



## MERU UNIVERSITY COLLEGE OF SCIENCE & TECHNOLOGY

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### University Examinations 2010/2011

FIRST YEAR, FIRST SEMESTER EXAMINATIONS FOR DIPLOMA IN AGRICULTURAL EDUCATION  
AND EXTENSION/FIRST YEAR, SECOND SEMESTER CERTIFICATE IN AGRICULTURE

#### CHE 0100: CHEMISTRY

DATE: DECEMBER 2010

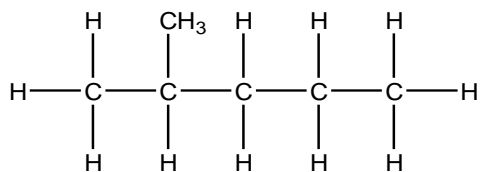
TIME: 1½ HOURS

INSTRUCTIONS: Answer *Question one* which is *Compulsory* and any other two questions

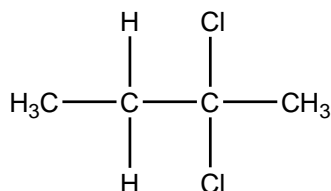
#### QUESTION ONE – (30 MARKS)

- (a) Write the electronic configuration of the following elements using the inert gas core notation.
- (i) Boron (B)
  - (ii) Fluorine (F)
  - (iii) Phosphorus (P)
  - (iv) Titanium (Ti) (4 Marks)
- (b) Draw the orbital diagrams for the following elements:
- (i) Magnesium
  - (ii) Sulphur
  - (iii) Carbon (6 Marks)
- (c) What are the possible values of the magnetic quantum number,  $m$  when the principal quantum number  $n = 3$  and the azimuthal quantum number,  $l = 1$ ? (3 Marks)
- (d) Differentiate between endothermic and exothermic processes. (2 Marks)
- (e) The simplest formula of a sample of vitamin C was found to be  $C_3H_4O_3$ . From another experiment, the molecular mass of vitamin C was found to be about 180. Determine the molecular formula of vitamin C. (4 Marks)
- (f) In what ways is lithium different from the rest of the group IA (Alkaline) metals? (3 Marks)
- (g) Name the following compounds using the IUPAC system. (3 Marks)

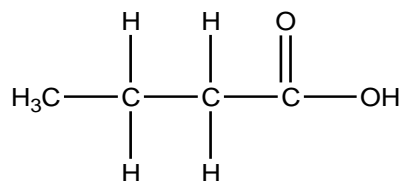
(i)



(ii)



(iii)



(h) (i) What are structural isomers?

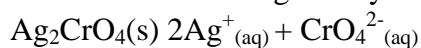
(1 Mark)

(ii) An organic compound has molecular formula  $\text{C}_4\text{H}_{10}$ . Write and give names of all possible structural isomers of this compound.

(4 Marks)

## QUESTION TWO – (15 MARKS)

(a) Silver Chromate, ( $\text{Ag}_2\text{CrO}_4$ ) is sparingly soluble in water and its equilibrium existing in a saturated solution is given by:



Given that the activity of pure solid is 1,

(i) Write the expression for the equilibrium constant  $K_c$

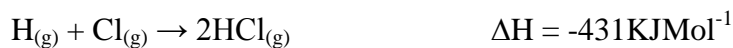
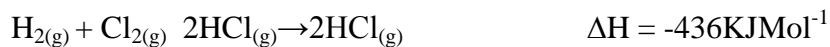
(2 Marks)

(ii) If the solubility product  $k_{sp}$  for  $\text{Ag}_2\text{CrO}_4$  is  $2.4 \times 10^{-12}$ , calculate the molar solubility of the

Silver Chromate,  $\text{Ag}_2\text{CrO}_4$  in water.

(4 Marks)

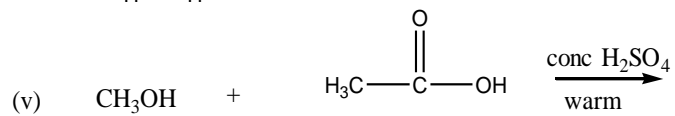
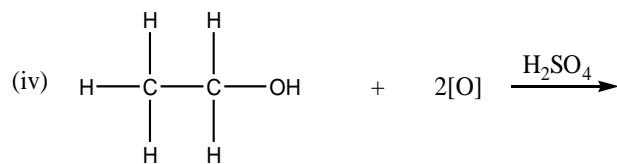
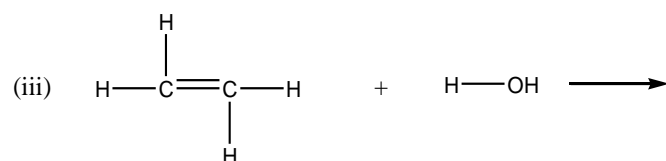
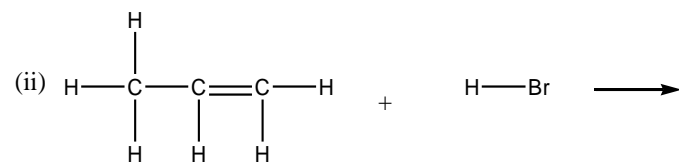
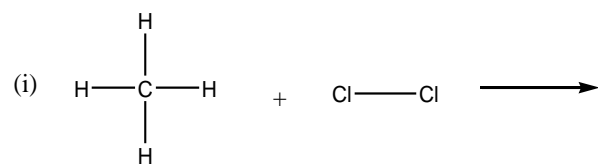
(b) The diatomic molecules of hydrogen and chlorine react to form hydrogen chloride as shown by the chemical equations below. Study the given equations and answer questions that follow.



