

MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

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University Examinations 2012/2013

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

CHE 0100: CHEMISTRY

DATE: APRIL 2013

TIME: 1½ HOURS

INSTRUCTIONS: Answer questions *one* and any other *two* questions.

- Speed of light $c = 2.99792 \times 10^8 \text{ms}^{-1}$
- Plancks constant, $h = 6.6262 \times 10^{-34} \text{Js}^{-1}$

QUESTION ONE (30 MARKS)

- a) Using the *s, p d* notations write the electronic configuration for the following elements (4 Marks)
- Magnesium (atomic number 12)
 - Titanium (atomic number 22)
 - Manganese (atomic number 25)
 - Zinc (atomic number 30)
- b) For radiation having $\lambda = 2 \times 10^{-7} \text{m}$ and given that the speed of light is $3.0 \times 10^8 \text{ms}^{-1}$. Calculate the energy in KJ for the radiation. (4 Marks)
- c) Explain why the ionization energy down group one $\text{Li} > \text{Na} > \text{K} > \text{Rb} > \text{Cs} > \text{Fr}$. (2 Marks)
- d) Use Valence Shell Electron Pair Repulsion Theory (VSEPR) to predict molecular geometry of the following molecules. (4 Marks)
- CO_2
 - NH_3
- e) Define the term acid according to Arrhenius. (2 Marks)
- f) Outline the failures of Bohr atomic model. (3 Marks)

- g) The K_{sp} value for solid AgI is 1.50×10^{-6} at 25°C . Calculate the solubility of AgI in water at 25°C . (3 Marks)
- h) Write the structural formula for the following compounds. (1 Mark)
- 2, 2-dimethylpent-1-ol
 - 2-chloro, 2,4-dimethylhex-2,3-diene
- i) Distinguish between strong acids and dilute acids. (2 Marks)
- j) Calculate the pH of 0.003M sulphuric acid. (4 Marks)

QUESTION TWO (15 MARKS)

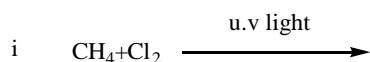
- a) Define the term buffer solution. (2 Marks)
- b) Write the chemical equation describing the reaction for dissolving solid PbCl_2 in water and also its K_{sp} expression. (3 Marks)
- c) Draw all the isomers of C_6H_{14} . (3 Marks)
- d) Mg^{2+} and Na^+ are isoelectronic. Explain why the ionic radii of Mg^{2+} is 65pm while that of Na^+ is 95pm. (2 Marks)
- e) The pH of 0.01M of ethanoic acid, CH_3COOH is 3.40 at 25°C . Calculate its dissociation constant at this temperature. (5 Marks)

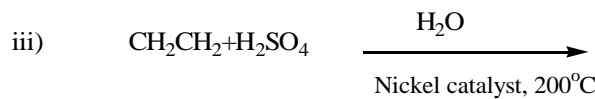
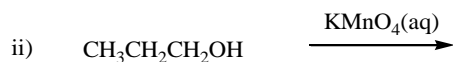
QUESTION THREE (15 MARKS)

- a) Name the four quantum numbers and state the properties of each. (8 Marks)
- b) Name the following compounds using the IUPAC system. (5 Marks)
- $\text{CH}_2\text{OHCHOHCH}_2\text{OH}$
 - $\text{C}_6\text{H}_5\text{NH}_2$
 - $\text{CH}_3\text{CH}=\text{CHCH}=\text{CHCH}_2\text{Cl}$
 - $\text{C}_6\text{H}_5\text{OH}$
 - $\text{CH}_3\text{CHClCH}_3$
- c) Distinguish between electro negativity and electron affinity. (2 Marks)

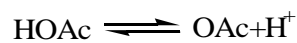
QUESTION FOUR (15 MARKS)

- a) From Einstein relativity theory, the fundamental law relating energy E , rest mass, M_0 and momentum, P of a particle is $\left(\frac{E}{c}\right)^2 = P^2 + m_0^2c^2$ and Plank's quantum theory, derive the De Broglie equation that relates the wavelength of all particles to momentum. (4 Marks)
- b) Distinguish between covalent bond and ionic bond. (2 Marks)
- c) Complete the following chemical equations to show the product of the following reactions. (4 Marks)





d) The dissociation of acetic acid $[\text{CH}_3\text{CO}_2\text{H}(\text{HOAc})]$ solution, can be expressed as follows



Show that the expression above for acetic acid can be written as

$$p^H = pK_a + \frac{[\text{OAc}^-]}{[\text{HOAc}]}$$

Also known as Henderson –Hasselbach equation.

(5 Marks)

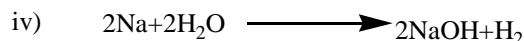
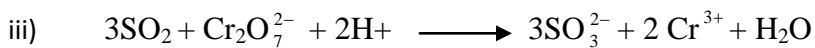
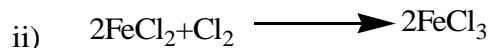
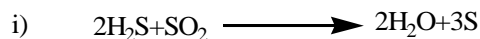
QUESTION FIVE (15 MARKS)

a) Outline four assumptions made in the Bohr atomic model.

(4 Marks)

b) State which reactant is oxidized in each of the following reactions and in each case give a reason.

(8 Marks)



c) Explain briefly why the atomic radii of elements across any period decrease from left to right in the periodic table.

(3 Marks)