



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF
BIOLOGICAL AND PHYSICAL SCIENCE**

DEPARTMENT OF PHYSICAL SCIENCE

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF EDUCATION
SCIENCE**

3RD YEAR 1ST SEMESTER 2019/2020 ACADEMIC YEAR

REGULAR

COURSE CODE: SCH 301

COURSE TITLE: CHEMICAL THERMODYNAMICS

EXAM VENUE:

STREAM: (Bed. SCI.)

DATE:

EXAM SESSION:

TIME: 2.00 HOURS

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.**

IMPORTANT INFORMATION:

CONSTANT	VALUE
Universal gas constant, R	8.314 kJ/K/mol
Faraday's constant, F	96500 C
Avogadro's constant, N	6.02×10^{23}
Electronic charge, e	1.619×10^{-19} C

Section A This section contains ONE COMPULSORY question

Q 1

(a) Name three factors that determines whether the process is spontaneous (3 Marks)

(b) What is phase Change? (3 Marks)

(c) Show how energy can be conserved from one system to the surroundings (8 Marks)

(d) (i) What is H ? (1 mark)

ii) How can standard free energy of reactions calculated from the standard free energy of formation?. (2Marks)

iii) Name two kinds of work which are normally associated with a chemical reaction (2 Marks)

(e) Define the following terms as used in Thermodynamics

(i) Standard Free Energy of formation(2 Marks)

- (ii) Standard free energy of reactions (2 Mark
- (iii) (f) What are the effects of temperature on spontaneity (2 Marks)

(g) Consider a case of one component system for two phases in Equilibrium. Justify that $F=C-P+2$ (4 Marks)

SECTION B

Q 2

- (a)
- (i) What is the relationship between entropy and the second law of thermodynamics? (3 marks)
- (ii) How entropy can be varied with the temperature? (4 marks)
- (iii) Write short notes on each of the following thermodynamics processes
- a) Surroundings (3 marks)
- b) Entropy change of reactions. (3 marks)
- c) Phase change (3 marks)
- iv) Calculate entropy of 100KJ of heat to large mass of water at 0°C results in a change (4 marks)

Q 3

- a. Derive the Gibbs free energy equation (7 marks)
- b. Derive a relationship which shows the variation of entropy with temperature and its effects on a reversible process. (7 marks)
- c. What is the relationship between the spontaneity of a reaction and the speed of a reaction ? (7 marks)

Q 4

- a. The enthalpy of vaporization of Benzene ($C_6 H_6$) is 350.8KJ/mole at the boiling point of 200.1°C .Calculate the entropy change for Benzene going from
- (i) Liquid to Vapor

(ii) Vapour to Liquid at 200.1°C
marks)

(10

b) Discuss how to determine the absolute entropy of a substance based on the third law of thermodynamics. Give an example of cyclopropane. (10 marks)

Q 5

- a. By giving appropriate examples describe the Entropy change of a phase change (10 marks)
- b. A hot objects cools to the temperature of its surrounding and a cool object does not suddenly become hotter than its surroundings. Why? Based on the second law of thermodynamics describe these observations and classify them. (10 marks)