



GARISSA UNIVERSITY

UNIVERSITY EXAMINATION **2017/2018** ACADEMIC YEAR **ONE**
FIRST SEMESTER EXAMINATION

SCHOOL OF EDUCATION, ARTS AND SOCIAL SCIENCES

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS)

COURSE CODE: CHE 110

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY

EXAMINATION DURATION: 3 HOURS

DATE: 04/12/17

TIME: 2.00-5.00 PM

INSTRUCTION TO CANDIDATES

- The examination has **SIX (6)** questions
- Question **ONE (1)** is **COMPULSORY**
- Choose any other **THREE (3)** questions from the remaining **FIVE (5)** questions
- Use sketch diagrams to illustrate your answer whenever necessary
- Do not carry mobile phones or any other written materials in examination room
- Do not write on this paper

This paper consists of **FIVE (5)** printed pages

please turn over



QUESTION ONE (COMPULSORY)

- (a) Briefly describe the following models of atomic theory as postulated by the respective scientist
- Dalton Particle theory of matter [2 marks]
 - Thomson model of Atomic theory [2 marks]
 - Bohr atomic model [2 marks]
 - Quantum Mechanical Atomic theory [2 marks]
- (b) Assume that the element with atomic number 113 has just been discovered in two different forms: one with 139 neutrons and one with 145 neutrons. If the first form occurs 75% of the time, what atomic mass should be listed on the periodic table for this element [2 marks]
- (c) Describe what each of the following rules that govern electron configurations states
- Aufbau Principle [1 mark]
 - Pauli Exclusion Principle [1 mark]
 - Hund's Rule [1 mark]
- (d) Explain how the following factors affect chemical reaction
- Concentration of the reactants and products [2 marks]
 - Catalyst [2 marks]
 - Temperature [2 marks]
- (e) 25 cm³ of a sample of vinegar (CH₃COOH) was pipetted into a volumetric flask and the volume was made up to 250 cm³. This solution was placed in a burette and 13.9 cm³ were required to neutralise 25 cm³ of 0.1 mol dm⁻³ NaOH. Calculate the molarity of the original vinegar solution and its concentration in g dm⁻³, given that it reacts with NaOH in a 1:1 ratio. [4 marks]
- (f) Explain why atoms in the same period get smaller from left to right in the Periodic Table [2 marks]

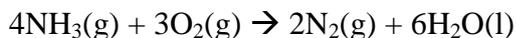
QUESTION TWO

- (a) Given the data:

Substance	H ₂ O(l)	NH ₃ (g)
$\Delta H_f / \text{kJ mol}^{-1}$	-286	-46



Calculate the enthalpy change of the following reaction:



[3 marks]

(b) State the main postulates of Dalton in the description of Atomic Theory model

[3 marks]

(c) Explain what is meant by the term relative isotopic abundance

[1 mark]

(d) Write the noble gas electron configurations. Cu=29 Cl=17 Fe=26

[6 marks]

i. Cu

ii. Cu^{2+}

iii. Cl

iv. Fe

(e) Determine the pH of a 0.2M sulfuric acid solution

[2 marks]

QUESTION THREE

(a) Define the terms:

[4 marks]

i. Oxidation

ii. Reduction

iii. Oxidising agent

iv. Reducing agent

(b) What is the molarity of 1.06g of H_2SO_4 in 250 cm^3 of solution

[2 marks]

(c) Analysis of a hydrocarbon showed that 7.8 g of the hydrocarbon contained 0.6 g of hydrogen and that the relative molecular mass was 78. Find the molecular formula of the hydrocarbon.

[4 marks]

(d) Explain how a catalyst lowers the activation energy for a reaction.

[2 marks]

(e) For the equilibrium $2\text{N}_2\text{O}_5(\text{g}) \rightleftharpoons 2\text{N}_2\text{O}_4(\text{g}) + \text{O}_2(\text{g})$

The equilibrium concentrations are $[\text{N}_2\text{O}_5] = 1.0 \text{ mol dm}^{-3}$, $[\text{N}_2\text{O}_4] = 0.11 \text{ mol dm}^{-3}$,

$[\text{O}_2] = 0.11 \text{ mol dm}^{-3}$. Calculate the value of K_C

[3 marks]



QUESTION FOUR

- (a) Why does atomic size of elements decrease across a period [1 mark]
- (b) Explain the trend in the following periodic properties on the periodic table [8 marks]
- i. Ionization energy
 - ii. Atomic radius
 - iii. Effective nuclear charge
 - iv. Electro negativity
- (c) State le Chatelier's principle [2 marks]
- (d) A compound contains C=62.08%, H =10.34% and O=27.58% by mass. Find its empirical formula and its molecular formula given that its relative molecular mass is 58. [2 marks]
- (e) Why does the first ionization energy of atoms generally increase across a period? [2 marks]

QUESTION FIVE

- (a) Using orbital Box Notation write the electron configuration of the following species [6 marks]
- (O =8, Co =27, Ca=20)
- i. O
 - ii. Co
 - iii. Ca^{2+}
- (b) A sample of Epsom salts, $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$, was heated to remove the water. 1.57 g of water was removed leaving behind 1.51 g of anhydrous MgSO_4 . Calculate the formula of the Epsom salts. [4 marks]
- (c) Draw Born-Haber cycle (with relevant equation for each step) for the formation of NaCl(s) from Na(s) and $\text{Cl}_2(\text{g})$ [5 marks]



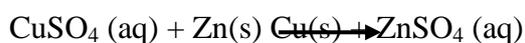
QUESTION SIX

(a) What is the difference between empirical and molecular formulae **[2 marks]**

(b) What does the following gas law states

- i. Charles law
- ii. Boyles law

(c) Zinc will displace copper from copper (II) sulphate solution according to the following equation:



If an excess of zinc powder is added to 50 cm³ of 1.0 moldm⁻³ copper (II) sulphate, the temperature increases by 6.3 °C. Calculate the enthalpy change for the reaction. **[4 marks]**

(d) Identify three substances for which the enthalpy of combustion is zero **[3 marks]**

(e) Using short form of the SPDF Notation write the electronic configuration of the following atoms

[6 marks]

Ar=18, V=23, Ag=47, Co=27, Ba=56, Br=35

- i. Ar
- ii. V
- iii. Ag
- iv. Co
- v. Ba
- vi. Br

