



ALUPE UNIVERSITY

... Bastion of Knowledge ...

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**OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH**

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER MAIN EXAMINATION

**FOR THE DEGREE OF BACHELOR OF EDUCATION
(SCIENCE)**

COURSE CODE: CHE 103

COURSE TITLE: INTRODUCTION TO KINETICS AND THERMODYNAMICS

DATE: 7TH JUNE, 2022

TIME: 1400 – 1700 HRS

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

THIS PAPER CONSISTS OF FOUR PRINTED PAGES PLEASE TURN OVER

REGULAR – MAIN EXAM**CHE 103: INTRODUCTION TO KINETICS AND THERMODYNAMICS****STREAM: BED(Sci)****DURATION: 3 Hours**INSTRUCTIONS TO CANDIDATES

$$R = 0.082\ 057\ 46(14)\ \text{L atm K}^{-1}\ \text{mol}^{-1}$$

*Answer all questions***Question One**

- a) Derive the van der Waals equation for n moles of a gas. (4 Marks)
- b) Explain the terms a and b as used in the van der Waals equation. (2 Marks)
- c) One mole of nitrogen gas at 27°C occupies 30.0 litres. Calculate the pressure of the gas using
- Ideal gas equation. (2Marks)
 - van der Waals equation. (5 Marks)
- (a = 1.387 L²atm mol⁻², b = 0.0387 L mol⁻¹)

Question Two

- a) Given are some values of pressure and volume for 2 g of hydrogen at 0 °C.

Show that the data verify Boyles law.

(3 Marks)

Pressure (atm)	2.00	1.00	0.90	0.75	0.50
Volume (dm ³)	11.3	22.4	24.7	29.9	44.4

- b) State the first law of thermodynamics. Give its mathematical statement (5 marks) and explain each term involved.
- c) Highlight two limitations of the first law of thermodynamics. (2 Marks)

Question Three

- a) i. Differentiate between intensive and extensive properties of matter. (4 Marks)
- ii. Derive a relationship between C_v and C_p for ideal gases. (5 Marks)
- b) A student performs an experiment on an ideal gas by adding 42.0 J of heat to it. As a result the student finds that the volume of the gas changes from 50 cm^3 to 150 cm^3 while pressure remains constant at 101.3 kpa. If the quantity of gas present is 0.007 moles, determine the molar specific heat capacity of the gas that the student would find at constant pressure. (5 Marks)

Question Four

- a) What is entropy? (2 Marks)
- b) What is the physical significance of entropy? (2 Marks)
- c) Differentiate between a cyclic and an isochoric process. (4 marks)
- (d) Sketch the isobar and the isotherm that defines Charles's law and Boyle's laws respectively. (4 marks)

Question Five

- a) Differentiate between the following terms
- i. Order and molecularity. (4 Marks)
- ii. Rate law and rate constant. (4 Marks)
- b) i. What is meant by rate of reaction? (2 Marks)
- ii. How can rate of reaction be determined experimentally? (2 Marks)
- c) Explain why hydrolysis of an ester follows first order kinetics in presence of an acid but follows second order kinetics in presence of an alkali. (2 Marks)
