UNIVERSITY OF SWAZILAND

FACULTY OF AGRICULTURE AND CONSUMER SCIENCE

SUPPLEMENTARY EXAMINATION

PROGRAMMES:

B.Sc. IN AGRONOMY: YEAR I
B.Sc. IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING: YEAR 1
B.Sc. IN AGRICULTURAL ECONOMICS AND AGRIBUSINESS MANAGEMENT: YEAR I
B.Sc. IN ANIMAL SCIENCE (DAIRY): YEAR I
B.Sc. IN AGRICULTURAL EDUCATION AND EXTENSION: YEAR I
B.Sc. IN ANIMAL SCIENCE: YEAR I
B.Sc. IN CONSUMER SCIENCES: YEAR I
B.Sc. IN CONSUMER SCIENCES IN EDUCATION: YEAR I
B.Sc. IN FOOD SCIENCE, NUTRITION AND TECHNOLOGY: YEAR I
B.Sc. HORTICULTURE: YEAR I
B.Sc. IN TEXTILE AND APPAREL DESIGN AND MANAGEMENT: YEAR I

COURSE CODE AND TITLE: CPR 103: CHEMISTRY
TIME ALLOWED: TWO [2] HOURS

INSTRUCTIONS:

1. ANSWER 4 QUESTIONS, 2 QUESTIONS FROM EACH SECTION
2. DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE CHIEF INVIGILATOR

NOTE: THIS PAPER CONTAINS 6 PAGES INCLUDING THE COVER PAGE

Section 1: Inorganic Chemistry
Question 1
a. Define the following terms:
    i.   A colloid   [2.5 marks]
    ii. A solid   [2.5 marks]
    iii. Solvent   [2.5 marks]
    iv. Endothermic reaction   [2.5 marks]
    v.   Electrolyte   [2.5 marks]
    vi. A nucleus   [2.5 marks]

b. Calculate the formula mass of Potassium dichromate ($K_2Cr_2O_7$) given the following information: K = 39.098 amu; Cr = 51.996 amu; O = 15.999 amu   [5 marks]

c. Distinguish between covalent and ionic bonds.   [5 marks]

                                                   [25 marks]
Question 2
    a. Calculate the atomic mass of Neon (Ne) in amu; given the following information of the isotopes:
        Neon 20 [^{20}Ne] with abundance of 90.48 %;
        Neon 21 [^{21}Ne] with abundance of 0.27 %; and
        Neon 22[^{22}Ne] with abundance of 9.25 %.

                                              [10 marks]

    b. Calculate the percent (%) elemental composition of Zinc pyrophosphate ($Zn_2P_2O_7$) given the following information: Zn = 65.39 amu; P = 30.974 amu; O = 15.999 amu
                                            [10 marks]

    c. Convert: 0.49 N Sulphuric acid (H_2SO_4) to Molarity.   [5 marks]

                                                   [25 marks]
Question 3
    a. What pressure (in bars) could 3.44 mol of argon gas exert in a vessel of volume 1600 ml at 24°C if it behaved as an ideal or a perfect gas?   [5 marks]

    b. You are required to make 200 ml of 0.77 M Sodium carbonate (Na_2CO_3); calculate the mass of the solute you would need to make this solution.   [10 marks]

    c. Calculate the equilibrium constant of the reaction of CO and H_2O to produce CO_2 and H_2 given that the concentrations are as follows; [CO] = 0.0044 M, [H_2O] = 0.0044 M, [CO_2]= 0.0033 M and [H_2] = 0.0033 M at 1000°C.

                                            [10 marks]

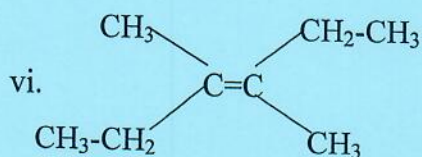   **[25 marks]**

Section 2: Organic Chemistry
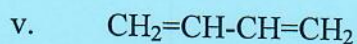
Question 4

    a. Define the following terms:
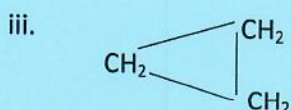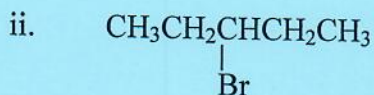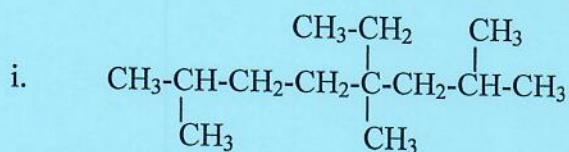   i.   Protein   [2.5 marks]
       ii.   Hydrocarbon   [2.5 marks]
       iii.   Saturated hydrocarbon   [2.5 marks]
       iv.   Molecular formula   [2.5 marks]
       v.   An alkyne   [2.5 marks]
       vi.   Halogenation reaction   [2.5 marks]

    b. What is the molecular formula of an alkane containing eight [8] carbon atoms?   [5 marks]

    c. Determine the molecular formula of an alkene that contains sixteen (16) hydrogen atoms.   [5 marks]

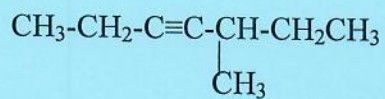   **[25 marks]**

Question 5

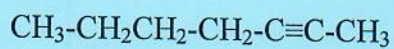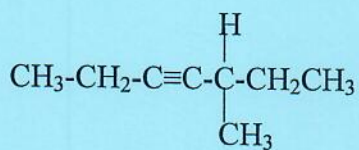   a. Give the IUPAC names of the following compounds: [1 mark each]

       i.

