# Physics 2314, Homework #7 (due 3/28)

Multiple choice questions

M1 (a) Two disks A and B have the same mass. Which disk has larger kinetic energy: disk A of radius 0.1 m rotating with angular speed 1 rad/s, or disk B of radius 0.2 m rotating with angular speed 0.5 rad/s?

    A. Disk A.

    B. Disk B.

    C. Their kinetic energies are equal.

(b) Two disks A and B have the same thickness and are made of the same material. Which disk has larger kinetic energy: disk A of radius 0.1 m rotating with angular speed 1 rad/s, or disk B of radius 0.2 m rotating with angular speed 0.5 rad/s?

    A. Disk A.

    B. Disk B.

    C. Their kinetic energies are equal.

M2 An object is rotating about the $z$ axis. Its angular position is given by the equation $\theta = t^3 - 3t^2$, where $t$ is in seconds, and $\theta$ is in radians. Mark all values of $t$ when the angular speed of the object is zero.

    A. $t = 0$

    B. $t = 1$ s

    C. $t = 2$ s

    D. $t = 3$ s

    E. $t = 4$ s

M3 (a) Which will roll down a hill faster – a solid cylinder or a solid sphere? Assume that both have the same mass and radius.

    A. The solid cylinder.

    B. The solid sphere.

    C. They will roll down with the same speed.

(b) Which will roll down a hill faster – a solid ball or a hollow ball? Assume that both have the same mass and radius.

    A. The solid ball.

    B. The hollow ball.

    C. They will roll down with the same speed.

Problems

P1 (a) An object is rotating about the $z$ axis. Its angular position is given by the equation

$$\theta = 1 + 2t + t^2,$$

where $\theta$ is in radians and $t$ is in seconds. Find angular position, angular speed, and angular acceleration of the object at $t = 2$ s.

(b) An object is rotating about the $z$ axis. Its angular position is given by the equation

$$\theta = 1 + 2t,$$

where $\theta$ is in radians and $t$ is in seconds. Find angular position, angular speed, and angular acceleration of the object at $t = 2$ s.

P2 A rotating wheel requires 5 s to rotate through 10 revolutions. Its angular speed at the end of the 5-s interval is 20 rad/s. What is the constant angular acceleration of the wheel?

P3 A massless cube of side 0.1 m has eight particles of mass 0.01 kg each placed at its corners. Find the moment of inertia about the axis passing through the centers of two opposite faces of the cube.
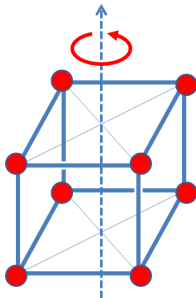


P4 The cam is a circular disk of radius $2r$ with a hole of radius $r$ through it offset by $r$. The cam with the hole cut out has mass $m$. The cam is mounted on a uniform, solid, cylindrical shaft of radius $r$ and mass $M$. The cam-shaft combination is rotating about the shaft's axis. If the kinetic energies of the cam and the shaft are equal, what is their mass ratio $m/M$?