

B.Sc. Second Year (CBCS Pattern) Sem-III
USPHT05 - Physics Paper-I (Thermal Physics)

P. Pages : 3

Time : Three Hours



GUG/W/23/11616 SR

Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. Draw neat & well labelled diagrams wherever necessary.

Either :

1. A) i) State any four assumptions of Kinetic theory of gases. 2
ii) Derive expression for the coefficient of viscosity of gas. 5
iii) Find the coefficient of viscosity of nitrogen at N.T.P. from following data: 3
 $P = 1.25 \text{ kg / m}^3$, $\bar{C} = 454.4 \text{ m / s}$, $\lambda = 9.44 \times 10^{-8} \text{ m}$.

OR

- B) a) State and prove law of equipartition energy. 2½
b) What are transport phenomena in gas. 2½
c) Obtain an expression for mean free path of a gas molecules. 2½
d) At what temperature will the average speed of hydrogen molecules be the same as that of nitrogen molecules at 35°C. Molecular weight of $\text{N}_2 = 28$ and that of $\text{H}_2 = 2$. 2½

Either :

2. A) i) Derive an expression for the work done during isothermal process in terms of pressure. 3
ii) Prove that for an adiabatic process, $PV^\gamma = \text{constant}$. 3
iii) Distinguish between the isothermal process and adiabatic process. 2
iv) A quantity of dry air at 27°C is compressed suddenly to $\frac{1}{4}$ of its volume. Calculate the final temperature. Given $\gamma = 1.4$. 2

OR

- B) a) State and explain Zeroth law of thermodynamics. Discuss its importance. 2½
b) State and explain the first law of thermodynamics. Give its physical significance. 2½
c) What are the extensive and intensive variables? Give their examples. 2½

- d) If the ideal gas expands isothermally from initial volume of 3 litres at 20 atm to a final volume of 30 litres, calculate the work done by the gas. 2½
 Given $1 \text{ atm} = 1.013 \times 10^5 \text{ N/m}^2$.

Either:-

3. a) i) What is the heat engine? Describe the construction of Carnot's ideal heat engine. Describe Carnot's reversible cycle and obtain an expression for its efficiency. 8
 ii) Calculate the efficiency of the Carnot's engine working between 100°C and 0 °C. 2

OR

- b) a) Define entropy of a system. Discuss its physical significance. 2½
 b) Discuss the reversible and irreversible processes. 2½
 c) State the various statements of the second law of thermodynamics. 2½
 d) Find the change in entropy when 10kg of ice at 273 K is converted into water at the same temperature. Given : Latent heat of fusion of ice 80 Kcal/kg. 2½

Either :

4. A) i) Describe the Joule – Thomson Effect porous plug experiment with diagram and give a theory to explain results. 3
 ii) Show that $H = U + PV$. 3
 iii) Write Maxwell's four thermodynamical relations. 2
 iv) If Latent heat, $L = 800 - 0.705 T$ then show that specific heat of steam is negative. 2

OR

- B) a) Obtain Clausius – Clapeyron's latent heat equation using Maxwell's thermodynamical equations. 2½
 b) Obtain the equation for Gibb's function G and Helmholtz energy function F. 2½
 c) Obtain the first Tds equation. 2½
 d) Derive Maxwell's first thermodynamic relation. 2½

5. Solve **any ten** of the following.

- a) What is Joule – Thomson effect? 1
 b) What is the relation between k and n? 1
 c) State Zeroth law of thermodynamic. 1

- d) Define isobaric and isochoric process. 1
- e) Define root-mean square velocity. 1
- f) State third law of thermodynamics. 1
- g) What is internal energy? 1
- h) State Carnot's theorem. 1
- i) Draw T-s diagram. 1
- j) Define Gibb's free energy. 1
- k) What are thermodynamic potentials? 1
- l) What is mean by sphere of influence. 1
