

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
B.Sc. PHYSICS - I SEMESTER
MID-SEMESTER TEST- AUGUST 2019
PH 118: Mechanics, Heat and Thermodynamics

Time : 1 hour

Max. Marks: 30

*This question paper has **one** printed page and **three** parts.*

PART-A

Answer any three of the following:

(3X6=18)

1. Explain the term Galilean invariance. Prove that Newton's laws of motion are invariant under Galilean transformations.
2. Define angular momentum \vec{J} and torque $\vec{\tau}$. What are their units? Show that torque is given by the time rate of change of angular momentum.
3. Using Maxwell's velocity distribution law obtain expressions for r.m.s. velocity and mean velocity. Given $\int_0^\infty e^{-bc^2} c^4 dc = \frac{3}{8b^2} \sqrt{\frac{\pi}{b}}$ and $\int_0^\infty e^{-bc^2} c^3 dc = \frac{1}{2b^2}$
4. a. Explain the variation of mean free path with (i) temperature and (ii) pressure
 b. Derive an expression for the work done during an adiabatic process.

PART-B

Solve the following:

(2X4=8)

5. Calculate the fictitious force and the total force acting on a mass of 10 kg in a frame of reference moving a) vertically downward and b) vertically upward with an acceleration of 2 m/s². Given g = 10 m/s². **OR**
- The polar coordinates of a point are (r, θ , Φ) are (8, 30°, 45°). Find the Cartesian coordinates of the same point.
6. Find the coefficient of viscosity of oxygen at N.T.P. if density of oxygen is 1.25 kg/m³ and mean free path is 9.44 x 10⁻⁸m. **OR**

A certain volume of air at 27°C expands adiabatically until its volume becomes 1.5 times its initial volume. Calculate the fall in temperature, if γ is 1.4

PART-C

7. Answer any two of the following:

(2X2=4)

- a) What is the relevance of fictitious force in discussing motion of a particle? **OR**
 In equal volume of each hydrogen and oxygen gas at S.T.P., which sample has a larger number of molecules? Give reasons.
- b) Newton's first is a special case of second law. Explain. **OR**
 The density of a gas is doubled, keeping all other factors unchanged. What will be the effect on the pressure of the gas? Justify your answer.