

**KWANTLEN COLLEGE
CHEMISTRY 1105 R-10
EXAM No. 1
July 21, 1994**

NAME: _____

Instructions: This exam contains **NINE + 1 BONUS** questions. Read the exam carefully and judge your time accordingly. **ALL CALCULATIONS MUST BE SHOWN TO RECEIVE FULL CREDIT!** If you need extra space, use the back of a preceding page and clearly indicate the question number. A periodic chart is supplied with this exam.

Maximum Score: 75+(4 bonus) points

"If a little knowledge is dangerous, where is the person who has so much as to be out of danger?."

Thomas Henry Huxley

USEFUL INFORMATION

Avagadro's Number, $N_0 = 6.022 \times 10^{23}$

Gas Constant, $R = 0.0821 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol}$

Pressure: $1 \text{ atm} = 760 \text{ mm Hg} = 101.325 \text{ kPa} = 760 \text{ torr} = 14.70 \text{ lb}/\text{in}^2$

Question One: (4 MARKS)

Diamonds (density = 3.51g/cm^3) are commonly measured in carats (1 carat = 200. mg). What is the volume, in mm^3 , of a 2.00 carat diamond? (Express your answer to the **correct** number of significant figures) (Remember a diamond is only carbon!)

Question Two: (11 MARKS)

a) For the species $^{120}\text{Sn}^{2+}$ indicate the following:

number of protons _____, number of electrons _____, and

number of neutrons _____ in one ion. (3)

b) Write the **complete** nuclear symbol, including atomic number, mass number, and charge (if any), for the species with 46 neutrons, 36 electrons, and a mass number of 80. (4)

c) A certain element consists of three isotopes. Given below are the mass and natural abundance of each isotope. (4 Marks)

<u>Isotope</u>	<u>Mass (amu)</u>	<u>% Abundance</u>
#1	27.9769	92.21
#2	28.9765	4.70
#3	29.9738	3.09

i) Calculate the atomic weight of the element.

ii) Identify the element by symbol and name.

Question Three: (10 MARKS)

a) Write the formula for each of the following compounds. (5)

i) lithium oxide

ii) aluminum hydroxide

iii) magnesium chlorate

iv) hydrocyanic acid

v) lead(iv) sulfate

b) Give the proper (IUPAC) names for each of the following compounds. (5)

i) Ca_2C

ii) $\text{Fe}_3(\text{PO}_4)_2$

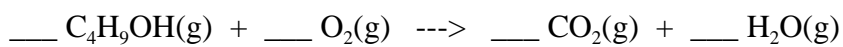
iii) HNO_2 (aq)

iv) P_4O_6

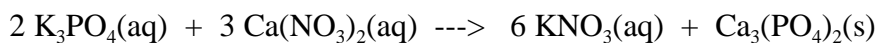
v) $\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2$

Question Four: (7 MARKS)

a) Balance the following equation: (3)



b) Write the **net ionic** equation for the following reaction. (4)



Question Five: (10 MARKS)

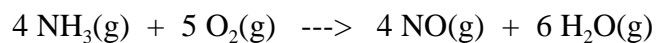
Eugenol (responsible for the aromatic odor of cloves), contains **only** carbon, hydrogen, and oxygen.

- a) In a combustion analysis, 3.284g of eugenol was completely burned in the presence of excess oxygen, and produced 8.802g of CO₂ and 2.162g of H₂O. Calculate the **empirical formula** of eugenol. (8)

- b) The molar mass of eugenol was determined to be approximately 160 g/mol. Determine the **molecular formula** of eugenol. (2)

Question Six: (8 MARKS)

The burning of ammonia, NH_3 , is an important first step in the industrial process to make nitric acid. The reaction is:



If 100.0g of ammonia are mixed with 150.0g of oxygen and reacted, calculate the following:

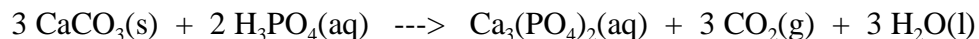
a) the theoretical yield of NO (in grams) (5)

b) the mass of the excess reactant left over. (2)

c) If 100.0g of NO were recovered from the reaction, what is the percent yield of NO? (1)

Question Seven: (5 MARKS)

The calcium carbonate carbonate content of a mixture can be analyzed by titrating the sample with H_3PO_4 solution. The reaction is



(The formula weights are: $\text{CaCO}_3 = 100.1$; $\text{H}_3\text{PO}_4 = 98.00$; $\text{Ca}_3(\text{PO}_4)_2 = 310.2$;
 $\text{CO}_2 = 44.01$; $\text{H}_2\text{O} = 18.02$)

The CaCO_3 content of a 20.25g sample of limestone was completely reacted by the addition of 85.10 mL of 1.379 M H_3PO_4 . Determine the percent purity of CaCO_3 in the the limestone sample. (Assume that the other contaminants do not react in this analysis)

Question Eight: (5 MARKS)

a) Calculate the volume of 0.275 M HI needed to give 50.0 mL of 0.150 M HI on dilution. (2)

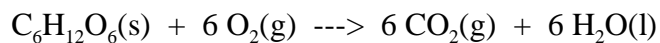
b) What mass of KCl would be required to prepare 375 mL of a 0.870 M KCl solution? (3)

Question Nine: (15 MARKS)

a) A helium filled balloon having a volume of 15.2 L at 1.20 atm and 25.0 °C is allowed to rise to the stratosphere (about 30 km above the earth), where the temperature and pressure are -23.0 °C and 3.00×10^{-3} atm, respectively. Calculate the final volume of the balloon. (4)

b) An unknown gas has a density of 1.61 g/L at a temperature of 23.4 °C and a pressure of 745 mm Hg. Determine its molecular weight (molar mass). (6)

c) The equation for the metabolic breakdown of glucose ($C_6H_{12}O_6$) is the same as that for the combustion of glucose in air:



Calculate the volume of $CO_2(g)$ produced at 37.0 °C and 1.00 atm when 5.60 g of glucose is used up in the reaction with excess oxygen. (molar mass of glucose = 180.2 g/mol) (5)

BONUS (4 MARKS)

Analysis of a metal chloride XCl_3 shows that it contains 67.2% Cl by mass. Calculate the atomic mass and identify the element "X".