

**Practice Test#3 ( Chapters 8,9, and 10 from Tipler)**

$$M \vec{r}_{cm} = \sum_i m_i \vec{r}_i ; \quad \vec{p} = m\vec{v} ; \quad F_{net,ext} = \frac{d\vec{p}}{dt} ;$$

$$K = \frac{1}{2}mv^2 \quad ; \quad U = mgh \quad ; \quad \vec{I} = \int \vec{F} dt = \Delta \vec{P} ; \quad \vec{F}_{av} = \frac{\vec{I}}{\Delta t}$$

$$v_{2f} - v_{1f} = -(v_{2i} - v_{1i}); \quad \text{relative speed of particles in an elastic collision.}$$

$$\omega = \frac{d\theta}{dt}; \quad \alpha = \frac{d\omega}{dt}; \quad v_{it} = r_i\omega; \quad a_{it} = r_i\alpha; \quad a_{ic} = \frac{v_i^2}{r_i} = r_i\omega^2$$

$$\omega = \omega_0 + \alpha t; \quad \theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2; \quad \omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$$

$$\tau = \vec{r} \times \vec{F} = rF \sin \phi; \quad I = \sum_i m r_i^2; \quad I = I_{cm} + Mh^2$$

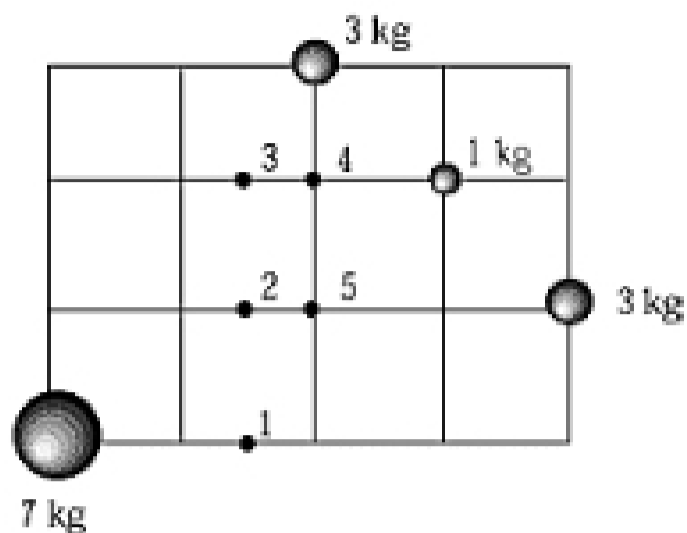
$$\tau_{net,ext} = I\alpha; \quad v = R\omega; \quad a = R\alpha;$$

$$K = \frac{1}{2}I\omega^2; \quad K = \frac{1}{2}I_{cm}\omega^2 + \frac{1}{2}Mv_{cm}^2; \quad v_{cm} = R\omega$$

$$\vec{A} \times \vec{B} = AB \sin \phi \hat{n}; \quad \vec{A} \times \vec{B} = -\vec{B} \times \vec{A};$$

$$\hat{i} \times \hat{j} = \hat{k}; \quad \hat{j} \times \hat{k} = \hat{i}; \quad \hat{k} \times \hat{i} = \hat{j}; \quad \hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = 0$$

$$\vec{L} = \vec{r} \times \vec{p}; \quad L = I\omega; \quad \tau_{net,ext} = \frac{dL}{dt};$$



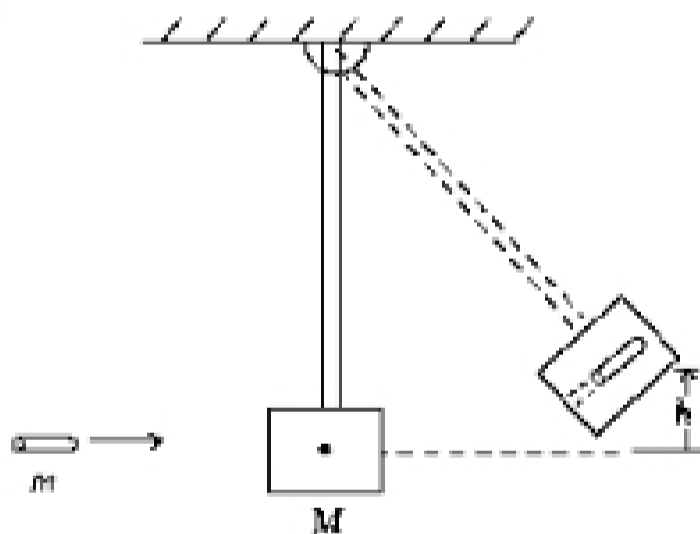
7 kg

The center of mass of the system of particles shown in the diagram is at point

- A) 1 B) 2 C) 3 D) 4 E) 5

2. A boy and girl on ice skates face each other. The girl has a mass of 20 kg and the boy has a mass of 30 kg. The boy pushes the girl backward at a speed of 3.0 m/s. As a result of the push, what is the speed of the ?

3.



A bullet,  $m = 0.500$  kg, traveling with a velocity of 100 m/s strikes and embeds itself in the bob of a ballistic pendulum,  $M = 9.50$  kg. The combined masses rise to a height  $h = 1.28$  m. Calculate the speed  $V_f$  of the combined masses immediately following impact.

4. A pitcher throws a baseball with a velocity of 27 m/s. After being struck by a bat the ball

travels in the opposite direction with a velocity of 40 m/s. If the ball has a mass of 0.11 kg and is in contact with the bat for 3.0 ms, calculate the average force exerted by the bat on the ball.

5. A 0.060-kg tennis ball, moving with a speed of 2.5 m/s, has a head-on collision with 0.090-kg initially moving away from it at a speed of 1.00 m/s. Assuming a perfectly elastic collision, what is the speed of each ball after the collision?
  
  
  
  
  
  
  
  
  
  
6. A wheel of diameter of 68.0 cm slows down uniformly from 8.40 m/s to rest over a distance of 115 m. What is the angular acceleration?
  
  
  
  
  
  
  
  
  
  
7. What constant torque, in the absence of friction, must be applied to a wheel to give it an angular velocity of 50 rad/s if it starts from rest and is accelerated for 10 s? The moment of inertia of the wheel about its axle is 9.0 kg · m<sup>2</sup>.
  
  
  
  
  
  
  
  
  
  
8. The moment of inertia of a slim rod of mass  $m$  and length  $L$  about a transverse axis through one end is  $mL^2/3$ . Calculate the moment of inertia of such a rod about a transverse axis through the rod at a distance  $L/3$  from one end.