

B.Sc Part - II

Paper - I

[Shilpa Vijay
9001706386]

Thermodynamics and Statistical Physics

Time allowed: 3 hrs

Max marks: 33

Attempt all ~~five~~^{six} questions

Q.1 (a) Explain micro states and macro states.

(b) Write third law of thermodynamics.

(c) What is phase space.

(d) Write Wien's displacement law.

(e) What is Joule-Thomson effect.

(f) Define most probable speed.

Q.2 (a) What is thermodynamic probability? Establish a relation between entropy and thermodynamic probability?

(b) What is partition function? Prove that the average energy of a molecule in a system

$$\bar{E} = kT^2 \frac{\partial}{\partial T} (\ln Z).$$

where the symbols have their usual meaning.

or

(b) Obtain expressions for the total work done in a Carnot cycle and the efficiency of the engine.

Q. 3 (a) What is Joule-Thomson effect? Derive Joule-Thomson coefficient for a van der Waal's gas.

(b) Prove that in the range of speed between c and $c + dc$ the number of molecules

is

$$dn = 4\pi n \left(\frac{m}{2\pi kT} \right)^{3/2} e^{-m^2/2kT} c^2 dc$$

or

(b) Explain the transport phenomena in gases. On the basis of kinetic theory of gases, derive an expression for the coefficient of viscosity.

Q. 4 (a) Prove that the partition function for a monatomic gas will be

$$Z = \frac{V}{h^3} (2\pi m kT)^{3/2}$$

(b) Establish barometric equation on the basis of Maxwell-Boltzmann statistics.

Q. 5 (a) Explain the meaning of degeneracy.

(b) Derive Planck's law for photon distribution and with its help derive Wien's displacement law.

or

(b) Assuming that free electrons in metals form Fermi-gas, derive Richardson-Dushman equation for thermionic emission.