6\text{O}$ (ethanol)
 - ☒ E. KOH
- strong base; v. soluble ionic compound
cf. Slide 9; text 112-114

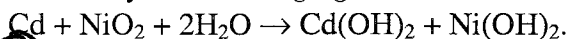
2. Which of these compounds is a *weak electrolyte*?

- A. HCl
 - ☒ B. CH_3COOH (acetic acid)
 - C. $\text{C}_6\text{H}_{12}\text{O}_6$ (glucose)
 - D. O_2
 - E. NaCl
- weak acid = weak electrolyte
slide 7; Text pp. 112, 113, 116.

3. Which of these compounds is a *nonelectrolyte*?

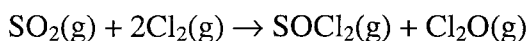
- A. NaOH
 - B. HNO_3
 - ☒ C. $\text{C}_2\text{H}_6\text{O}$ (ethanol)
 - D. KF
 - E. CH_3COOH (acetic acid)
- not ionic. Slide 3; slide 9; Sample problem 4.2 (methanol)

4. Identify the *reducing agent* in the chemical reaction



- ☒ A. Cd
 - B. NiO_2
 - C. H_2O
 - D. Cd(OH)_2
 - E. Ni(OH)_2
- $\text{Cd}^0 \rightarrow \text{Cd}^{2+}$ loses e^- $\therefore$ oxidized
 $\therefore$ reducing agent

5. Sulfur dioxide reacts with chlorine to produce thionyl chloride (used as a drying agent for inorganic halides) and dichlorine oxide (used as a bleach for wood pulp and textiles).



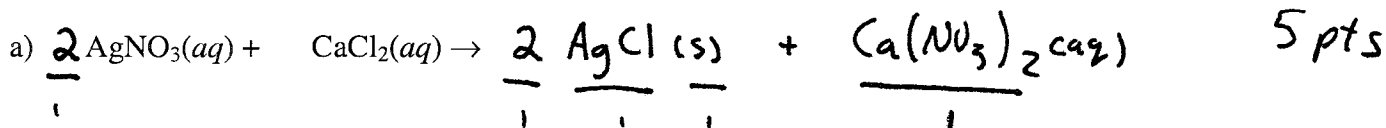
If 0.400 mol of Cl_2 reacts with excess SO_2 , how many moles of Cl_2O are formed?

- A. 0.800 mol
 - B. 0.400 mol
 - ☒ C. 0.200 mol
 - D. 0.100 mol
 - E. 0.0500 mol
- $0.4 \text{ mol Cl}_2 \times \frac{1 \text{ mol Cl}_2\text{O}}{2 \text{ mol Cl}_2} = 0.2 \text{ mol Cl}_2\text{O}$

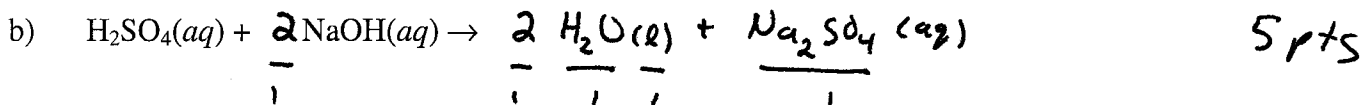
Student: _____

II Short Answer (41 points)

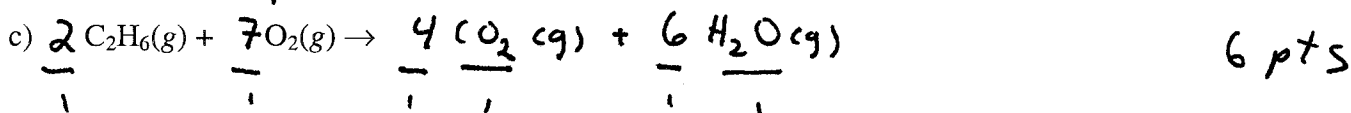
6. (16 points) Give the product(s) for the following reactions, and balance the equations.



