UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: DIPLOMA IN AGRICULTURE YEAR I
DIPLOMA IN AGRICULTURAL EDUCATION YEAR I
HOME ECONOMICS YEAR I
HOME ECONOMICS EDUCATION YEAR I

COURSE CODE: CP 101

TITLE OF PAPER: CHEMISTRY
SECTION 1: INORGANIC CHEMISTRY
SECTION 2: ORGANIC CHEMISTRY

TIME ALLOWED: TWO AND A HALF [2.5] HOURS

INSTRUCTIONS: ANSWER FOUR [4] QUESTIONS, AT LEAST
TWO QUESTIONS [2] FROM EACH SECTION

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SECTION : 1 INORGANIC CHEMISTRY

QUESTION 1

(a)   Define or give brief descriptions of the following terms and phrases. Each answer
       carries two [2] marks.

(i)   Freezing point
(ii)   An electron
(iii)   A neutron
(iv)   Solid
(v)   An ionic compound
(vi)   Inorganic chemistry
(vii)   liquid
(viii)   Endothermic reaction
(ix)   A strong base
(x)   An orbital

                                                                    [20]

(b)   Calculate the percent elemental composition of dolomite [$CaMg(CO_3)_2$] given the
       atomic masses of the following elements:

                        Ca = 40.0800   amu
                        O = 15.9994   amu
                        Mg = 24.305   amu
                        C = 12.305   amu

       Your final answers should be expressed to two [2] decimal places.   [5]

                                                                    25]

QUESTION 2

(a)   Determine the mass of two atoms of $^{238}_{92}U$ (Uranium) in grams given that the mass
       of the isotope is 238.050784 amu and that Avogadros' number is equal to
       6.022045 $\times$ 10^{23} atoms per mole.
       Show all calculations and express your final answer to four [4] decimal places.

                                                                    [10]

(b) Calculate the atomic mass of magnesium given the abundances and masses of its naturally occurring isotopes. <u>Show all calculations and do not round off your final answer.</u>

Isotope	Abundance (%)		Mass (amu)
$^{24}_{12}Mg$	77.89	$\rightarrow$	23.985042
$^{25}_{12}Mg$	10.11	$\rightarrow$	24.985837
$^{26}_{12}Mg$	12.00	$\rightarrow$	25.982593

[10]

(c) Calculate the formula mass of orthoclase feldspar $[KAlSi_3O_8]$ by using the following information:

$$K = 39.0983 \text{ amu} \quad \text{(atomic mass)}$$
$$Al = 26.9815 \text{ amu} \quad \text{(atomic mass)}$$
$$Si_3 = 84.3566 \text{ g} \quad \text{(molecular mass)}$$
$$O_2 = 31.9988 \text{ g} \quad \text{(molecular mass)} \quad [5]$$

[25]

QUESTION 3

(a) How many atoms of hematite $[Fe_2O_3]$ are there if it has a mass of 12.01 grams, given the molecular masses of :

$$Fe_2 = 111.694 \text{ g}$$
$$O_3 = 47.9983 \text{ g and}$$
$$\text{Avogadro's number} = 6.022045 \times 10^{23} \text{ atoms per mole}$$

[10]

(b) Briefly explain how you would practically make a 1 N H_2SO_4 from a 8 M H_2SO_4 stock solution (using water as a solvent) in the laboratory. Clearly show your calculations. Atomic masses: H = 1.00794 amu. S = 32.06 amu. O = 15.9994 amu. [15]

[25]

SECTION 2 : ORGANIC CHEMISTRY

QUESTION 4

(a)   Define or briefly describe the following terms and phrases. Use a structural formula where necessary . Each answer carries two [2] marks.

(i)   Unsaturated hydrocarbon
(ii)   Hydrocarbon
(iii)   An organohalogen
(iv)   Essential amino acids
(v)   An electrophile
(vi)   Para directing group
(vii)   Protein
(viii)   A ketone
(ix)   An amine
(x)   A tertiary amine

[20]

(b)   Write the molecular formula of an alkane containing nine [11] carbon atoms

[2]

(c)   Determine the molecular formula of an alkene that contains twenty four [24] hydrogen atoms
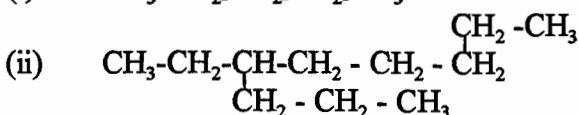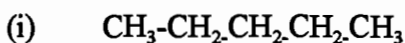
[2]

