MODEL QUESTION PAPER
CLASS XI
SEMESTER IV

F.M.=40

General Instructions:
1. All questions are compulsory
2. There are three sections. Section A contains seven questions of 1 mark each. Section B contains nine questions of 2 marks each. Section C contains three questions of 5 marks each.

SECTION A

1. Give an example in which a body is not in equilibrium even though the net force on it is zero.
2. Does the center of mass of a body necessarily lie inside the body? Give justification.
3. About which axis the moment of inertia of a uniform cube may be minimum?

OR

Is a force necessary to keep a sphere rolling with uniform velocity? If so name it, if not, justify.
4. A wooden cylinder floats in water in a vessel with its axis vertical. How may the level of water in the vessel change if the cylinder floats with its axis horizontal?
5. A wire elongates by *l* mm when a load W is hung from it. If the wire is passed over a pulley and two weights W each are hung at two ends, what would be the elongation produced?
6. Two bodies of masses m_1 and m_2 have equal thermal capacities. What may be the ratio of their specific heat capacities?

OR

Two bodies of masses m_1 and m_2 have specific heat capacities c_1 and c_2 respectively. What will be the specific heat capacity of the combined body?
7. Is there any energy transfer when a gas expands adiabatically? Justify.

SECTION B

8. The angular momentum of a system of particles is conserved. Its moment of inertia is changed. Show that the kinetic energy of rotation will not be conserved.

OR

The moment of inertia of a uniform circular disc about a tangent in its own plane is $5MR^2/4$, where M is the mass and R is the radius of the disc. Find its moment of inertia about an axis through its centre and perpendicular to its plane.

9. A body weighs 63 N on the surface of Earth. What is the gravitational force on it due to the Earth at a height equal to half the radius of Earth?
10. If a satellite is revolving round a planet of density ρ, then show that the quantity ρT^2 is a constant.

11. A bottle full of liquid is fitted with a tight cork. Why a slight blow to the cork may be sufficient to break the bottle?

12. Two sides A and B of a heat conducting slab are at temperatures T_1 and T_2 respectively. Heat flows from A to B and the amount of heat conducted per second is Q. If the temperature of side A is doubled, to keep the heat flow unchanged, what value the temperature of side B should be changed to?

13. A system of ideal gas is taken from one state (P_1,V_1) to another (P_2, V_2) ($P_1<P_2$ and $V_1<V_2$) by a sequence of isochoric and isobaric processes. Which of the following sequences would you prefer to take the system is you want to expend less heat? (a) 1st isochoric then isobaric, (b) 1st isobaric then isochoric.

14. An ideal gas filled in a rigid cylinder fitted with pressure gauge is kept in thermal contact with pure melting ice. The steady value of pressure read by the pressure gauge is P_1. Another such system under the same condition shows a steady value of P_2. Which of the two systems is showing the correct temperature of melting ice?

15. How can temperature be interpreted in terms of kinetic theory? If a man runs with a gas cylinder on his head, will the temperature of the gas increase?

16. The volume of a vessel A is twice the volume of another vessel B and both are filled with the same gas. If the temperature and pressure of gas filled in A is twice those of in B, compare the number of molecules of gas in A with that in B.

SECTION C

17. Define angular momentum. Show that the rate of change of angular momentum is equal to the torque about the axis of rotation. Obtain the angular momentum of a particle moving with uniform velocity about any point outside its trajectory.

OR

Starting from force on a rigid body show that it may be considered as a particle whose position vector is given by $\vec{R} = \frac{\sum_i m_i \vec{r_i}}{\sum_i m_i}$.

18. Define gravitational potential at a point. Find the total energy of a satellite moving round the earth in a circular orbit of radius 'r'. How will you interpret the negative sign?

OR

A satellite is moving round the earth in an orbit of radius 'r'. Find its angular momentum in terms of mass of earth 'M' and the gravitational constant G. If the speed of the satellite is half the escape speed from the earth's surface, find the radius of the orbit. Take the radius of earth as 'R'.

19. Define Young's modulus. An aluminium wire and a steel wire of same length and cross section are attached end to end. The compound wire is hung from a rigid support and a load is suspended from the free end. Young's modulus for steel is 20/7 times that of aluminium. Find the ratio of longitudinal deformation and the elastic potential energy of the two wires.

OR

What is Poisson's ratio? Find the Poisson's ratio of a solid whose volume remains unchanged when it is stretched to be deformed.