Class XI

Laws of motion, WEP, Rotation

Time Allowed: **Maximum Marks: 35**

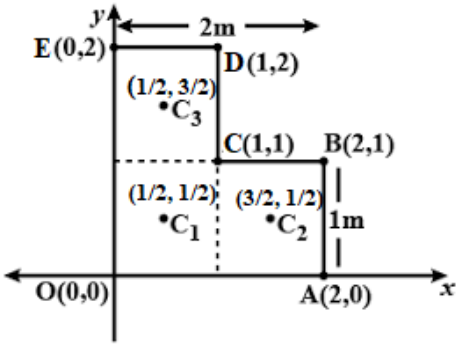
Section A (10×1 = 10 marks)

1. How does friction help in walking? Explain.
2. Does a single external force acting on a particle necessarily change its KE?
3. When an arrow is shot from its bow, it has kinetic energy. From where does it get the kinetic energy?
4. Foes the CM of a system change from rest due to internal forces?
5. A cannon after firing recoils due to
   (a) Conservation of energy (b) Backward thrust of gases produced
   (c) Newton's third law of motion (d) Newton's first law of motion
6. A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponent. The force that acts on the player is
   (a) frictional force along westward (b) muscle force along southward
   (c) frictional force along south-west (d) muscle force along south-west
7. A particle moves from position $3\hat{\imath} + 2\hat{\jmath} - 6\hat{k}$ to $14\hat{\imath} + 13\hat{\jmath} + 9\hat{k}$ due to a uniform force of $(4\hat{\imath} + \hat{\jmath} + 3\hat{k})$N. If the displacement. In metre then work done will be
   (a) 300J (b) 250J (c) 100J (d) 0
8. A body of mass 20kg, moving in x direction with a constant speed of 20m/s is subjected to a retarding force F = 0.2xJ/m during its travel from x = 20m to 30m. Its final kinetic energy will be
   (a) 50J (b) 475J (c) 4000J (d) 3250J
9. If the resultant of all external forces is zero, then velocity of centre of mass will be
   (a) Zero (b) Constant (c) Either a or b (d) Neither a nor b
10. A disc of radius 4m and mass 200kg rolls on a horizontal floor. Its centre of mass has speed of 10cm/s. How much work is needed (to stop it)
    (a) 1.5J (b) 3J (c) 20J (d) 30J

Section C (3×2 = 6 marks)

11. State and prove work energy theorem.

12. Find the centre of mass of a L shaped lamina (a thin flat plate) with dimensions as shown in figure. The mass of the lamina is 3kg.



13. Find the component along X, Y, Z axes of the angular momentum $\vec{L}$ of a particle, whose position vector is $\vec{r}$ with components $\vec{x}$, $\vec{y}$, $\vec{z}$ and moment is $\vec{p}$ with components $\vec{p}_x$, $\vec{p}_y$ and $\vec{p}_z$. Show that if the particle moves only in the X-Y plane, the angular momentum has only a Z component.

Section D (3×3 = 9 marks)

14. Draw a graph showing the variation of frictional force with the applied force. What is meant by limiting friction?

Or

Prove that the coefficient of static friction is equal to the tangent of the angle of friction.

15. A body of mass 'm' is released from the top of the tower of height 'h'. Calculate its total energy at the top of the tower and then just before striking the ground. Show that it is in accordance with the law of conservation of mechanical energy.

16. Derive an expression for work in case of rotational motion.

Section E (2×5 = 10 marks)

17. An electric motor is used to lift an elevator and its load (total 1500kg) to a height of 20m. The time taken for job is 20s. The efficiency of the motor is 75 percent. What is the rate at which work is done? What is the rate at which energy is supplied?

18. What do you mean by one dimensional elastic collision? Determine the velocities of two objects after elastic collision.