1ST SEMESTER 2009/2010

THE UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

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

COURSE CODE: CP 101

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

TIME ALLOWED: TWO [2] HOURS

INSTRUCTION: ANSWER FOUR [4] QUESTIONS WITH AT LEAST TWO [2] QUESTIONS FROM EACH SECTION

NOTE: THAT THE PAPER CONTAINS SIX [6] PAGES INCLUDING THE COVER PAGE

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SECTION 1 : INORGANIC CHEMISTRY

QUESTION 1

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

(i) An acid

(ii) An electron

(iii) A shell

(iv) An atom

(v) An isotope

(vi) A proton

(vii) A compound

(viii) A subshell

(ix) A molecular formula

(x) An endothermic reaction

[20]

Given the following information: Atomic masses : Mg =24 .305 amu; O_2 = 15.9994 amu; $H_{2 = 1.007\ amu}$, calculate the equivalent mass of magnesium hydroxide [$Mg(OH)_2$]. [5]

[25]

QUESTION 2

(a) Determine the atomic mass of magnesium given the abundances and masses of its naturally occurring isotopes listed below. Show all calculations and express the final answer to five [5] decimal places.

Isotope	Abundances (%)	Masses (amu)
$^{24}_{12}Mg$	78.99	23.985042
$^{25}_{12}Mg$	10.00	24.985837
$^{26}_{12}Mg$	11.01	25.982593

[15]

(b) Calculate the formula mass of the mineral mascagnite $[(NH_4)_2SO_4]$, given the atomic masses of the following elements. O = 15.9994 amu. N = 14.0067 amu. H = 1.007 amu. S = 32.06 amu. [10]

[25]

QUESTION 3

(a) Find the percent element composition of the mineral Celsian $[BaAl_2Si_2O_8]$ by using the following information. Ba = 137.53 amu. Al = 26.9815 O = 15,9994 amu. Si = 28.00855 amu.

[15]

(b) By using the Product Rule, determine the pH values at the following concentrations.

(i) 0.001 M [5]

(ii) $2.0 * 10^{-2}$ M [5]

[25]

SECTION 2 : ORGANIC CHEMISTRY

QUESTION 4.

(a) Define or give brief descriptions of the following terms or phrases. Include a **structural** formula where possible. Each answer carries two [2] marks.

(i) An hydrocarbon

(ii) An alkene

(iii) An alkane

(iv) An alkyne

(v) A saturated hydrocarbon

(vi) An ether

(vii) An organohalogen

(viii) A phenol

(ix) A nucleophile

(x) An addition reaction.

[20]

(b) Determine the following molecular formulae by using the correct formula when calculating:

(i) An alkane that has seven [7] carbon atoms.

(ii) An alkane that has six [6] hydrogen atoms.

(iii) An alkene that has six [6] carbon atoms.

(iv) An alkene that has a total of twenty four hydrogen [24] atoms

(v) A cycloalkane that has a total of six [6] carbon atoms.

[5]

[25]

QUESTION 5

(a) Give the IUPEC names to each of the following compounds. Each answer carries two [2] marks.

(i) $CH_3 - \underset{\displaystyle CH_3 - CH_2}{\underset{|}{CH}} - CH_2 - CH_2 - CH_2 - CH_3$

(ii) $CH_3 - CH_2 - \underset{\displaystyle CH_2 - CH_2 - CH_3}{\underset{|}{\overset{\displaystyle CH_2 - CH_3}{\overset{|}{C}}}} - CH_3$

(iii) $CH_3 - \underset{\displaystyle CH_3 - CH_2}{\underset{|}{CH}} - CH_2 - \underset{\displaystyle CH_2 - CH_3}{\underset{|}{CH}} - CH_2 - CH_3$

(iv) $CH_3 - CH_2 = \underset{\displaystyle CH_2 - CH_2 - CH_2 - CH_3}{\underset{|}{C}} - CH_2 - CH_2 - CH_3$

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

(vi) $CH_3 - CH_2 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

(vii) $CH_3 - CH_2 - CH_2 - \underset{\displaystyle OH}{\underset{|}{CH_2}}$

(viii) $CH_3 - CH_2 - \underset{\displaystyle Cl}{\underset{|}{CH}} - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3$

(ix) $CH_3 - CH_2 - \underset{\displaystyle O}{\underset{\|}{C}} - CH_3$

(x) $CH_3 - CH_2 - O - CH_2 - CH_2 - CH_3$ [20]

(a) The reaction between an unsymmetrical alkene and an unsymmetrical reagent like an hydrogen halide gives two products of different quantities. State a rule that specifies the route followed by the electrophile so that one product is favored. Include an equation to illustrate the rule.

[25]

QUESTION 6

(a) Write **condensed** IUPAC structural formulae for the following named compounds. Each answer carries two [2] markes.

i) 2 - bromo -2- heptanol

ii) 3 - methyl - 2 - hexyne

iii) 3 - iodo - 4 - heptanol

iv) 1 ,1 - dichloropentane

v) Cyclohexane

[10]

(b) Either copy and complete the following equations or just supply the required answers only. Each answer carries three [3] marks.

i) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle}{CH}} - CH_2 - CH_3 + Cl_2 =$

ii) $CH_4 + Cl_2 =$

iii) $CH_4 + O_2 =$

iv) $CH_2 = CH_2 + Br_2 =$

v) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{C}} - OH + [O] =$

[15]

[25]