Practice Quiz (Rotation and Rotational Kinetic Energy)

1) Two children ride on a merry-go-round, George is at a greater distance from the axis of rotation than Jacques. It is a true statement that
A) Jacques has a greater speed than George.
B) Jacques and George have the same speed.
C) Jacques has a smaller speed than George.
D) Cannot tell which one has the greater speed without knowing their masses.
Answer: C

2) A dumbbell-shaped object is composed by two equal masses, \( m \), connected by a rod of negligible mass and length \( r \). If \( I_1 \) is the moment of inertia of this object with respect to an axis passing through the center of the rod and perpendicular to it and \( I_2 \) is the moment of inertia with respect to an axis passing through one of the masses we can say that
A) \( I_1 = I_2 \).
B) \( I_1 > I_2 \).
C) \( I_1 < I_2 \).
D) There is no way to compare \( I_1 \) and \( I_2 \).
Answer: C

3) Two balls, one of radius \( R \) and mass \( M \), the other of radius \( 2R \) and mass \( 8M \), roll down an incline. They start together from rest at the top of the incline. Which one will reach the bottom of the incline first?
A) The small sphere
B) Both reach the bottom together.
C) The large sphere
D) It depends on the height of the incline.
Answer: B

4) A ball is released from rest on a no-slip surface, as shown. After reaching its lowest point, the ball begins to rise again, this time on a frictionless surface.

![Diagram of a ball on a no-slip surface reaching its lowest point and then rising again on a frictionless surface.]

When the ball reaches its maximum height on the frictionless surface, it is
A) at a greater height as when it was released.
B) at a lesser height as when it was released.
C) at the same height as when it was released.
D) impossible to tell without knowing the mass of the ball.
Answer: B

5) A uniform ball with a mass of 125 g is rolling without slipping along the horizontal surface of a table with a speed of 4.50 m/s when it rolls off the edge and it falls towards the floor, 1.10 m below. What is the rotational kinetic energy of the ball just before it hits the floor?
A) 0.506 J
B) 0.732 J
C) 1.05 J
D) 2.61 J
Answer: A

6) An Atwood machine has a mass of 3.50 kg connected by a light string to a mass of 6.00 kg over a pulley with a moment of inertia of 0.0352 kg m^2 and a radius of 12.5 cm. If the system is released from rest, what is the speed of the masses after they have moved through 1.25 m?
A) 2.00 m/s  
B) 2.28 m/s  
C) 4.00 m/s  
D) 4.95 m/s  
Answer: B

7) A disk, a hoop, and a sphere are released at the same time at the top of an inclined plane. They all roll without slipping. In what order do they reach the bottom?
A) disk, hoop, sphere  
B) sphere, disk, hoop  
C) hoop, sphere, disk  
D) hoop, disk, sphere  
Answer: B

8) An object is made up of three masses connected by massless rods of fixed length. Mass A is located at (30.0 cm, 0 cm) and has a mass of 250 grams, mass B is located at (0 cm, 30.0 cm) and has a mass of 350 grams, mass C is located at (-30.0 cm, 0 cm) and has a mass of 450 grams. What is the moment of inertia of this object about an axis perpendicular to the x-y plane and passing through the origin?
A) 0.0945 kg m²  
B) 0.315 kg m²  
C) 0.0135 kg m²  
D) 0.0450 kg m²  
Answer: A

9) A thin hoop with a radius of 10 cm and a mass of 3.0 kg is rotating about its center with an angular speed of 3.5 rad/s. What is its kinetic energy?
A) 0.18 J  
B) 0.092 J  
C) 1.05 J  
D) 0.53 J  
Answer: A