THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATIONS - 2020

FORESTRY - FIRST YEAR DEGREE

AS 113 – FOUNDATION CHEMISTRY

FRIDAY 23RD OCTOBER, 2020 – 12:50 P.M.

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES:

1. You have 10 minutes to read the paper. You must not begin writing in the answer book during this time.

2. **ANSWER ALL QUESTIONS**

3. All answers must be written in the answer books provided.

4. Write your name and number clearly on the front page. Do it now.

5. Calculators are permitted in the examination room. Notes and textbooks are not allowed.

6. Show all workings and calculations in the answer book.

MARKING SCHEME

QUESTION 1	[25 MARKS]
QUESTION 2	[25 MARKS]
QUESTION 3	[25 MARKS]
QUESTION 4	[25 MARKS]

1.   (a)   Name the following Type-II binary ionic compounds:

                (i) $CuBr$

                (ii) FeS

                (iii) PbO

                                                             [6 marks]

     (b)   Write the formula of the acids below.

                (i)   Acetic acid

                (ii)   Nitrous acid

                (iii)   Sulfurous acid

                (iv)   Chlorous acid

                                                               [4 marks]

     (c)   (i)   Ethanol burns in air and produces carbon dioxide and
                      water. Write the balanced equation for the reaction.   [2 marks]

               (ii)   When iron (III) bromide in aqueous solution is mixed with an
                      aqueous solution of sodium sulphide, a precipitate of iron III sulphide
                      forms. Write a balanced equation to describe this reaction.   [2 marks]

(iii)   Sodium carbonate (Na_2CO_3) reacts with HCl to produce sodium chloride, carbon dioxide and water. Write the balanced **molecular** equation as well as the corresponding **ionic** equation for this reaction.   [4 marks]

(d)   (i)   Write the atomic symbol ($_Z^A$X) for an isotope having Z = 8 and neutrons = 9.   [2 marks]

(ii)   How many protons, neutrons and electrons are in the cation ion below?
$_{27}^{59}Co^{3+}$ [3 marks]

(iii)   Calculate the number of iron atoms in a 4.48 mole sample of iron.   [2 marks]

(Total = 25 Marks)

2.   (a)   (i)   What is the molar weight of calcium chloride?   [2 marks]

(ii)   What is the molarity (M) of 2.0 grams of Cu(II) nitrate dissolved in 100 mL of distilled water?   [5 marks]

(b)   A solution containing 29.0 grams of calcium nitrate is added to a solution containing 33.0 grams of sodium fluoride. Calcium fluoride precipitates as shown by the equation:

$Ca(NO_3)_2 + 2NaF \longrightarrow CaF_2 + 2NaNO_3$
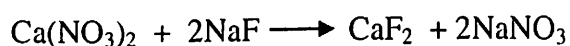
How many grams of calcium fluoride will precipitate? How many grams of excess reactant will remain?   [7 marks]

(c)   Find the oxidation state of each of the elements of the formula below.

    (i) HNO_3.   [2 marks]

    (ii) H_2O_2.   [2 marks]

(d)   Draw Lewis structure and calculate formal charge of HBr.   [3 marks]

(e)   These questions relate to the practical experiment on the cycle of copper reaction.

    (i)   Write the chemical equation that shows the action of heat on $Cu(OH)_2$.   [2 marks]

    (ii)   Why was Zn powder added to $CuSO_4$ solution?   [1 mark]

   (iii)   Why was HCl added to the $CuSO_4$ solution?   [1 mark]

(Total = 25 Marks)

3. (a) Define the following:

    (i) Isoelectronic.   [1 mark]

    (ii) Electronegativity.   [1 mark]

    (iii) Ionization energy.   [1 marks]

    (b) (i) Explain the electronegative property of elements going across the
             period and going down the group. State the reason behind this trend.   [4 marks]

         (ii) In the bonds below, which element would have a stronger pull on
               the electrons? Explain you answers.   [4 marks]

               A. Lithium & Bromine.

               B. Bromine & Chlorine.

    (c) (i) How many KJ are required to convert 50 grams of water, initially
              at $20^{\circ}C$ to steam at $120^{\circ}C$.
              The specific heat of water (l) is 4.18 J/g $^{\circ}C$; latent heat of water (l)
              is 2.26 KJ/g and specific heat of water vapour is 2.0 J/g $^{\circ}C$.   [8 marks]

(ii)   For the equation below at equilibrium in a closed vessel, how would the concentrations of each product and reactant compare to the original concentrations if adjustment is made to one.
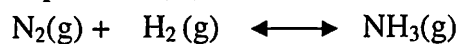
$$H_2O(g) + CO(g) \rightleftharpoons H_2(g) + CO_2(g)$$
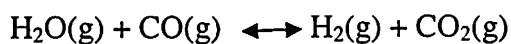
      A.   If H_2O is added.

      B.   If H_2 is added.   [4 marks]

(iii)   Balance the equation below and show the respective equilibrium expression (K).   [2 marks]

$$N_2(g) + H_2(g) \rightleftharpoons NH_3(g)$$

(Total = 25 Marks)

4.   (a)   As related to water chemistry define the following:

         (i)   Surface tension.   [1 mark]

         (ii)   Specific conductance.   [1 mark]

    (b)   What quality of water do the parameters listed below indicate.

         (i)   Water pH.   [2 marks]

         (ii)   Specific conductance.   [2 marks]

(c)   Using the expression for the ionic product of water, calculate
       the pH of 2 x 10^{-3} moles/L of NaOH.   [4 marks]

(d)   As related to gas law, state;

       (i)   Boyles Law.   [2 marks]

       (ii)   Avogadro's Law.   [2 marks]

(e)   The formula, C_4H_{10} has two structural isomers. Show the structures of these
       isomers and give their respective IUPAC names.   [4 marks]

(f)   Normally hydrocarbons are inert substances, but under certain conditions,
       they will react. Name THREE of these reactions discussed in lectures.   [3 marks]

(g)   Show the structure of the functional groups listed below.

    (i)   Carboxylic acid.

    (ii)   Aldehyde.

    (iii)   Amide.

    (iv)   Ester.   [4 marks]

(Total = 25 Marks)