1. What is the condition for pure translational motion in a rigid body?
   A. All particles of the body move in circles.
   B. The angular velocity of all particles is the same.
   C. All particles of the body have the same velocity at any instant.
   D. The velocity of the centre of mass is zero. (C)

Explanation : In pure translation, all particles of the rigid body move parallel to each other with the same velocity at a given instant.

2. The vector expression for the position of the centre of mass of a system of particles is :
   A. $R = 1/M \sum m_i v_i$ B. $R = \sum m_i r_i$
   C. $R = 1/M \sum m_i r_i$ D. $R = \sum r_i$ (C)

Explanation : The position vector of the centre of mass is given by $R = 1/M \sum m_i r_i$, where M is the total mass of the system.

3. When a projectile explodes mid-air, what happens to the centre of mass of its fragments?
   A. It stops instantly.
   B. It continues on the same parabolic path.
   C. It deviates in the direction of the heaviest fragment.
   D. It falls vertically downward. (B)

Explanation : The explosion involves internal forces, so the external force (gravity) remains unchanged. Thus, the centre of mass continues on its original parabolic trajectory.

4. For three equal-mass particles forming a triangle, the centre of mass lies at :
   A. The midpoint of the longest side
   B. The centroid of the triangle
   C. The midpoint between any two particles
   D. The centre of the inscribed circle (B)

Explanation : For particles of equal mass, the centre of mass lies at the centroid of the triangle they form.

5. What is the direction of angular velocity vector in rotational motion about a fixed axis?
   A. Along the velocity of the particle
   B. Perpendicular to the axis of rotation
   C. Along the radius vector
   D. Along the axis of rotation (D)

Explanation : The angular velocity vector points along the axis of rotation in the direction determined by the right-hand rule.

6. Which one of the following expressions represents torque (moment of force)?
   A. $F \times r$ B. $r \cdot F$
   C. $r \times F$ D. $F \cdot r$ (C)

Explanation : Torque is defined as the vector product $\tau = r \times F$, where r is the position vector.

7. When the total external force on a system is zero, what remains constant?
   A. Angular velocity
   B. Angular momentum
   C. Linear momentum
   D. Moment of inertia (C)

Explanation : If the net external force is zero, the total linear momentum of the system remains conserved.

8. In rotational motion about a fixed axis, which particles have zero linear velocity?
   A. All particles on the boundary
   B. Particles farthest from the axis
   C. Particles lying on the axis
   D. Particles with maximum angular displacement (C)

Explanation : Particles on the axis of rotation have zero perpendicular distance from the axis and hence zero linear velocity.

9. For a rigid body under rotational motion, the linear velocity of a particle is given by:
   A. $v = F \times r$ B. $v = \omega \cdot r$
   C. $v = \omega \times r$ D. $v = r \cdot \omega$ (C)

Explanation : The linear velocity v of a particle in rotational motion is given by the vector product $v = \omega \times r$.

10. What is the necessary condition for mechanical equilibrium of a rigid body?
    A. Net force and net torque are zero
    B. Net torque is maximum
    C. Angular acceleration is non-zero
    D. Moment of inertia is constant (A)

Explanation : A body is in mechanical equilibrium when both the net external force and net external torque acting on it are zero.