1. A solid sphere of radius 0.2 m and mass 2 kg is at rest at a height 7 m at the top of an inclined plane making an angle 60° with the horizontal. Assuming no slipping, what is the speed of the cylinder at the bottom of the incline?

   1) Zero

   2) 2 m/s

   3) 4 m/s

   4) 6 m/s

   5) 10 m/s

2. What is the moment of inertia of a spinning object of radius 0.5 m and mass 6 kg moving at 5 m/s, if it has a kinetic energy of 100 J?

   1) 1 kgm^2

   2) 2 kgm^2

   3) 4 kgm^2

   4) 8 kgm^2

   5) 20 kgm^2

3. What is the ratio of translational kinetic energy to rotational kinetic energy for a solid sphere rolling at a constant speed v along a flat surface?

   1) 1:5

   2) 2:5

   3) 1:2

   4) 2:1

   5) 5:2

4. What is the ratio of translational kinetic energy to rotational kinetic energy for a solid cylinder rolling at a constant speed v along a flat surface?

   1) 1:4

   2) 1:2

   3) 3:4

   4) 2:1

   5) 4:1

5. How much work is done by a 15 N tangential force on a disk of radius .2 m during one revolution?

   1) Zero

   2) 3 J

   3) 3**p** J

   4) 6 J

   5) 6**p** J

6. A force on a circular object creates a torque that varies according to the equation $\tau = \cos\boldsymbol{t}$, where is in N-m and $\boldsymbol{t}$ is in degrees. How much work is done by that force as the object rotates from 37$\boldsymbol{t}$ to 53$\boldsymbol{t}$?

   1) Zero

   2) –0.5 J

   3) –0.2 J

   4) 0.2 J

   5) 0.5 J

7. A ball rolls down an incline plane without slipping. What is the ratio of its angular velocity at $h/3$ to its angular velocity at $2h/3$?

   1) 1:2

   2) 1:`2

   3) 1:1

   4) `2:1

   5) 2:1

8. An object with a rotational inertia of I has an angular position $\theta(t) = 3t^2 + 3t + 3$, where θ is in radians and t is in seconds. What is the net torque acting on the object?

   1) $3I$

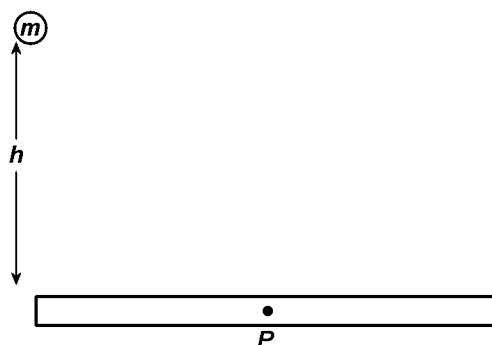   2) $6I$

   3) $9I$

   4) $12I$

   5) $15I$

9. Base your answer to the following question on the information below.

   A spinning object with moment of inertia I increases in angular speed from $\omega = 0$ to ω_a in t seconds.

   What is the average power delivered to the object during this interval t?

   1) $I\omega_a/2t^2$

   2) $I\omega_a^2/t$

   3) $I\omega_a^2/2t$

   4) $I\omega_a^2/t^2$

   5) $I\omega_a^2/2t^2$

10. Base your answer to the following question on the diagram below.

   The rod of rotational inertia I is initially at rest. A ball of mass m falls onto the rod such that all of its kinetic energy is imparted to the rod. What is the rotational velocity of the rod around point P immediately after the collision?

   1) mg/I

   2) $(mgh/2I)^{i}$

   3) $(mgh/I)^{i}$

   4) $(2mgh/I)^{i}$

   5) $2mg/I$

11. A solid sphere of radius 5 m and mass 2 kg rolls at an angular velocity of 3 rad/s. What is its rotational kinetic energy?

   1) 9 J

   2) 30 J

   3) 90 J

   4) 225 J

   5) 450 J

12. A solid sphere of radius 5 m and mass 2 kg rolls at an angular velocity of 3 rad/s on a surface at a height of 4 m above the ground. What is the potential energy of the system?

   1) 80 J

   2) 90 J

   3) 170 J

   4) 225 J

   5) 305 J

13. Two equal forces do W Joules of work on cylinder and a hoop of the same radius and same mass. What is the ratio of the total kinetic energy of the cylinder to the total kinetic energy of the hoop after this work has been done?

   1) 1:1

   2) 1:2

   3) 2:1

   4) 1:4

   5) 4:1

14. What is the total kinetic energy of a hoop of radius 1 m and mass 2 kg that rolls at an angular velocity of 1 rad/s?

   1) 1 J

   2) 1.5 J

   3) 2 J

   4) 2.5 J

   5) 3 J

Answer Key
M.o.I. & Rotational Dynamics MC Questions [Mar 28, 2011]

1.   5

2.   2

3.   5

4.   4

5.   5

6.   4

7.   4

8.   2

9.   3

10.   4

11.   3

12.   1

13.   1

14.   3

Name _____   Class _____   Date _____

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____