- (i) What is enthalpy change in a chemical reaction? (2 Marks)
- (ii) Calculate the enthalpy change for the formation of hydrogen chloride gas from hydrogen and chlorine gases. (5 Marks)
- (iii) Write the thermo-chemical equations for the reaction between hydrogen and chlorine gases to form hydrogen chloride gas. (2 Marks)

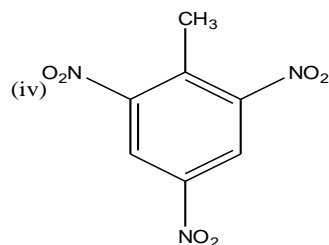
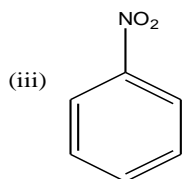
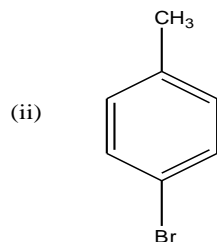
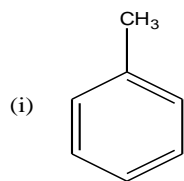
### QUESTION THREE – (15 MARKS)

(a) Complete the equations to show the products of the following reactions (10 Marks)



(b) Give the systematic names of the following compounds

(5 Marks)



#### QUESTION FOUR – (15 MARKS)

(a) The atomic masses of the two stable isotopes of copper are given below:

Isotope (%)	Atomic Mass (ama)	Abundance
<sup>63</sup> Cu	62.929599	69.17
<sup>65</sup> Cu	64.92779	30.83

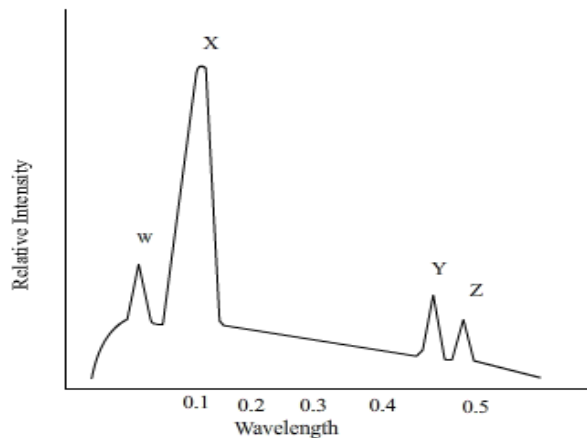
Calculate relative atomic mass of copper.

(3 Marks)

(b) The first line of the Balmer series occurs at a wavelength of 656.3nm. What is the energy difference ( $\Delta E$ ) between the two energy levels that are involved in the emission that result in this spectral line? ( $c = 3.0 \times 10^8 \text{ m/s}$ )

(4 Marks)

(c) The diagram shows an X-ray spectrum of a certain element M.



- (i) Identify the peaks W, X, Y, Z (4 Marks)
- (ii) The X-rays spectrum for element M, showed a frequency of the peak X being  $3.77208 \times 10^{18}$  Hz. Determine the atomic number of the element M. (3 Marks)
- (iii) Identify the element M. (1 Mark)

#### QUESTION FIVE – (15 MARKS)

- (a) Briefly explain why:
  - (i) The sizes of atoms DECREASE from the left to the right across any given period in the periodic table of elements. (2 Marks)
  - (ii) The sizes of atoms (INCREASE) on descending any group in the periodic table of elements. (2 Marks)
- (b) The first ionization potential (ionization energy may be described as the energy required to convert  $M \rightarrow M^+$ ). The first and the second ionization potentials of the group IA metals are given in the table below. Study the table and then answer the questions that follow.

Metal	1 <sup>st</sup> Ionization Potential (ev)	2 <sup>nd</sup> Ionization Potential (ev)
Lithium	5.39	75.62
Sodium	5.14	47.29
Potassium	4.34	31.81
Rubidium	4.18	27.36
Calcium	3.89	23.40

- (i) Briefly explain how the FIRST ionization potential would change from lithium to calcium (2 Marks)
- (ii) Identify the factors that influence the magnitude of the ionization potential.

- (c) (i) Explain giving a relevant example, the Brosted theory of an acid. (4 Marks)
- (ii) Calculate the pH of a  $5.0 \times 10^{-2}$  M solution of NaOH. (2 Marks)
- (3 Marks)