



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

PUBLIC HEALTH

COURSE CODE : SCH 3112

COURSE TITLE: APPLIED CHEMISTRY

FIRST YEAR FIRST SEMESTER

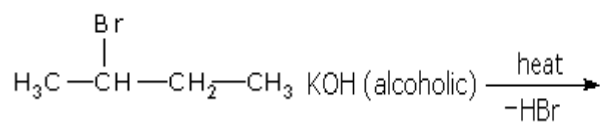
INSTRUCTIONS

1. Answer question 1(Compulsory) in section A and ANY other 2 questions in section B
2. Candidates are advised not to write on the question paper
3. Candidates must hand in their answer booklets to the invigilator while in the examination room
4. Some important information/formula are found on the last page of the questions paper

SECTION A

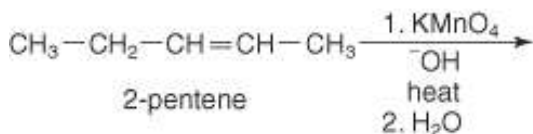
QUESTION 1 30 marks

- a) Name and draw the structure of the main compounds A, B, C, D and E in the reactions below 5 mrks
- i.



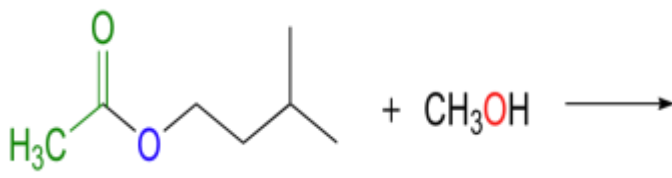
A

ii



B + C

iii



- b) The cations O_2^+ and N_2^+ are important components of the earth's upper atmosphere. Using Molecular orbital energy level diagram write the electronic configuration of O_2^+ and predict the bond order. 4 mrks
- c) Briefly discuss the following terms with the help of examples in each case;
- i. Dipole-dipole interaction 2 mrks
 - ii. Ion-dipole interaction 2 mrks
- d) Compare the THREE elements N, O and P
- i. Arrange the elements in order of increasing atomic radius. Justify your answer 3 mrks
 - ii. Identify the element with the highest ionization energy. Explain your answer 3 mrks
 - iii. Between N and P which one has the highest electron affinity? Explain 2 mrks
 - iv. Explain why the Ionization energies of Si, P and S are in the order of $\text{Si} < \text{P} > \text{S}$ 2 mrks
- e)
- i. A buffer solution was prepared by mixing 0.20 mol dm^{-3} ethanoic acid and 0.10 mol dm^{-3} sodium ethanoate. If the K_a for ethanoic acid is $1.74 \times 10^{-5} \text{ mol dm}^{-3}$, calculate the theoretical hydrogen ion concentration and pH of the buffer solution. 3 mrks
 - ii. In what ratio should a 0.30 mol dm^{-3} of ethanoic acid be mixed with a 0.30 mol/dm^3 solution of sodium ethanoate to give a buffer solution of pH 5.6? 4 marks

SECTION B

Answer ANY TWO questions from Section B

QUESTION 2 20 MARKS

- a) Define the term line spectrum 1 mrk
- b) Explain how line spectrum can be used for the identification of elements 2 mrks
- c) Hydrogen atom has one electron, however its spectrum contains so many lines. Explain. 2 mrks
- d) Consider an electron that jumps from the 4th ($n=4$) orbit to the second orbit ($n = 2$). Determine;
- i. the energy change (ΔE) for the electron in this jump 3 mrks
 - ii. the frequency (ν) and wavelength (λ) of light emitted from this energy change 3 mrks
 - iii. the spectral region in which this light will be formed 2 mrks
- e) With the help of an example distinguish between Molarity and Molality 2 mrks
- f) In an experiment equal volumes of $0.025 \text{ mol dm}^{-3}$ potassium bromide (KBr) and $0.005 \text{ mol dm}^{-3}$ lead(II) nitrate ($\text{Pb}(\text{NO}_3)_2$) solutions were mixed ($K_{\text{sp}}(\text{PbBr}_2) = 7.9 \times 10^{-5} \text{ mol}^3 \text{ dm}^{-9}$)
- a) Write down
- (i) the K_{sp} expression for lead(II) bromide 1 mrk
 - (ii) the ionic equation for its precipitation. 1 mrk
- b) Show by calculation if lead (II) bromide precipitates after mixing the solutions. 3 mrks

QUESTION 3 20 MARKS

- a) State Le Chatelier's Principle 2 mrks
- b) Define the term limiting reagent 1 mrks
- c) Explain why elements of the same group have similar properties. 2 mrks

- d) A student is in possession of a weak acid solution of 0.2 M HF. He decided to add to his solution an equal amount 0.10 M HCl. $K_a = 6.8 \times 10^{-4}$
- Determine the concentration of fluoride Ion and the pH of the solution before adding hydrochloric acid. 3 mrks
 - Calculate the pH of the mixture and explain the effect of the common effect to the pH of the final solution. 3 mrks
- e) Briefly explain the correlation between atomic size and ionization enthalpy 3 mrks
- f) Discuss any TWO relevant applications of radioactivity 6 mrks

QUESTION 4 20 MARKS

- Distinguish between artificial and natural Transmutation 2 mrks
 - With the help of curly arrows explain the Electrophilic Aromatic Substitution mechanism using benzene and a compound **EY** 3 mrks
 - Explain why aromatic compounds are stable? 1 mrk
 - Discuss the relevance of electromagnetic radiation in the Global Warming phenomena 3 mrks
 - Identify the missing product in the radioactive equation below 1 mrk
- $${}^{216}_{84}\text{Po} \rightarrow ? + {}^0_{-1}\beta$$
- State Pauli exclusion principle 2 mrks
 - Write the electronic configuration of the following Cr, Ti, Sn 4 mrks
 - Calculate the lattice enthalpy for lithium fluoride, given the following information 4 mrks
 - Enthalpy of sublimation for solid lithium = 161 kJ/mol
 - First ionization energy for lithium = 520 kJ/mol
 - F-F bond dissociation energy = 154 kJ/mol
 - Enthalpy of formation for F(g) = 77 kJ/mol
 - Electron affinity for fluorine = -328 kJ/mol
 - Enthalpy of formation for solid lithium fluoride = -617 kJ/mol

End

$h = \text{planck's constant} = 6.626 \times 10^{-34} \text{ J.S}$
 $C = \text{speed of light} = 3.0 \times 10^8 \text{ m/s}$
 $R = \text{Rhyberg's constant} = 1.0973731 \times 10^7 \text{ m/s}$

Periodic table