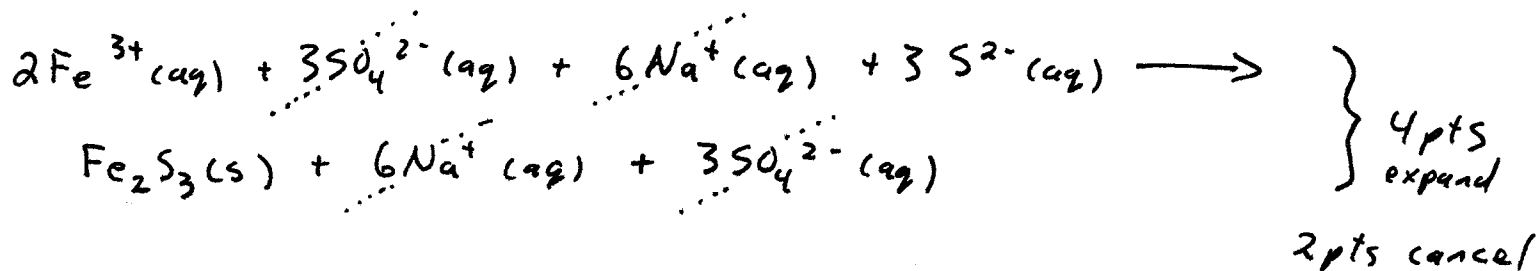
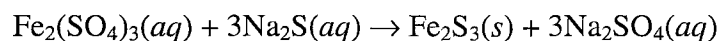
cf. Sample 4.4 in text; checkpoint 4.6.1 text



page 124 text



7. (10 points) Write the *net ionic equation* for the following reaction. First expand the equation to show all ions, then cancel all spectator ions, and finally write the net ionic equation.



text: p. 120; 4.21 - 4.22

slides 16-21

See 4.63c)

Student: _____

10. (8 points) Water is added to 25.0 mL of a 0.866 M KNO_3 solution until the volume of the solution is 500.0 mL. What is the concentration of the final solution?

$$M_1 L_1 = M_2 L_2$$

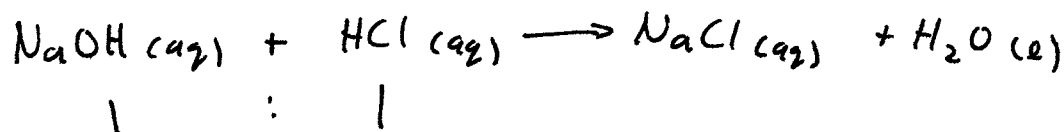
$$(25.0 \text{ mL})(0.866 \text{ M}) = (500.0 \text{ mL}) M_2 \quad (\text{mL cancel in this case ... conversion to L not required})$$

$$M_2 = 0.0433 \text{ M}$$

text: 4.68

Chatellier Exam 2 #4

11. (8 points) Calculate the concentration (in molarity) of an NaOH solution if 25.0 mL of the solution is needed to neutralize 17.4 mL of a 0.312 M HCl solution. text 4.87 ~~text 4.87~~



$$\text{moles HCl: } (0.0174 \text{ L})(0.312 \text{ mol/L}) = 5.429 \times 10^{-3} \text{ mol HCl}$$

$$\times \frac{1 \text{ mol NaOH}}{1 \text{ mol HCl}} = 5.429 \times 10^{-3} \text{ mol NaOH}$$

$$\div 0.0250 \text{ L} = 0.217 \text{ M}$$

Student: _____

12.(14 points) The insecticide DDT was formerly in widespread use, but now it is severely restricted owing to its adverse environmental effects. It is prepared as follows:



chloral chlorobenzene DDT

text: 3.104
Chatellier Exam 2 #5

If 10.00 g of chloral were reacted with 10.00 g of chlorobenzene:

a. what is the maximum amount (mol) of DDT which could be formed?

b. what is the limiting reagent?

c. what is the % yield, if 12.15 g of DDT is produced?

$$\text{chloral: } 147.39 \text{ g/mol} \quad \frac{10.00 \text{ g}}{147.39 \text{ g/mol}} = 0.067847 \text{ mol} \quad 3 \text{ pts}$$

$$\text{C}_6\text{H}_5\text{Cl: } 112.56 \text{ g/mol} \quad \frac{10.00 \text{ g}}{112.56 \text{ g/mol}} = 0.088842 \text{ mol} \quad 3 \text{ pts}$$

DDT: 354.49 g/mol

Balanced equation: $\frac{\text{chlorobenzene}}{\text{chloral}} = \frac{2}{1}$

$$\text{here: } \frac{0.088842}{0.067847} = \frac{1.309}{1}$$

not enough chlorobenzene $\therefore$ it's limiting reagent
b) 2 pts

$$\frac{\text{DDT}}{\text{chlorobenzene}} = \frac{1}{2} = \frac{x}{0.088842}$$

$$x = 0.44421 \text{ mol DDT a) } 2 \text{ pts}$$

c) $0.44421 \text{ mol} \times 354.49 \text{ g/mol} = 15.747 \text{ g theoretical yield } 2 \text{ pts}$

$$\frac{12.15 \text{ g}}{15.747 \text{ g}} \times 100\% = 77.16\% \quad 2 \text{ pts.}$$

(Your method of calculating may vary)