

B. SC. PHYSICS (HONOURS) EXAMINATION, 2023

(2nd Year, 1st Semester)

THERMAL PHYSICS

PAPER – CORE 06

Time : Two hours

Full Marks : 40

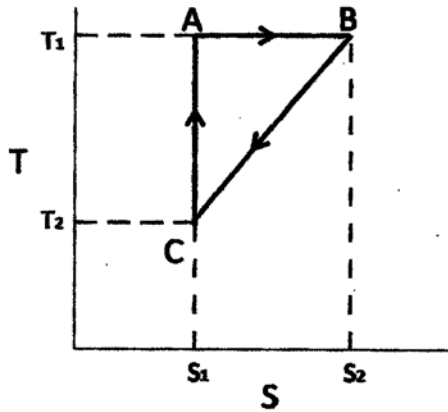
Answer question 1 and *any three* from the rest.

1. Answer *any four* questions. 4×2.5=10
 - a) What is Thermodynamic equilibrium?
 - b) Draw the T-S diagram of adiabatic demagnetization and explain the cooling process.
 - c) Show that for adiabatic process work done is independent of path.
 - d) Using Maxwell's velocity distribution law, find the expression of average velocity of gas molecules.
 - e) What is Gibb's free energy (G)? Show that for isothermal isobaric process, G remains constant.
 - f) Define 'degrees of freedom' of a dynamical system. Find the degrees of freedom of a diatomic gas at room temperature.
2.
 - a) State and explain 1st law of Thermodynamics. From this law derive Law of Calorimetry.
 - b) Using Jacobian method derive 2nd and 3rd Maxwell's equation of Thermodynamics. 5+5

[Turn over

[2]

3. a) What is critical coefficient? What is its value for a Van der Waal's gas?
- b) Define Joule-Thomson coefficient. Show that in Porous-plug experiment enthalpy is constant.
- c) Find the expression of Joule-Thomson coefficient for Van der Waal's gas. 4+4+2
4. a) Find out the work done of four processes in Carnot cycle.
- b) Draw Carnot cycle in TS diagram and find out its efficiency. What is the ratio of efficiency of the Carnot cycle and the cycle given below:



- c) 10 gm of ice (at 0°C) is supplied heat energy so that it is converted to 10 gm of water at 20°C. Find out the increase in Entropy in this process. [Latent heat of ice to water is 80 cal/gm] 4+4+2

[3]

5. a) What is mean free path? Show that the probability of a gas molecule traversing a distance 'a' without collision is $e^{-\frac{a}{\lambda}}$, where λ is the mean free path of the gas molecules.
- b) Derive the expressions for the coefficient of viscosity and thermal conductivity of a gas. 4+6