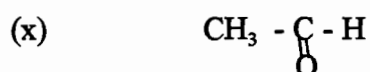(d)   What is the molecular formula of an alkyne that has Six [6] carbon atoms.
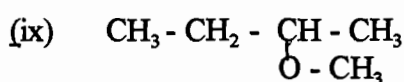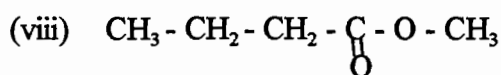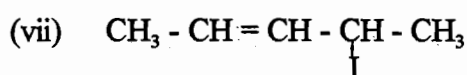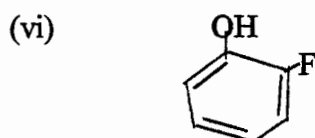[1]
[25]

QUESTION 5

(a)   Write the IUPAC names of the following compounds. Each answer carries two [2] marks.

(i) $CH_3-CH_2.CH_2.CH_2.CH_3$

(ii) $CH_3-CH_2-CH-CH_2 - CH_2 - CH_2$
         with $CH_2 -CH_3$ above
         and $CH_2 - CH_2 - CH_3$ below

(iii) $CH_3-CH_2-\underset{I}{CH} - \underset{F}{CH}-CH_3$

(iv) $CH_3 - CH = \underset{CH_3}{C} - \underset{OH}{CH} - CH - CH_3$

(v) $CH \equiv C - CH_2 - CH_3$

(vi)

(vii) $CH_3 - CH = CH - \underset{I}{CH} - CH_3$

(viii) $CH_3 - CH_2 - CH_2 - \underset{O}{\overset{}{C}} - O - CH_3$

(ix) $CH_3 - CH_2 - \underset{O - CH_3}{CH} - CH_3$

(x) $CH_3 - \underset{O}{\overset{}{C}} - H$
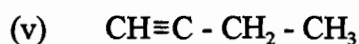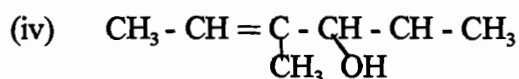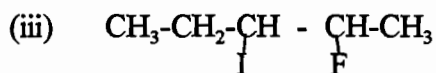
[20]

(b) Write **condensed** IUPAC **structural** formulae for the following compounds. Each answer carries one [1] mark.

(i) 2 - chloro - 1 - heptanol
(ii) 2 - iodo - 4 - heptinal
(iii) Ethoxycyclohexene
(iv) 2 - pentyne
(v) Hexanone
(vi)   [25]

QUESTION 6

(a) Copy ,complete and balance the following equations. Each answer carries one [1] mark.

(i) $CH_3 - CH_3 \quad + \quad F_2 \qquad =$

(ii) $CH_2 F_2 \quad + \quad F_2 \qquad =$

(iii) + I₂ =

(iv) + HNO₃ =

(v) $CH_3CH=CH_2$ + HCl =

(vi) $CH_2=CH_2$ + Br_2 =

(vii) $CH_2=CH_2$ + $3O_2$ =

(viii) $CH_3CH_2CH_2CH=CH_2$ + HBr =

(ix) $CH_3CH_2CH_2OH$ + HI =

(x) $CH_3 - C - CH_3$ + HCN =
         O

(xi) CH_4 + $2O_2$ =

(xii) $R - \overset{R}{\underset{R}{C}} - OH$ + [O] =

(xiii) $CH_3 - CH_2\,OH$ + $3O_2$ =

(xiv) CH_4 + Cl_2 =

(xv) + H_2SO_4 =

[15]

(b) Write correct condensed structural formulae of the incorrectly written condensed ones for the following compounds. Each answer carries two[2] marks.

(i)   Propane $\neq$ $CH_3-CH_3-CH_4$

(ii)   Propanal $\neq$ $CH_3-CH_2-CH_2$

(iii)   Pentanol $\neq$ $CH_3-CH_3-\overset{\displaystyle O}{\overset{\|}{C}}H-\underset{\displaystyle OH}{C}H-CH_2$

(iv)   Methoxypentene $\neq$ $CH_3-O-CH_2-CH=CH-CH-CH_2$

(v)   Hexanone $\neq$ $CH_3CH-CH_3-CH-\underset{\displaystyle O}{\overset{\|}{C}}-CH_3$

[10]

[25]