WebAssign
CH09-HW01-SP12 (Homework)

Yinglai Wang
PHYS 172-SPRING 2012, Spring 2012
Instructor: Virendra Saxena

Current Score : 23 / 23 **Due :** Tuesday, March 20 2012 11:59 PM EDT

1. 12/12 points | Previous Answers MI3 9.2.X.019

Consider a system consisting of three particles:
m_1 = 5 kg, $\vec{v}_1$ = < 10, -6, 14 > m/s
m_2 = 5 kg, $\vec{v}_2$ = < -13, 9, -3 > m/s
m_3 = 3 kg, $\vec{v}_3$ = < -21, 37, 24 > m/s

(a) What is the total momentum of this system?

$\vec{p}_{tot}$ = ✔ kg·m/s

(b) What is the velocity of the center of mass of this system?

$\vec{v}_{cm}$ = ✔ m/s

(c) What is the total kinetic energy of this system?
K_{tot} = 5056.5 ✔ J

(d) What is the translational kinetic energy of this system?
K_{trans} = 1474.89 ✔ J

(e) What is the kinetic energy of this system relative to the center of mass?
K_{rel} = 3581.61 ✔ J

One way to calculate K_{rel} is to calculate the velocity of each particle relative to the center of mass, by subtracting the center-of-mass velocity from the particle's actual velocity to get the particle's velocity relative to the center of mass, then calculating the corresponding kinetic energy, then adding up the three relative kinetic energies. However, there is a much simpler way to determine the specified quantity, without having to do all those calculations; think about what you know about the relationships among the various kinds of kinetic energy in a multiparticle system. (If you wish, you can check your result by doing the complicated calculation just described.)

- *Read the eBook*
- Section 9.2

2. 1/1 points | Previous Answers MI3 9.3.X.005

If an object has a moment of inertia 26 kg·m^2 and rotates with an angular speed of 83 radians/s, what is its rotational kinetic energy?

K_{rot} = 89557 ✔ J

- *Read the eBook*
- Section 9.3

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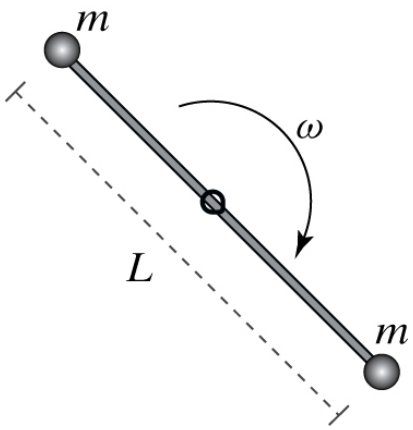
3. 2/2 points | Previous Answers MI3 9.3.X.006

A barbell spins around a pivot at its center (see figure). The barbell consists of two small balls, each with mass m = 470 grams, at the ends of a very low mass rod whose length is L = 24 cm. The barbell spins with angular speed ω = 50 radians/s.



Calculate K_{rot}.

K_{rot} = 16.92 ✔ J

- *Read the eBook*
- Section 9.3

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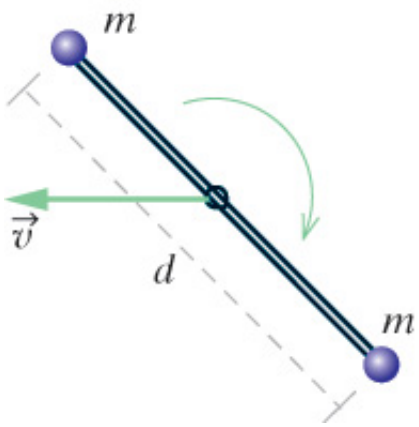
4. 8/8 points | Previous Answers



A barbell consists of two massive balls connected by a low-mass rod. The barbell slides across a low-friction icy surface, spinning as it moves, as shown in the diagram. The mass *m* of each ball is 0.5 kg. The distance *d* between the centers of the balls is 0.27 m. The speed *v* of the center of mass of the barbell is 0.41 m/s, and the barbell makes one complete revolution in 5 seconds.

What is the translational kinetic energy of the barbell?

K_{trans} = 0.08405 ✔ J

Considering only the motion of the barbell relative to its center of mass, what is the speed of one ball as it rotates around the center of the barbell?

v_{rot} = 0.1696 ✔ m/s

What is the rotational kinetic energy of the barbell? (This is the kinetic energy associated with motion relative to the center of mass.)

K_{rot} = 0.01439 ✔ J

What is the total kinetic energy of the barbell?

K_{tot} = 0.09844 ✔ J