Bachelor of Science (S.Y.B.Sc.) (CBCS Pattern) Third Semester CBCS

# USPHT05 -Physics Paper-I (Thermal Physics)

P. Pages : 3 **GUG/W/18/11616**

Time : Three Hours * 3 8 6 3 * Max. Marks : 50

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

**1.** Either

a) i) State any four assumptions of Kinetic theory of gases. **2**

ii) Obtain an expression for thermal conductivity of gas. **4**

iii) What is the effect of temperature and pressure on thermal conductivity of gas. **2**

iv) At what temperature will the average speed of hydrogen molecules be the same as that of nitrogen molecules at 35ºC. Molecular weight of $N_2 = 28$ and that of $H_2 = 2$. **2**

**OR**

b) a) State and prove law of equipartition energy. **2½**

b) In a experiment the viscosity of gas was found to be $1.66 \times 10^{-5}\ N \cdot s / m^2$. The average speed of molecule is $4.5 \times 10^2\ m/s$. If the density of gas is $1.25\ kg/m^3$. Calculate mean free path and frequency of collision. **2½**

c) What is degree of freedom? Explain the degree of freedom for mono and diatomic gases. **2½**

d) Obtain an expression for mean free path of a gas molecules. **2½**

**2.** Either

a) i) What is isothermal process? Obtain the expression for work done in isothermal process. **3**

ii) What is adiabatic process? Obtain the expression for work done in adiabatic process. **4**

iii) A quantity of gas is compressed isothermally until its pressure is doubled. It is then allowed to expand adiabatically until its original volume is restored. Find the final pressure in terms of initial pressure. Given $\gamma$ for gas = 1.4. **3**

**OR**

b) a) What is thermodynamic system? Explain homogeneous and heterogeneous system with examples. **2½**

b) State the first law of thermodynamics. Express its mathematical form and state its limitation. **2½**

c) Obtain the adiabatic relation between T and V for a perfect gas. **2½**

d) Calculate the work done by a gas in expanding from initial volume of 3 lit. at 20 atm. pressure to a final volume of 30lit at constant temperature. **2½**

**3.** Either

a) i) Explain the construction of an Carnot's ideal heat engine. **3**

ii) Obtain an expression for efficiency of a Carnot's heat engine. **4**

iii) A Carnot's heat engine having source temperature 400ºK takes 500 calories of heat and reject 400 calories to the sink in each cycle. Calculate the temperature of sink and efficiency of an engine. **3**

**OR**

b) a) Distinguish between reversible and irreversible process with examples. **2½**

b) Explain the change of entropy in an irreversible cyclic process. **2½**

c) Explain entropy-temperature diagram. **2½**

d) Find the change in entropy when 10kg of ice at 0ºC is converted into water at the same temperature if the latent heat of fusion of ice is 80Kcal/kg. **2½**

**4.** Either

a) i) Define latent heat. Obtain the first latent heat equation. **4**

ii) Using this equation explain the effect of change of pressure on melting point and boiling point. **3**

iii) Obtain the Maxwell's first thermodynamic relation. **3**

**OR**

b) a) Obtain the equation for Gibb's function G and Helmholtz energy function F. **2½**

b) Obtain the first T-ds equation. **2½**

c) Obtain the second thermodynamic relation $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$. **2½**

d) Explain the porous-plug experiment with neat diagram. **2½**

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

a) State equation for the pressure exerted by gas on wall of container. **1**

b) Define root-mean square velocity. **1**

c) Obtain the relation between coefficient of viscosity and coefficient of self diffusion. **1**

d) Define intensive and extensive variable. **1**

e) Define isobaric and isochoric process. **1**

f) State the zeroth law of thermodynamics. **1**

g) Calculate the efficiency of Carnot's engine working between 100ºC and 0ºC. **1**

h) State third law of thermodynamics. **1**

i) State the Carnot's theorem. **1**

j) State the second latent heat equation. **1**

k) What is Joule-Thomsan effect? **1**

l) State third and fourth thermo-dynamic relations. **1**

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