Chapter H - Problems

Blinn College - Physics 2425 - Terry Honan

Problem H.1

A wheel rotates from rest to $12 \, \text{rad/s}$ in 3 s. Assume the angular acceleration is constant.
(a) What is the magnitude of the wheel's angular acceleration?
(b) Through what angle (in radians) does the wheel rotate?

Problem H.2

(a) What is the angular velocity of the Earth in its orbit about the Sun.
(b) What is the angular velocity of the Moon in its orbit about the Earth.

Problem H.3

A grinding wheel rotating at $100 \, \text{rev/min}$ is turned off. It slows with a constant angular acceleration of $2 \, \text{rad/s}$.
(a) How long does it take the wheel to stop?
(b) Through what angle, in radians, does it turn while slowing?

Problem H.4

A car races around a circular track of radius 250 m at a constant speed of $45 \, m/s$.
(a) What is its angular velocity?
(b) What is the magnitude and direction of its acceleration?

Problem H.5

By rotating through 1.25 rev of a 1 m radius arc, a discus thrower uniformly accelerates a discus from rest to $25 \, m/s$.
(a) What is the final angular velocity of the discus?
(b) What is its angular acceleration?
(c) What is the total time of acceleration?

Problem H.6

Assume that a baseball is a uniform sphere of radius 3.80 cm. If it moves at a speed of $38 \, m/s$ (the speed of the center of mass) and rotates at $125 \, \text{rad/s}$ then what is the ratio of the rotational kinetic energy to the translational kinetic energy.

Problem H.7

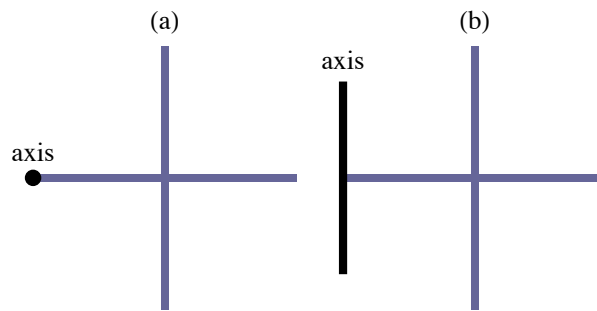Three masses glued onto a light rigid sheet in the xy plane. The masses and positions are:

$$4 \text{ kg at } (-3 \text{ m}, 5 \text{ m}), \quad 6 \text{ kg at } (4 \text{ m}, 0) \quad \text{and} \quad 8 \text{ kg at } (0, -3 \text{ m}).$$

(a) Suppose this sheet is rotated about the y axis at an angular velocity of 12 rad/s. What is its total rotational kinetic energy?

(b) Suppose it rotates about the z axis at 12 rad/s. What is its rotational kinetic energy?
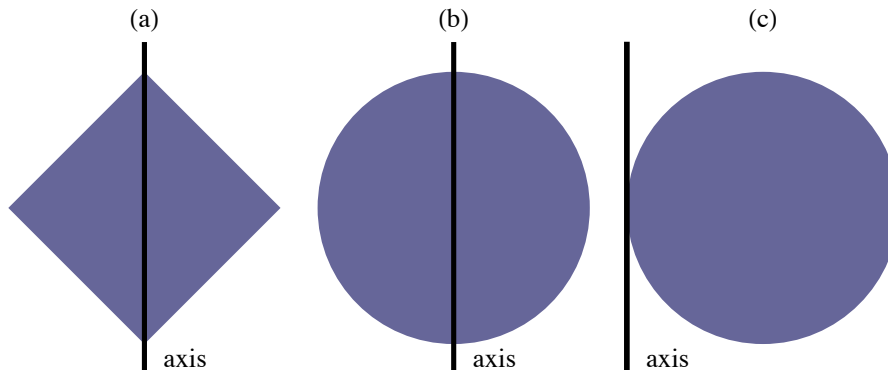
Problem H.8

Two identical thin rods of length L and mass M are perpendicular and joined at their center. What is the moment of inertia about an axis at the end of one rod that is:
(a) perpendicular to the plane,
(b) parallel to the other rod.

Problem H.9

What are the moments of inertia of the following flat uniform bodies of mass M about the axis mentioned?
(a) an $L \times L$ square about a diagonal
(b) a circle of radius R about a diameter
(c) a circle of radius R about a tangent

Problem H.10

(a) A uniform solid cylinder of mass m and radius R rotates about an axis at its rim parallel to the central axis. What is its moment of inertia.

(b) What is the moment of inertia of a uniform solid sphere of mass m and radius R about an axis tangent to its surface.

(c) What is the moment of inertia of a uniform thin-shelled hollow sphere of mass m and radius R about an axis tangent to its surface.