Roll No. .....

(05/16-I)

5177

B. Sc. EXAMINATION

(Second Semester)

PHYSICS

First Paper (PH-201)

Properties of Matter and Kinetic Theory of Gases

Time : Three Hours *Maximum Marks :* 40

Note : Q. No. **1** is compulsory. Four more questions are to be attempted selecting *one* question from each Unit. Log tables may be asked.

Compuslory Question

1. (a) Will solid and hollow spheres of equal mass and equal radius have equal moment of inertia ? Explain. 2

   (b) Differentiate between angle of twist and angle of shear. 2

(c) What are average speed, most probable speed and RMS speed ? 2

(d) What do you understand by transport phenomena in a gas ? 2

Unit I

2. (a) Derive expression for the moment of inertia of a thin spherical shell about a diameter. 5

(b) Determine the ratio of rotational and translational kinetic energy of a thing spherical shell rolling on a horizontal surface. 3

3. (a) Describe, how you can determine the moment of inertia of a body using a torsion pendulum. 5

(b) A sphere has a radius of 0.30 m. Calculate its moment of inertia about any diameter. 3

Unit II

4. (a) If Y, η, σ and k represent Young's modulus, modulus of rigidity, Poissons ratio and Bulk modulus respectivley, then prove that :

(i) $Y = 2\eta(1 + \sigma)$

(ii) $Y = 3K(1 - 2\sigma)$ 5

(b) Find the work done in twisting a steel wire of radius 1 mm and length 0.25 m through 60°. Given η for steel $= 8\times10^{10}$ Nm^{-2}. 3

5. (a) Derive an expression for the torque required for twisting a solid cylinder of radius r, length l and modulus of rigidity η through an angle θ. 5

(b) A steel wire of 4 m long and 5 mm in diameter is streched by a 5 kgwt. Find the elongation of the wire. Given $Y = 2.4\times10^{10}$ kgm^{-2}. 3

Unit III

6. (a) State the essential features of the kinetic theory of gases and hence prove that the pressure of an ideal gas is given by $P = \frac{1}{3}\rho c^2$ where symbols have their usual meaning. 6

   (b) Calculate RMS speed of H_2 having density 8.9×10^{-2} kgm^{-3} at NTP. 2

7. (a) Explain the term degree of freedom. Using law of equipartition of energy, show that for a perfect polyatomic gas, the ratio of specific heat (r) is equal to 1.33. 5

   (b) What is Brownian motion ? What are the factors which increases the Brownian motion of gas molecules. 3

Unit IV

8. (a) Define mean free path. Show that mean free path is inversely proportional to pressure. 5

   (b) The molecular diameter of a given gas is 2×10^{-10} m. Calculate the mean free path at NTP. 3

9. (a) Derive the expression for the coefficient of viscosity of a gas on the basis of kinetic theory of gases. 5

   (b) Find the number of molecular of Argon gas per m^3, when diameter of the gas molecules is 3×10^{-8} m and mean free path is 2×10^{-3} m. 3