Class 11 Physics · Chapter 6: Systems of Particles and Rotational Motion

Worksheet · 20 marks · about 40 minutes · based on NCERT

Name _____ Class and section _____ Date _____

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1. For the unit vectors of a right-handed system, $\hat{k} \times \hat{i}$ equals [1]

(a) $-\hat{j}$ (b) the null vector

(c) $\hat{k}$ (d) $\hat{j}$

2. A shell fired from a gun on level ground would have landed 240 m away. At the highest point it explodes into two fragments of equal mass, which reach the ground at the same instant. One fragment lands 180 m from the gun, on the line of fire. Neglecting air resistance, the other lands at a distance from the gun of [1]

(a) 300 m (b) 240 m

(c) 60 m (d) 420 m

3. A nucleus at rest breaks into two fragments whose masses are in the ratio 2 : 3. External forces are negligible. The ratio of the kinetic energy of the lighter fragment to that of the heavier fragment is [1]

(a) 2/3 (b) 3/2

(c) 9/4 (d) 1

4. The centre of gravity of a body coincides with its centre of mass when [1]

(a) the body is symmetric about an axis (b) the acceleration due to gravity is the same at every point of the body

(c) the body is at rest (d) the body is perfectly rigid

5. Two small balls P and Q are joined by a light rod 60 cm long. The centre of mass of the pair is 15 cm from P. The ratio of the mass of P to the mass of Q is [1]

(a) 1/3 (b) 3

(c) 4 (d) 1/4

6. Distinguish between the centre of mass and the centre of gravity of a body. Would the two points coincide for a tower so tall that g at its top is noticeably smaller than at its base? Give a reason. [2]

7. A 1.5 kW motor drives a grinding wheel of radius 0.10 m at a steady 300 rad s^{-1}. Find the torque the motor supplies, and the tangential force this corresponds to at the rim of the wheel. [2]

8. A driver turns a steering wheel with both hands, pushing up on one side of the rim and pulling down on the other with forces of equal size. Name this pair of forces and explain why the wheel turns but does not move sideways. [2]

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9. State the two conditions for the mechanical equilibrium of a rigid body. How many independent scalar conditions remain when all the forces lie in one plane? Give one example of a body in translational equilibrium but not in rotational equilibrium. [3]

10. Find a unit vector perpendicular to both $\mathbf{a} = \hat{\imath} + \hat{\jmath}$ and $\mathbf{b} = \hat{\jmath} + \hat{k}$. Verify by a scalar product that your answer is perpendicular to a. [3]

11. Three small balls, each of mass 1.0 kg, are fixed to a light rod at the 0 m, 0.5 m and 1.0 m marks. Find the moment of inertia of the system about an axis perpendicular to the rod through (i) the end ball and (ii) the middle ball. Find its rotational kinetic energy at 4.0 rad s^{-1} in each case. [3]