JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF HEALTH SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR PUBLIC HEALTH AND COMMUNITY HEALTH AND DEVELOPMENT

1ST YEAR 1ST SEMESTER 2022/2023 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: HCB 1107

COURSE TITLE: APPLIED CHEMISTRY

DATE: **TIME:**

TIME: 2 HOURS

Instructions:

1. Answer ALL questions in Section A and B and ANY other TWO questions in Section C
2. Tick the most correct alternative in Section A
3. Answers to Questions in Section B and C must be written in the spaces provided on the question paper.
4. Candidates must ensure they submit their work by clicking “finish and submit attempt” button at the end.

Registration No……

SECTION A: 20 Marks (Each question carries 1 mark)

***NB*: These are multiple choice questions with four choices, A, B, C, and D and the candidate is supposed to tick the correct answer.**

1. Which one below is not an isotope of carbon? ***[1 mark]***
   a) ^{14}C
   b) ^{15}C
   c) ^{12}C
   d) ^{13}C
2. Electrophilic substitution reaction proceed via three-step mechanism, which one of the following is not considered as an electrophilic substitution reaction step. ***[1 mark]***
   a) Generation of an electrophile
   b) Formation carbocation
   c) Removal of a an electron from the intermediate
   d) Removal of a proton form the intermediate
3. Identify the element presented by the $1s^2 2s^2 2p^6 3s^2 3p^1$ electronic configuration. ***[1 mark]***
   a) Magnesium
   b) Aluminium
   c) Phosphorous
   d) Silicon
4. Which one of the following is not a property of aromatic compounds? ***[1 mark]***
   a) They have aroma
   b) They follow the Huckel's rule
   c) They are cyclic planar hydrocarbons
   d) They undergo addition reaction
5. Which one of the following is not an aromatic compound? ***[1 mark]***
   a) Toluene
   b) Furan
   c) Hemiacetal
   d) Phenol
6. One of the following is not a property of esters. ***[1 mark]***
   a) They polar compounds
   b) They are non-volatile compounds
   c) They undergo saponification reactions
   d) They undergo hydrolysis under acid-base conditions
7. Which of one the following is not a method for alkyne synthesis? ***[1 mark]***
   a) Dihaloakanes
   b) Cracking
   c) Hydrohalogenation

d) Dehydrohalogenation

8. Identify the acid in the following reaction: NH_3 (g) + H_2O <===> NH_4+ (aq) + OH^- (aq) ***[1 mark]***
   a) NH_3
   b) H_2O
   c) NH_4^+
   d) OH^-
9. Which one is not a property of ionic compounds? ***[1 mark]***
   a) They are usually crystalline solids in nature
   b) They are polar compounds
   c) They have high melting and boiling points
   d) They are poor conductors in molten and aqueous solution
10. Identify the non-metalloid in the list of the elements below. ***[1 mark]***
    a) Silicon
    b) Arsenic
    c) Selenium
    d) Pollonium
11. One of the following is not wave behavior in the spectroscopy. ***[1 mark]***
    a) Emission
    b) Excitation
    c) Transmission
    d) Absorption
12. Alkenes undergo several reactions, which of the following is not. ***[1 mark]***
    a) Halogenation
    b) Polymerization
    c) Hydration
    d) Dihaloalkane
13. How many isomers does pentane form? ***[1 mark]***
    a) 2
    b) 3
    c) 4
    d) 5
14. In the nomenclature of aromatic compounds, the 1,4 distribution is known as. ***[1 mark]***
    a) Par**a**
    b) Meta
    c) Ortho
    d) Pala
15. Calculate the number of particles of 32g of methane (CH_4) given that $N_A = 6.022 \times 10^{23}$ mol^{-1} ***[1 mark]***
    a) 6.022×10^{23} mol^{-1}
    b) 6.022×10^{23}
    c) 12.044×10^{23} mol^{-1}
    d) $12.0\mathbf{\mathit{44}} \times 10^{23}$
16. Calculate the value of pOH given that $[H^+]$ is 8.0×10^{-5}. ***[1 mark]***

a) 4
b) 10
c) 14
d) 8

17. Which one of the following is correctly matched? ***[1 mark]***
    a) Layman series – $n \geq 2$ to $n = 1$
    b) Brackett series – $n \geq 5$ to $n = 4$
    c) Paschen series – $n \geq 4$ to $n = 3$
    d) Balmer series – $n \geq 5$ to $n = 2$
18. Arrange the electromagnetic spectrum in the order of increasing wavelength. ***[1 mark]***
    a) X-rays-Gamma-UV-IR-Visible-IR-Microwave-Radio
    b) Gamma-UV-X-rays-Visible-Microwave-IR-Radio
    c) Gamma-X-rays-UV-Visible-IR-Microwave-Radio
    d) Radio-Microwave-IR-Visible-UV-X-rays-Gamma
19. Which one of the following does not determine the bond angle? ***[1 mark]***
    a) Electron lone pair
    b) Hybridization of the central atom
    c) Electronegativity
    d) Electron affinity
20. Which one of the following is not a reaction of alkanes? ***[1 mark]***
    a) Hydrogenation
    b) Halogenation
    c) Combustion
    d) Cracking

SECTION B: 30 Marks

The candidate is supposed to attempt all questions in this section. Answers to questions in this section must be written in the spaces provided. Answers must be precise and concise.

The questions are supposed to be structured/short answer questions which carry 2 to 5 marks each, making a total of 30 marks.

1. Differentiate atomic mass, atomic weight and atomic number. ***[3 marks]***
2. A mixture of 0.125mol H_2 and 0.125mol I_2 was placed in a 250cm^3 stainless steel flask at 430^{0}C. Calculate the concentrations of H_2, I_2 and HI at equilibrium given that the equilibrium constant K_c for the reaction H_2 (g) + I_2 (g) <=> 2HI (q) is 54.3 at this temperature. ***[3 marks]***
3. Define what amines are and briefly explain the three types of amines. ***[3 marks]***
4. Define valence electron and explain octet rule as used in chemical bonding. ***[3 marks]***
5. Discuss the merits and demerits of Arrhenius, Brønsted-Lowry and Lewis concepts of acid and base. ***[3 marks]***

6. Calculate the solubility constant Ksp given that 23.4g of $NaHCO_3$, was dissolved in 150cm^3 of water (Given that molar mass of Na, H, C and O are 23g/mol, 1g/mol, 12g/mol and 16g/mol respectively) ***[3 marks]***
7. Draw the IUPAC structure of the following compounds: ***[3 marks]***
   a) 2-methylpentanoic acid
   b) Cyclohexylmethylketone
   c) 2,5-dimethyl-4-octene
8. Briefly describe the terms "absorption" and "emission" as used in spectroscopy. ***[3 marks]***
9. Give three differences between ionic and covalent bonding. ***[3 marks]***
10. Name and describe the three classes of elements in the periodic table. ***[3 marks]***

SECTION C:20 Marks

These are long answer questions.

There are a total of three (3) questions, each carrying ten (10) marks. A candidate is supposed to answer any two (2) questions.

1. Explain the following using the acid-base concept. ***[10 marks]***
   a) Arrhenius, Brønsted-Lowry and Lewis concepts
   b) Using examples, differentiate strong and week acids and strong and weak bases.
2. Discuss at least five spectroscopic instruments and explain their concept. ***[10 marks]***
3. Use Sulphur (Z=16) to explain the rules used for assigning electrons in orbitals and the methods used to write electronic configuration of elements. ***[10 marks]***