

T.Y.B.SC. SEM – VI (2014 COURSE) : SUMMER - 2018
SUBJECT: PHYSICS: THERMODYNAMICS AND STATISTICAL PHYSICS

Day : Friday
Date : 20/04/2018

S-2018-0782

Time : 12.00 NOON TO 02.00 PM
Max. Marks : 40.

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the **RIGHT** indicate full marks.
- 3) Draw neat and labelled diagrams **WHEREVER** necessary

Q.1 Attempt any **TWO** of the following: (10)

- a) Derive an expression for the coefficient of viscosity (η) of a gas in terms of mean free path of the molecules.
- b) Derive Maxwell's four thermodynamic relations.
- c) What is Joule-Thomson effect? Prove that enthalpy remains constant in a throttling process.

Q.2 Attempt any **TWO** of the following: (10)

- a) Explain the simple random walk problem in one-dimension and obtain the probability of finding the particle
- b) A single molecule of mass m in a spherical enclosure of volume V has energy that can vary from 0 to E . Show that the number of accessible microstates ϕ of the molecule is expressed by $\phi = \frac{4\pi V}{3h^3} (2mE)^{\frac{3}{2}}$.
- c) For canonical ensemble, obtain the expression for mean energy and mean square energy in terms of β and z .

Q.3 Attempt any **TWO** of the following: (10)

- a) The mean free path of a gas molecule at a pressure P and temperature T is 1.2×10^{-6} m. What will be the mean free path at a pressure $2P$ and temperature $T/4$?
- b) Prove that for a perfect gas, $C_p - C_v = R$
- c) Derive an expression for Joule-Thomson coefficient.

Q.4 Attempt any **FIVE** of the following: (10)

- a) What do you understand by mean free path of molecules of a gas?
- b) State the First law of thermodynamics.
- c) What is the principle of regenerative cooling?
- d) Define the probability of an event.
- e) When a card is drawn from a well shuffled pack of 52 cards, what is the probability of the card to be either a king or a queen?
- f) Define and explain the terms macrostate and microstate with the help of an example.
- g) Distinguish between microcanonical and canonical ensembles.

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