

## Announcements

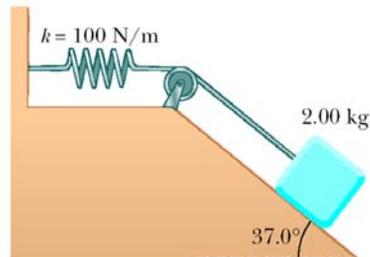
1. Exam #2 is Friday Nov 13 at 8:10 pm. See web site for your room assignment. Click on building to see directions.
2. Make up a formula sheet—two sides of an 8.5”x11” paper in your own hand—no copies. Keep the material from exam 1 on it.
3. Bring scratch paper, #2 pencil, GATOR 1 ID, and a calculator. Any calculator is ok as long as it is not a communication device.
4. Cell phones off and packed during exam.
5. Special cases should have already made arrangements with me or Dr. Ihas.
6. HW due next week (Nov. 18)
7. Clicker questions do not count for grade **today**

- Pleeeeeeeeeeeeeeeease mark your UFID, exam number, and name correctly.
- 20 problems
- From chapter 5.4 to 8.4
- No rocket motion formula
- No section 7.6 (Kepler’s laws)

**Go through the homework, discussion and clicker quizzes problems carefully. All HW solutions are up on the website.**

**76.** A 2.00-kg block situated on a rough incline is connected to a spring of negligible mass having a spring constant of 100 N/m (Fig. P5.76). The block is released from rest when the spring is unstretched, and the pulley is frictionless. The block moves 20.0 cm down the incline before coming to rest. Find the coefficient of kinetic friction between block and incline.

- A. 0.255
- B. 0.552
- C. 0.115
- D. 0.600



$$W_f = (f_k \cos 180^\circ) x = -\mu_k n x = -\mu_k (m g \cos \theta) x.$$

$$W_{nc} = (KE + PE_g + PE_s)_f - (KE + PE_g + PE_s)_i$$

$$W_{nc} = W_f = -\mu_k (m g \cos \theta) x = \Delta KE + \Delta PE_g + \Delta PE_s.$$

$$-\mu_k (19.6 \text{ N} \cos 37.0^\circ) (0.200 \text{ m})$$

$$= 0 + (19.6 \text{ N}) (-0.200 \text{ m} \sin 37.0^\circ) + \frac{1}{2} (100 \text{ N/m}) (0.200 \text{ m})^2$$

A 20-kg object sitting at rest is struck elastically in a head-on collision with a 10-kg object initially moving at +3.0 m/s. Find the final velocity of the 20-kg object after the collision.

- a. -1.0 m/s
- b. -2.0 m/s
- c. +1.5 m/s
- d. +2.0 m/s

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$

$$0 + 10 \times 3 = 20v_{1f} + 10v_{2f}$$

$$2v_{1f} + v_{2f} = 3$$

$$v_{1i} + v_{1f} = v_{2i} + v_{2f}$$

$$0 + v_{1f} = 3 + v_{2f}$$

$$v_{1f} - v_{2f} = 3$$

A 45.0 kg girl is standing on a 165 kg plank. The plank, originally at rest, is free to slide on a frozen lake, which is a flat, frictionless surface. The girl begins to walk along the plank at a constant velocity of 1.51 m/s relative to the plank. What is her velocity relative to the surface of ice?

A. 0.32 m/s

B. 1.19 m/s

C. 1.51 m/s

D. 1.65 m/s

Scanned solutions 1

An 8.00 g bullet is fired into a 280 g block that is initially at rest at the edge of a table of 1.00 m height. The bullet remains in the block, and after the impact the block lands  $d = 2.1$  m from the bottom of the table. Determine the initial speed of the bullet.

