2023

Chemistry (H)

B.Sc. First Semester End Examination - 2023

PAPER - MJ101T

Full Marks : 28 *Time : 2 hours*

The figures in the right-hand margin indicate marks.
Candidates are required to give their answers in their own words as far as practicable.
Illustrate the answers wherever necessary.

Group - A

Answer any three question : **4×2=8**

1. (a) What is the equation of state? If V is the volume of a gas and V_{id} is the volume in ideal condition, then what does V/V_{id}?

   (b) What does happen to the peak of the Maxwell's distribution curve of molecular speeds at given temperature if the gas is changed from He to Ar?

(c) Show the Joule Thomson experiment is an irreversible process.

(d) A zero-order reaction must be a multispet reaction. Explain.

(e) Test the cyclic rule for the gas obeying the equation PV=RT.

Group-B

Answer any four questions : 4×5=20

2. (a) If an ideal gas at temperature T and pressure P has an average speed (C_a), by how many times would C_a changes if T is doubled at constant P?

(b) Two flask namely A and B have eaual volumes. A is iantained at 300K and B at 600K while A contains H_2 gas, B has an equal mass of CH_4 gas. Assuming ideal behaviour of both the gases, find the followings and establish your answer quantatively :

(i) Flask in which the molecules are moving faster?

(ii) Flask in which the compressibility factor is greater? 2+3

3. (a) Devive an expression for Joule Thomson coefficient ($\mu_{/T}$) of a gas obyeing the equation P(V-b) =RT. Comment on the result.

(b) Using the concept of Gamma function, calculate the value of following integral : $\int_0^\infty e^{-bx^2} x^4 dx$. 3+2

4. (a) The rate of reaction 2A + B → C become doubled when the concentration of B is only doubled and the rate becomes eight fold when concentration of both A and B are doubled. Find out the order of the reaction with respect to A and B.

(b) A certain first order reaction is 20% completed in 15 minutes at 27°C but for the same extent of reaction at 37°C, only 5 minutes are required. Calculate the activation energy of the reaction. 3+2

5. (a) Draw schematically the velocity distribution curve at three different temperature and write down the characteristics of the curves.

(b) Point out the average velocity, r.m.s. velocity and most probable velocity in the same distribution plot. 3+2

6. (a) The value of γ (C_p/C_v) of a nonlinear molecule A_xB is 1.167. Find out the value of x. (Assume ideal behaviour)

   (b) Adiabatic process must occur is isolated system. Comment. 3+2

7. (a) prove that reversible work is greater irreversible work.

   (b) 48 gm of oxygen gas expands adiabatically against a constant pressure of 1 atm until the pressure balances. The initial temperature and volume are 200°C and 20 liters respectively.

   (i) Explain whether the process if reversible or not?

   (ii) Calculate the final temperature and work done.

   2+3