JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

KISUMU LEARNING CENTER

UNIVERSITY EXAMINATIONS 2012/2013 ACADEMIC YEAR

COURSE CODE: SCH 2121

COURSE TITLE: GENERAL CHEMISTRY II

DURATION: 1 HOUR 30 MINUTES

INSTRUCTIONS:

1. Answer any **THREE** questions.
2. All answers should be written on the answer booklet provided.
3. Each question consists of equal marks.

1. (a) Define the following terms

i) Hybridization (1mark)

ii) Isotopes (1mark)

iii) Polymer (1mark)

iv) Functional group (1 mark)

v) Saturated hydrocarbon (1mark)

(b) Carbon which is a group 4 element is unique compared to other elements in the same group. Briefly explain the following observations in the chemistry of carbon

i) Carbon has the highest tendency to catenation (1 mark)

ii) Carbon differs from other elements in its limitation to a coordination number FOUR. (2 marks)

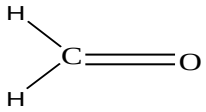
iii) Carbon and silicon have similar chemical characteristics which differ widely from germanium an tin (2 marks)

(c) Carbon in its ground state cannot participate in chemical boding. It undergoes electron excitation for it's to actively participate in bonding. (2 marks)

i) Using the 'Box' model write the electronic configuration of Carbon both in the ground state and its excited state. (2 marks)

ii) Using the energy level diagrams show how SP^2 hybridization takes place and hence use the orbital shapes to show how carbon- carbon double bonds (C ═ C) are arrived at. (2 marks)

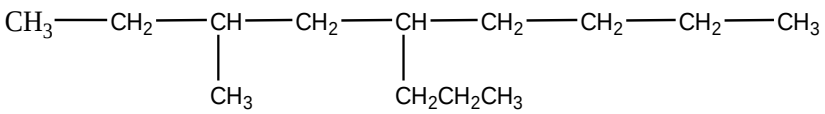
iii) Illustrate using orbital shapes how chemical bonding occurs in the following compounds.

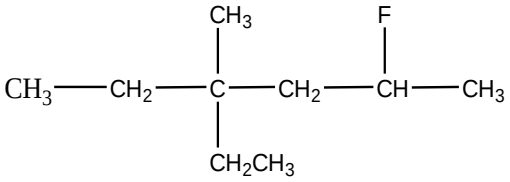
I. Carbonyl group  (2 marks)

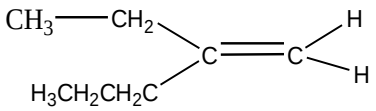
II. Amine group $CH_3–NH_2$ (2 marks)

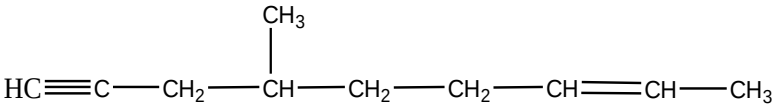
2. (a) Functional group plays a major role in determining the chemical properties of a given compound. Apart from alkanes, alkenes and alkynes, name and give the structures of THREE other functional groups. (3marks)

(b) Give the names of the following compounds.

i)  (1 mark)

ii)  (1mark)

iii)  (1 mark)

iv)  (1 mark)

c) Explain the following observations:

i) The covalent radii increase down the group FOUR elements but the difference in size between Si and Ge is less than might be otherwise expected. (2 mks)

ii) The oxides of Carbon differ from those of other elements in the same group. (1 mark)

(d) Carbon forms FIVE different compounds with oxygen.

i) List the oxides of carbon with their chemical formulae. (2 marks)

ii) With the aid of a chemical equation, describe how carbon (II) oxide is prepared from formic acid. (2 marks)

iii) Explain the chemical test for the presence carbon (II) oxide (2 marks)

(e) A plastic material is any of a wide range of synthetic organic solids that are moldable.

i) Name and briefly explain the TWO types of plastics. (2 marks)

ii) Recent technology has developed biodegradable plastics. Briefly describe the TWO biodegradable plastics. (2 marks)

3. (a) Silicon is one of the elements in group FOUR which is also abundant in the earth's crust.

i) Write the electronic configuration of Silicon. (2 mark)

ii) Silicon is known to react with oxygen to form Silicates. Predict the hybridization of Silicon that aids it to form orthosilicates. (2 marks)

iii) Apart from orthosilicates, name other FOUR forms of silicates. (4marks)

(b) Carbon can combine with other elements as well as with itself and this allows it to form many elements with varying size and shape.

i) Explain what catenation means with reference to group 4 elements. (2 marks)

ii) Name and briefly explain the three different allotropes of Carbon. (3 marks)

iii) One of the allotropes can be used to make lubricants while another can be used to make drills. Account for these uses. (2 marks)

c) Give the structures for the following compounds.

i) 3 – Ethyl -2- pentene (1 mark)

ii) 4 – methyl -7- nonen -1-yne (1 mark)

iii) 1- Heptene -6 –yne (1 mark)

iv) 4- chloro-6,6- di-iodo-7 methyl -2-nonyne (1 mark)

v) 4-methyl-1,5-octadiyne. (1 mark)

4. (a) Petroleum is an important product especially in the energy industry.

   i) Define the term petroleum (1 mark)
   ii) Petroleum can be separated into useful compounds/products by fractional distillation of the crude oil. Outline the products extracted from it starting with the ones with least number of carbons. (3 marks)
   iii) Explain why the petroleum fractions differ in their colour intensities and boiling points. (3marks)

(b) Cement is an essential component when it comes to building and construction. Portland cement is the most common type of cement in general use around the world.

   i) Define the term cement. (1mark)
   ii) Name the four main chemical composition of Portland cement. (2 marks)
   iii) Explain why Portland cement is also known as 'hydraulic cement' (2 marks)
   iv) Fineness is one of the properties of cement. Explain how this property is of use to cement. (2 marks)
   v) Briefly explain how 'ordinary Portland cement' is prepared in the factory. (2 marks)

d) Modified Portland cement also known as expansive cement is that which contain hydraulic calcium silicates

   i) What is the importance of using expansive cement over the Portland cement? (1mark)
   ii) Briefly name and explain any TWO kinds of expansive cement. (2 marks)
   iii) Explain why non-hydraulic cement can be used in underwater constructions. (1mark)

5. (a) Depending on the final use and application, the composition of glass will vary to achieve the adequate properties for the specific application.

i) List the common ingredients used to obtain glass. (3 marks)

ii) State the main properties of glass. (3 marks)

iii) Give TWO uses of glass. (2 marks)

(b) There are other materials called ceramic materials.

i) What are ceramic materials? (1 mark)

ii) Name any TWO anions forming part of the chemical composition of ceramic materials. (2 marks)

iii) Name TWO processes involved in the manufacture of ceramic materials. (2 marks)

iv) State THREE properties of ceramic materials. (3 marks)

(c) Asbestos are of advantage and disadvantageous to the humanity.

i) Explain the meaning of is asbestos (1 mark)

ii) Give ONE advantage and TWO disadvantages of asbestos. (3 marks)