

- (b) Discuss the concept of Brownian motion in the various factors on which it depends. **4**

7. (a) Calculate the kinetic energy of translation of oxygen gas molecules at 27°C. Given that Boltzmann's constant = 1.37×10^{-23} J/K. **3**

- (b) Derive an expression for critical constants in terms of van der Waals' constant. **8**

Unit IV

8. (a) Explain the phenomenon of viscosity of a gas. Deduce an expression for the coefficient of viscosity of a gas in terms of mean free path. **5**
- (b) Find the mean free path of helium (He) molecules at a temperature of 0°C and a pressure of 760 mm of Hg. Coefficient of viscosity is 1.3×10^{-5} Nm⁻²s. Density of helium is 1.1786 kgm⁻³. **3**

32081

B. Sc. EXAMINATION, 2025

(Re-appear Only)

(Second Semester)

PHYSICS

Paper I

Properties of Matter and Kinetic Theory of
Gases

Time : 3 Hours

Maximum Marks : 40

Note : Attempt *Five* questions in all. Q. No. **1** is compulsory. Use of Scientific (non-programmable) calculator is allowed.

(Compulsory Question)

1. (a) Why the thermal conductivity of hydrogen is large as compared to any other gas at a given temperature ?

- (b) What do you mean by transport phenomenon in a gas ?
- (c) A cantilever of uniform cross section is more likely to break near its fixed end. Why ?
- (d) Two bodies of same mass and same radius moving with same angular speed can have different kinetic energy. Explain using mathematical relations. **4×4=16**

Unit I

- 2. (a) State and prove theorem of parallel axis. **4**
- (b) Derive expression for moment of inertia of a hollow sphere about its diameter and about a tangent. **4**
- 3. (a) Describe, how can you determine the moment of inertia of a body by using torsional pendulum ? **5**
- (b) A sphere has a radius of 0.15m, calculate the moment of inertia about any diameter. Density of material is $7.8 \times 10^3 \text{ kg m}^{-3}$. **3**

Unit II

- 4. (a) Explain the term bending moment. Derive an expression for the depression of a centrally loaded beam supported at its ends. Weight of the beam is supposed to be negligible. **5**
- (b) Poisson's ratio for the material is 0.40 and its Young's modulus is $5.6 \times 10^{10} \text{ Nm}^{-2}$. Find modulus of rigidity of wire for the given material. **3**
- 5. (a) Show that couple required to twist the one end of a wire through a given angle is proportional to the fourth power of its radius. **4**
- (b) Prove the relation :

$$\eta = Y/2 (1 + \sigma)$$
 where the symbols have their usual meaning. **4**

Unit III

- 6. (a) State essential feature of kinetic theory of gases and hence prove that the pressure of an ideal gas is given as

$$P = \frac{1}{3} \rho c^2.$$
 4

9. (a) Define most probable speed, average speed and root mean square speed. Derive the relation for them. **5**
- (b) Calculate the temperature at which rms speed of a hydrogen molecule will be equal to 8 km per second. **3**



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