1. How many significant figures are in each of the following? (2 points)

(a) 0.0000101 [   ] (b) 22.04030 [   ] (c) 0.00480 [   ]

2. Perform the following mathematical operations, and express each result to the correct number of the significant figures. (4 points)

a. (9.04 −8.23 + 21.954 + 81.0) / 3.1416

b. $\dfrac{(3.14159)(4.599\times10^6)-(1.12\times10^7)}{(4.756\times10^8)+(3.67\times10^4)}$

3. Give the systematic name of each of the following compounds. (6 points)

(a) $Fe(NO_3)_3$

(b) $Ti(NO_3)_4$

(c) P_4O_{10}

(d) $NaOCl$

(e) $BaCrO_4$

(f) S_4N_4

4. Write the formula for each of the following compounds. (3 points)

(a) Copper(II) nitrate

(b) Nitrous acid

(c) diphosphorus pentoxide

5. Balance the following chemical reaction, which illustrates the synthesis of an important industrial chemical. (2 points)

__ Al_2O_3 •$2H_2O$ $_{(s)}$ + __ H_2SO_4 $_{(aq)}$ ⇒ __ $Al_2(SO_4)_3$ $_{(s)}$ + __ H_2O $_{(l)}$

6. A silicon chip used in an integrated circuit of microcomputer has a mass of 5.68 mg. How many silcon (Si) atoms are present in the chip? (5 points)

7. A mole of helium gas contains 6.02×10^{23} helium atoms. How many helium atoms are there in a micromole of helium? How many moles of helium does 1.25×10^{20} atoms of helium represent ? (5 points)

8. A white powder is analyzed and found to contain 43.64 % phosphorus and 56.36 % oxygen by mass. The compound has a molar mass of 283.88 g/mol. What are the compound's empirical and molecular formulas? (5 points)
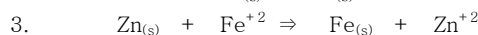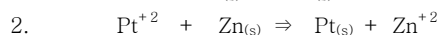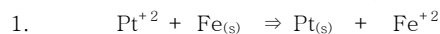
9. The element europium exists in nature as two isotopes. : ^{151}Eu has a mass of 150.9196 amu, and ^{153}Eu has a mass of 152.9209 amu . The average atomic mass of europium is 151.96 amu. Calculate the relative abundance of the two europium isotopes. (5 points)

10. The element magnesium (Mg) has three stable isotopes with the following masses and abundances: Calculate the average atomic mass of magnesium from these data. (5 points)

Isotope	Mass (g/mol)	Abundance (%)
^{24}Mg	23.9850	78.99
^{25}Mg	24.9858	10.00
^{26}Mg	25.9826	11.01

11. From the following information derive an activity series for the metals Pt, Zn, and Fe. (3 points)

1. Pt^{+2} + $Fe_{(s)}$ ⇒ $Pt_{(s)}$ + Fe^{+2}

2. Pt^{+2} + $Zn_{(s)}$ ⇒ $Pt_{(s)}$ + Zn^{+2}

3. $Zn_{(s)}$ + Fe^{+2} ⇒ $Fe_{(s)}$ + Zn^{+2}

12. Iron is made from the smelting of iron ore. That is to say the reaction of Fe_2O_3 at elevated temperatures with coke ($C_{(s)}$) to make $CO_{2(g)}$ and $Fe_{(l)}$. Write the balanced chemical equation for this reaction and tell what elements are being oxidized and which are being reduced. (5 points)

13. The following unbalanced reaction summarizes the "wet process" for the synthesis of phosphoric acid.

$5 H_2SO_4 + Ca_5F(PO_4)_3 \Rightarrow 3H_3PO_4 + 5 CaSO_4 + HF$
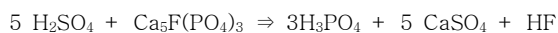
If treatment of 5.0×10^3 kg of $Ca_5F(PO_4)_3$ with excess sulfuric acid gives 2.72×10^3 kg of phosphoric acid, what is the % yield of the process? (10 points)

14. A 1.23 g sample which contains gold, silver and metal oxides is treated with concentrated HNO_3 which dissolves all the metals and metal oxides with the exception of the gold. The mass of yellow metal remaining is 7.4×10^{-2} g. The solution is then treated with aqueous sodium chloride which precipitates AgCl and nothing else. A total of 0.196 g of AgCl is obtained. What is the percent gold and silver in this ore? (10 points)

15. Determine the chemical formula and elemental % composition of the following compound (MM (g/mol) (10 points)
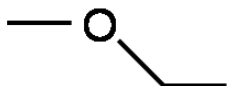
16. Hydrazine (N_2H_4) is made by the reaction of ammonia (NH_3) with hypochlorite (OCl−). Given the following equation 420 kg of ammonia is reacted with excess hypochlorite to generate 315 kg of hydrazine. What is the percent yield for this reaction?

$2 NH_3 + OCl^- \Rightarrow N_2H_4 + Cl^- + H_2O$

(10 points)
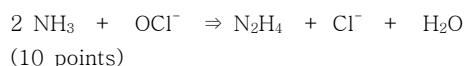
17. A student prepared 1.00 L of a solution of NaOH for use in titrations. The solution was standardized by titrating a sample of potassium hydrogen phthalate ($KHC_8H_4O_4$) whose mass was 0.7996 g. Before titration, the buret reading was 0.15 mL. When the indicator changed color, the buret reading was 43.75 mL. Calculate the molarity of the NaOH solution. (10 points)

************** Molar mass **************************
He = 4.003
H = 1.01
C = 12.01
N = 14.01
O = 16.00
F = 19.00
Na = 23.0
Si = 28.09
P = 30.97
S = 32.07
Cl = 35.45
Ca = 40.08
Au = 197.0
Ag = 107.9
$KHC_8H_4O_4$ = 204.2