$$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3-CH_2}{|}}{C}}-CH_2-\underset{\underset{CH_3}{|}}{CH}-CH_3$$

       ii. $CH_3CH_2\underset{\underset{Br}{|}}{CH}CH_2CH_3$

       iii.

       iv. $CH_2{=}CH{-}CH{=}CH{-}CH{=}CH{-}CH{=}CH{-}CH_3$

       v. $CH_2{=}CH{-}CH{=}CH_2$

       vi.

$$\underset{CH_3-CH_2}{\overset{CH_3}{\diagdown}}C{=}C\underset{CH_3}{\overset{CH_2-CH_3}{\diagup}}$$

vii.

viii. $CH_3\text{-}CH_2\text{-}C{\equiv}C\text{-}CH\text{-}CH_2CH_3$
                                  $|$
                                 CH_3

ix. $CH_3\text{-}CH_2CH_2\text{-}CH_2\text{-}C{\equiv}C\text{-}CH_3$

x. H
                          $|$
    $CH_3\text{-}CH_2\text{-}C{\equiv}C\text{-}C\text{-}CH_2CH_3$
                          $|$
                         CH_3

xi.

xii.

xiii. CH_3
              $|$
     $CH_3CHCHCH_3$
                $|$
               NH_2

xiv. $CH_3CH_2CH_2NH_2$

xv. CH_3
                  $|$
    $CH_3CH_2\text{-}C\text{-}CH_3$
                  $|$
                 OH
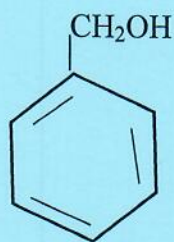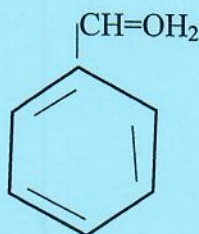
b. Write down the structural formula for each of the following compounds:
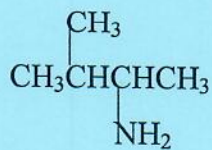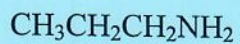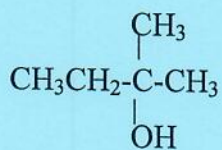
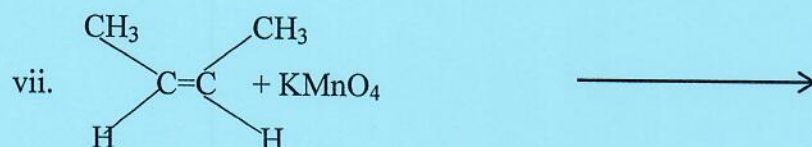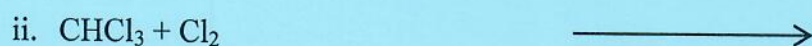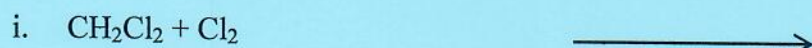   i. Butane   [2 marks]

      ii. Methylcyclohexane   [2 marks]

      iii. 3-ethyl-2-methyloctane   [2 marks]

      iv. Pentene   [2 marks]

      v. 2-methyl-2-pentene   [2 marks]

[25 marks]

Question 6

a. Complete the following chemical equations: [2 marks each]

i. $CH_2Cl_2 + Cl_2$ $\longrightarrow$

ii. $CHCl_3 + Cl_2$ $\longrightarrow$

iii. $CH_3CH_2CH_3 + 5O_2$ $\longrightarrow$

iv. $CH_3CH_2CH_3 + 3.5O_2$ $\longrightarrow$

v. $CH_2=CH_2 + HCl$ $\longrightarrow$

vi. $CH_3(CH_2)_3CH=CH_2 + Br_2$ $\longrightarrow$

vii.
$$\begin{array}{ccc} CH_3 & & CH_3 \\ & C=C & \\ H & & H \end{array} + KMnO_4 \longrightarrow$$

viii. $H-C{\equiv}C-CH_2-CH_2-CH_3 + 2HBr \longrightarrow$

ix. $CH_3CH_2CH_2CH_2OH + $ $\xrightarrow[H_2SO_4]{K_2Cr_2O_7}$

x. $CH_3CH_2CH_2\overset{\displaystyle O}{\overset{\|}{C}}H + $ $\xrightarrow[H_2SO_4]{K_2Cr_2O_7}$

b. Describe how you would treat someone poisoned by carbon monoxide (CO)?   [5 marks]

[25 marks]

Extra information given:

1. Equation of a perfect gas: $pV = nRT$

2. Gas constant (R) = 8.31447×10^{-2} L bar K^{-1} mol^{-1}

3. Avogadro's constant: 6.02214×10^{23} mol^{-1}

4. Density of water: 1 g/cm^3

5. pH = log 1/[H$^+$] = - log [H$^+$]

6. mA + nB   pC + qD

7. K   = $([C]^p [D]^q)/ ([A]^m[B]^n)$

8. X = p/K

9. F = $k(C_1 \times C_2)/r^2$

10. $\Delta G = \Delta H - T\Delta S$

11. $C_1V_1 = C_2V_2$