CHM1311 B: Principles of Chemistry

Prof. N. Goto
Assignment #1
Due Sept 19th, at the beginning of class

Assignments can be submitted individually, or by groups of up to 4 students.

1) Name: _____ **Student ID:** _____

2) Name: _____ **Student ID:** _____

3) Name: _____ **Student ID:** _____

4) Name: _____ **Student ID:** _____

Solutions must be written legibly, in the space provided. Adequate detail to the calculation (including units, appropriate sig figs) must be provided to make it possible for other students to understand how you arrived at the final solution. If more space is needed, use the back of the page. Do not add extra pages, as they will not be marked. Assignment pages must be stapled together.

NOTE: For each question an on-line resource in WileyPLUS is given in brackets that can walk you through a similar type of problem. (ILW = Interactive Learning Ware.)

Question 1. (ILW 1.21)
Use the data in the following table to calculate the molar mass of naturally occurring element:

Isotope	Isotopic Molar Mass (g/mol)	Abundance (%)
^{32}S	31.9721	94.93
^{33}S	32.9715	0.76
^{34}S	33.9679	4.2900
^{36}S	35.9671	0.02

Question 2. (ILW Problem 15)

Solution A is prepared by dissolving 91.9 g of Na_3PO_4 in enough water to make 1.50 L of solution. Solution B is 2.5 L of 0.684 M Na_2SO_4.

a) What is the molar concentration of Na_3PO_4 in Solution A?

b) What volume of Solution A will give 2.50 g of Na_3PO_4?

c) If 50.0 mL of Solution B is mixed with 75.00 mL of Solution A, what is the concentration of Na^+ ions in the final solution?

Question 3. (ILW 1.35)

An oral contraceptive was found to contain 0.0330 mg ethynyl estradiol ($C_{20}H_{24}O_2$) in one pill.

a) How many carbon atoms are in a 0.0330 mg sample of ethynyl estradiol?

b) What mass of carbon is this?

Question 4. (Chapter 1 on-line tutorial question #1.)
Nitrogen monoxide and molecular oxygen combine to give nitrogen dioxide.
a) Write the balanced chemical equation for this reaction. Be sure to include the phases.

b) What is the mass of nitrogen oxide that is required to completely react with 525 kg of molecular oxygen?

Question 5. (Office hours video, 1.93)
Hydrogen fluoride is produced industrially by the action of sulphuric acid on CaF_2. Suppose 449 kg of CaF_2 is treated with an excess of sulphuric acid and 139 kg of HF is produced. What is the percent yield of HF?

Question 6. (Video for 1.75)

The following unbalanced reaction is called the thermite reaction. It releases tremendous amounts of energy and is sometimes used to generate heat for welding.

$$Al(s) + Fe_3O_4\ (s) \rightarrow Fe(s) + Al_2O_3\ (s)$$

a) Write the balanced chemical equation for this reaction.

b) Determine the masses of all the substances present after the reaction if 197 g of Al and 801 g of Fe_3O_4 react to completion. Enter your final answers in the table below:

	Fe (s)	Al_2O_3 (s)	Al(s)	Fe_3O_4(s)
Mass (in g)				

Question 7. (Office hours video, 21.3)

a) What is Z, A and N for the nuclide of barium with a neutron:proton ratio of 1.25

b) What is the nuclear symbol for the copper isotope that contains 34 neutrons?

Question 8. (Chapter 1 on-line tutorial question #1.)
Cyclohexane (C_6H_{12}) can be oxidized to make apidic acid ($C_6H_{10}O_4$), with water also being produced in this reaction. If the oxidation reaction is 78.4 % efficient, what mass of cyclohexane is required to produce 3.08 kg of adipic acid?

Question 9. (ILW Problem 1.10)
A 47.89 mg sample of an unknown organic compound is subjected to airproof combustion analysis. The sample gives 120.6 mg of CO_2 and 25.75 mg of H_2O. When this sample is analyzed for nitrogen content, it is found to be 3.8% by mass. What is the empirical formula of the compound?