# CBSE

## SYSTEM OF PARTICLES AND ROTATIONAL MOTION WS 7

### Class 11 - Physics

**Section A**

1. A rigid body is a body which: **[1]**

   a) becomes longer or shorter if force is applied.

   b) does not deform on the application of force.

   c) does not maintain the same distance between any two points on it if force is applied.

   d) deforms on the application of force.

2. For rotational equilibrium, **[1]**

   a) $\sum_{i=1}^{n} \tau_{\text{net}} = 0$

   b) Both $\sum_{i=1}^{n} \mathbf{F}_{\text{net}} = 0$ and $\sum_{i=1}^{n} \tau_{\text{net}} = 0$ are the necessary conditions for the rotational equilibrium

   c) Both $\sum_{i=1}^{n} \mathbf{F}_{\text{net}}$ and $\sum_{i=1}^{n} \tau_{\text{net}} = 0$ are not necessary for rotational equilibrium

   d) $\sum_{i=1}^{n} \mathbf{F}_{\text{net}} = 0$

3. **State True or False:** **[1]**

   (a) Centre of the mass of a body always coincides with the centre of gravity of the body. **[1]**

4. O is the centre of an equilateral triangle ABC. $F_1$ $F_2$ and $F_3$ are three forces acting along the sides AB, BC and AC as shown in the figure. What should be the magnitude of $F_3$ so that the total torque about O is zero? **[1]**

   a) $(F_1 + F_2)/2$

   b) $(F_1 - F_2)$

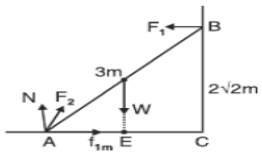
   c) $2(F_1 + F_2)$

   d) $(F_1 + F_2)$

5. A faulty balance with unequal arms has its beam horizontal. Are the weights of the two pans equal? **[1]**
6. Can a body be In equilibrium while in motion? If yes, give an example. **[1]**
7. Why is it more difficult to revolve a stone tied to a large string than a stone tied to a smaller string? **[1]**
8. Distinguish between the stable, unstable and neutral equilibria of a body. **[1]**
9. A metre stick is balanced on a knife-edge at its centre. When two coins, each of mass 5 g are put one on top of the other at the 12.0 cm mark, the stick is found to be balanced at 45.0 cm, what is the mass of the metre stick? **[1]**
10. A thin wheel can stay up right on its rim for a considerable length of time when rolled with a considerable velocity, while it falls from its upright position at the slightest disturbance when stationary. Give reason. **[1]**
11. From a uniform disc of radius R, a circular disc of radius R/2 is cut out. The centre of the hole is at R/2 from the centre of original disc. Locate the centre of gravity of the resultant flat body. **[1]**

**Section B**

12. A 3m long ladder weighting 20 kg leans on a frictionless wall. Its feet rest on the floor 1 m from the wall as shown in figure. Find the reaction forces $F_1$ and $F_2$ of the wall and the floor. **[2]**

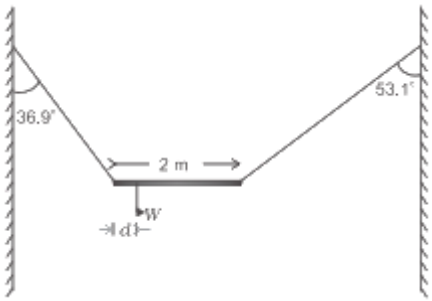



13. Name the physical quantity corresponding to force in rotational motion. How is it related to force and give its unit? **[2]**

14. When does a rigid body said to be in equilibrium? State the necessary condition for a body to be in equilibrium. **[2]**

**Section C**

15. A non-uniform bar of weight W is suspended at rest by two strings of negligible weight as shown in fig. The angles made by the strings with the vertical are $36.9^o$ and $53.1^o$ respectively. The bar is 2 m long. Calculate the distance d of the centre of gravity of the bar from its left end. **[3]**




16. A metre stick is balanced on a knife edge at its centre. When two coins, each of mass 5 g are put one on top of the other at the 12.0 cm mark, the stick is found to be balanced at 45.0 cm. What is the mass of the metre stick? **[3]**

17. The centre of gravity of a body on the earth coincides with its centre of mass for a 'small' object whereas for an 'extended' object it may not. What is the qualitative meaning of 'small' and 'extended' in this regard? For which of the following the two coincides? A building, a pond, a lake, a mountain? **[3]**

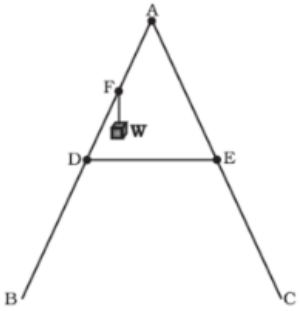
**Section D**

18. From a uniform disk of radius R, a circular hole of radius $\frac{R}{2}$ is cut out. The centre of the hole is at $\frac{R}{2}$ from the centre of the original disc. Locate the centre of gravity of the resulting flat body. **[5]**

19. A beam of uniform cross-section and uniform mass-density of mass 20 kg is supported at ends. A mass of 5 kg is placed at a distance of $\frac{L}{5}$m from one of its end. If beam is L m long, what are reactions of supports? **[5]**

20. The two sides of a step ladder BA and CA are 1.6 m long and hinged at A. A rope DE, 0.5 m is tied half way up. A weight 40 kg is suspended from a point F, 1.2 m from B along the ladder BA. Assuming the floor to be frictionless and neglecting the weight of the ladder, find the tension in the rope and forces exerted by the floor on the ladder. (Take g = 9.8 m/$s^2$) **[5]**

(Hint: Consider the equilibrium of each side of the ladder separately.)




**Section E**

21. **Fill in the blanks:** **[8]**

(a) A rigid body will be in equilibrium if both the _____ and _____ of the body remain constant with time. **[1]**

(b) If the net torque acting on the rigid body is zero but the net force is non-zero, then the rigid body is in _____ equilibrium only. **[1]**

(c) A body in stable equilibrium possesses _____ potential energy and in unstable equilibrium, it possesses _____ potential energy. **[1]**

(d) If a body is supported on a point such that total gravitational torque about this point is zero, then this point is called _____. **[1]**

(e) In translational equilibrium only, the rigid body have _____ linear acceleration. **[1]**

(f) If the net force acting on the rigid body is zero but net torque is non-zero, then rigid body is in _____ equilibrium only. **[1]**

(g) If an external force is not acting on the system of particles, the rate of change of momentum is _____. **[1]**

(h) The time rate of the total angular momentum of a system of particles about a point is equal to the sum of the external _____ acting on the system taken about the same point. **[1]**