



**KISII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**

**SECOND YEAR EXAMINATION FOR THE AWARD OF**  
**THE DEGREE OF BACHELOR OF SCIENCE IN ENVIRONMENTAL**  
**CHEMISTRY**  
**FIRST SEMESTER 2021/2022**  
**(FEBRUARY-JUNE, 2022)**

**CHEM 229: BASIC ELECTROCHEMISTRY AND CHEMICAL KINETICS**

**STREAM: Y2 S1**

**TIME: 2 HOURS**

**DAY: MONDAY, 9.00 AM – 11.00 AM**

**DATE: 12/09/2022**

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**INSTRUCTIONS:**

- 1. Do not write anything on this question paper.***
- 2. Answer ALL questions in section A and any other TWO Questions in section B.***

**SECTION A: 40 MARKS**

- (a) Explain the following terminologies (10marks)
  - System
  - Adiabatic Change
  - Universe
  - Enthalpy of formation
  - Entropy
- (b) i) Explain the relationship between free energy and maximum work function (9marks)  
ii) Explain three thermochemical laws. (9marks)

(d)i) Explain the physical significance of entropy. (3marks)

ii) The boiling point of water at a pressure of 50 atm. is 265 °C and at 1 atm. it is 100 °C. Assuming the temperature of the sink is 40 °C, compare the theoretical efficiencies of a steam engine operating between the boiling point of water and that of the sink at:

- a. 1 atm.
- b. 50 atm.

(6marks)

## SECTION B

2. (a) Define standard enthalpy of combustion. (3marks)

(b) State Hess's Law and explain its relationship with first law of thermodynamics

(7marks)

(c) . At 0°C and 1 atm. Pressure the volume of 1 mole of an ideal monatomic gas is 22.415 litres. The gas is expanded until its pressure is 0.4 atm. by a reversible adiabatic process. Determine the final volume. (5marks)

3. (a) What is Molar heat capacity? (3 marks)

(b) A cylinder fitted with a piston contains 3 moles of helium at 400K and 1.00 atm. Pressure. The pressure is increased reversibly to 5atm. Determine w, q and  $\Delta E$  for this process. ( $R= 8.314 \text{ J/mol/K}$ ) (6marks)

(c) 0.1 mole of an ideal gas is expanded isothermally at 273 K from 3 dm<sup>3</sup> to 5 dm<sup>3</sup>. Determine the energy (q) absorbed from the surroundings. (6marks)

4. (a) Explain work done in gas expansion or compression. (5marks)

(b) Give and explain a relationship between entropies and third law of thermodynamics?

(6marks)

(c) state and explain expression on heats of reaction at constant pressure and constant volume? (4marks)

5. (a) Using internal energy and work explain first law of thermodynamics. (7marks)

(b) When one mole of water, at 100°C and 1 atm. pressure, is converted to steam (at 100°C) the amount of heat absorbed is 40670J. Calculate  $\Delta E$  for the change. (4marks)

(c) Two moles of an ideal gas at 273 K and 101325 NM<sup>-2</sup> pressure expand from 0.056 M<sup>3</sup> to 0.28 M<sup>3</sup> at the same temperature. Determine the work done. (4marks)