This print-out should have 15 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

Concept 08 26

12:01, highSchool, multiple choice, < 1 min, fixed.

001

Nobody at the playground wants to play with an obnoxious boy, so he fashions a seesaw as shown so he can play by himself.

Explain how this is done.

1. The angular velocity of the boy is cancelled with that of the board.

2. The weight of the boy is balanced by the weight of the board.

3. The fulcrum is very far from the boy.

4. The weight of the boy is balanced with an unknown heavy metal.

Serway CP 08 40

10:09, trigonometry, numeric, > 1 min, normal.

002

The net work done in accelerating a propeller from rest to an angular speed of 200 rad/s is 3000 J.

What is the moment of inertia of the propeller? Answer in units of $\mathrm{kg \cdot m^2}$.

Diatomic Molecule O2

10:05, trigonometry, numeric, > 1 min, normal.

003

Consider the diatomic molecule oxygen, O_2, which is rotating in the xy plane about the z axis passing through its center, perpendicular to its length. The mass of each oxygen atom is 2.66×10^{-26} kg, and at room temperature, the average separation distance between the two oxygen atoms is 1.21×10^{-10} m(the atoms are treated as point masses).

If the angular speed of the molecule about the z axis is 4.6×10^{12} rad/s, what is its rotational kinetic energy? Answer in units of J.

Inertia of Solid Cylinder

10:06, trigonometry, numeric, > 1 min, normal.

004

Calculate the moment of inertia of a solid cylinder of mass 10.2 kg and radius 5 m about an axis parallel to the center-of-mass axis and passing through the edge of the cylinder. (Use the parallel-axis theorem and Table 10.2) Answer in units of $\mathrm{kg\,m^2}$.

005

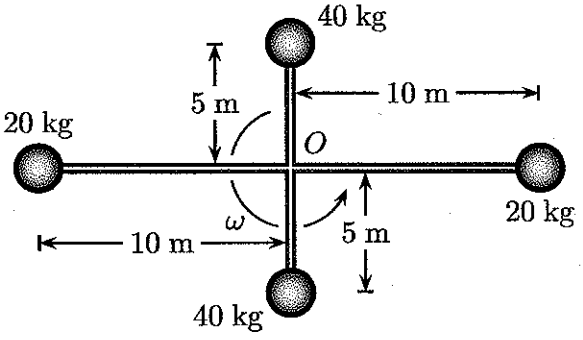
Calculate the moment of inertia of a solid sphere of mass 10.2 kg and radius 5 m about an axis tangent to its surface. Answer in units of $\mathrm{kg\,m^2}$.

Rotating a Rigid Object 01

10:06, trigonometry, numeric, > 1 min, normal.

006

The rigid object shown is rotated about an axis perpendicular to the paper and through center point O. The total kinetic energy of the object as it rotates is 5 J.



What is the moment of inertia of the object? Neglect the mass of the connecting rods and treat the masses as point masses. Answer in units of $\mathrm{kg \cdot m^2}$.

007

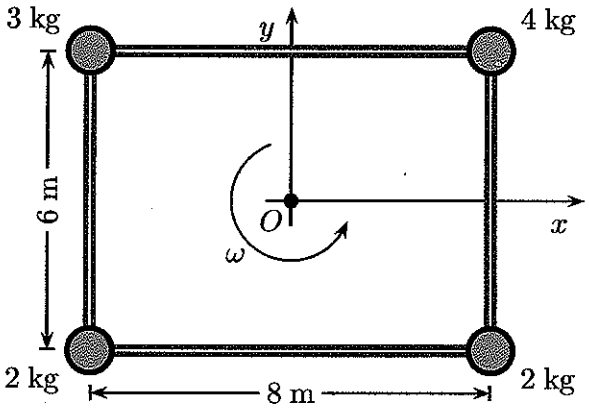
What is the angular velocity of the object? Answer in units of rad/s.

Rigid Rectangular System

10:05, trigonometry, numeric, > 1 min, normal.

008

Four particles with masses 3 kg, 2 kg, 2 kg, and 4 kg are connected by rigid rods of negligible mass at the corners of a rectangle. The origin is at the center of the figure.



What is the moment of inertia about the y-axis? Answer in units of $\mathrm{kg\,m^2}$.

009

What is the moment of inertia about the z-axis? Answer in units of $\mathrm{kg\,m^2}$.

010

The system rotates around the z-axis at an angular velocity of 3 rad/s.

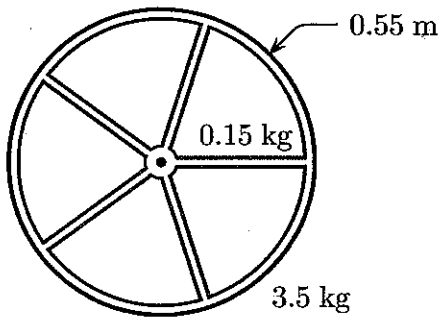
What is the kinetic energy of the system? Answer in units of J.

Spoked Wheel

10:06, trigonometry, numeric, > 1 min, wording-variable.

011

A wheel is formed from a hoop of mass 3.5 kg and five equally spaced spokes each of mass 0.15 kg. The hoop's radius is the length of 0.55 m each spoke.



Determine the moment of inertia of the wheel about an axis through its center and perpendicular to the plane of the wheel. Answer in units of $\mathrm{kg \cdot m^2}$.

012

Determine the moment of inertia of the wheel about an axis through its rim and perpendicular to the plane of the wheel. Answer in units of $\mathrm{kg \cdot m^2}$.

Rod Plus Weight

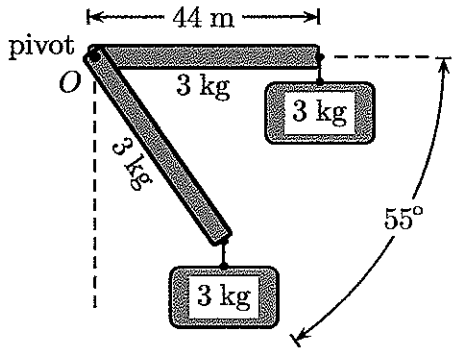
10:09, trigonometry, numeric, > 1 min, normal.

013

A uniform rod has length 44 m and mass 3 kg .

A mass of 3 kg is attached at one end. The other end of the rod is pivoted about the horizontal axis at O.

The acceleration of gravity is 9.8 $\mathrm{m/s^2}$.



Determine the torque about O immediately after the rod-plus-mass system is released from the horizontal position. Answer in units of $\mathrm{kg\,m^2/s^2}$.

014

After the rod-plus-mass system is released, it rotates freely about the point O.

Determine its angular velocity ω as the rod passes through the vertical direction. Answer in units of s^{-1}.

015

The angle between the instantaneous position of the rod and the initial horizontal direction is $55°$.

How much potential energy is released in going from $0°$ to $55°$.? Answer in units of J.