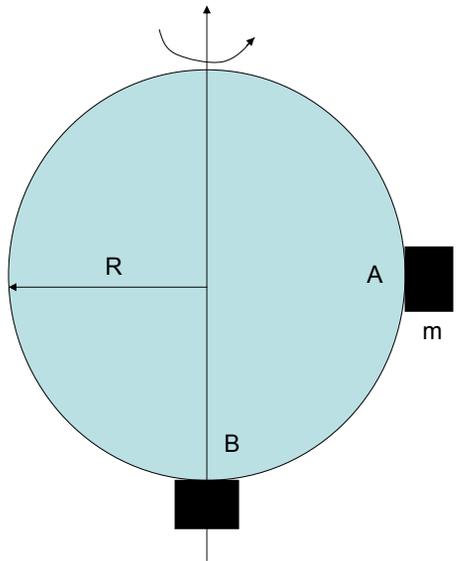
A. 4.65 m/s

B. 9.80 m/s

C. 1.00 m/s

D. 166 m/s

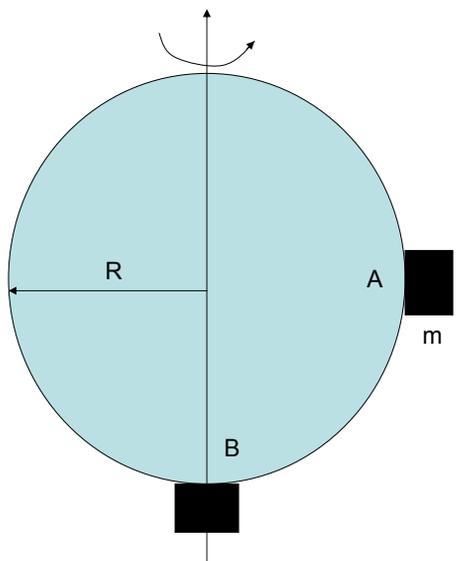
Scanned solutions 2



The planet is rotating about the vertical axis with constant angular velocity  $\omega$ . What is the acceleration of the mass  $m$  at point A.

A. 0  
B.  $g$   
C.  $\omega^2 R$

The diagram shows a light blue circle representing a planet of radius  $R$ . A vertical axis passes through the center, with a curved arrow at the top indicating rotation. A horizontal line from the center to the left is labeled  $R$ . Point A is on the right edge of the circle, and a black square mass  $m$  is attached to it. Point B is at the bottom of the circle, where the vertical axis intersects the circle. A black square is also attached to the planet at point B.



The planet is rotating about the vertical axis with constant angular velocity  $\omega$ . What is the acceleration of the mass  $m$  at point B.

A. 0  
B.  $g$   
C.  $\omega^2 R$

The diagram is identical to the one above, showing a light blue circle of radius  $R$  rotating about a vertical axis. Point A is on the right edge with a mass  $m$  attached. Point B is at the bottom of the circle, where the vertical axis intersects the circle. A black square is also attached to the planet at point B.

Part of a roller-coaster ride involves coasting down an incline and entering a loop 8.00 m in diameter. For safety considerations, the roller coaster's speed at the top of the loop must be such that the force of the seat on a rider is equal in magnitude to the rider's weight. From what height above the bottom of the loop must the roller coaster descend to satisfy this requirement?

- A. 12.0 m
- B. 8.00 m
- C. 9.80 m
- D. 100 m

Scanned solutions 3

A wheel undergoes constant angular acceleration. Find the angular acceleration if the initial angular velocity is zero and the final angular velocity after 10 s is 100 rad/s.

- A. 1 rad/s<sup>2</sup>
- B. 10 rad/s<sup>2</sup>
- C. 100 rad/s<sup>2</sup>
- D. 1000 rad/s<sup>2</sup>

$$\omega_f = \omega_i + \alpha t$$

$$100 = 0 + 10\alpha$$

The launching mechanism of a toy gun consists of a Hooke's law spring of unknown spring constant. If the spring is compressed a distance of 0.120 m and the gun fired vertically, the gun can launch a 20.0-g projectile from rest to a maximum height of 20.0 m above the starting point of the projectile. Neglecting all resistive forces, determine the spring constant

1. 100 N/m
2. 980 N/m
3. 483 N/m
- ✓ 4. 544 N/m

$$W_{nc} = \Delta KE + \Delta PE_g + \Delta PE_s$$

$$W_{nc} = 0$$

$$\Delta KE = 0$$

$$\Rightarrow \Delta PE_g = -\Delta PE_s$$

$$\Rightarrow PE_{gf} - PE_{gi} = PE_{si} - PE_{sf}$$

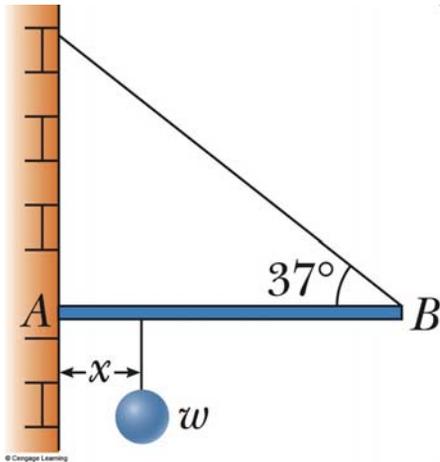
$$\Rightarrow mgh = (1/2)kx^2$$

$$\Rightarrow k = (2mgh)/x^2$$

A 100-N uniform ladder rests against a smooth vertical wall. The coefficient of static friction between ladder and floor is 0.40. What minimum angle can the ladder make with the floor before it slips?

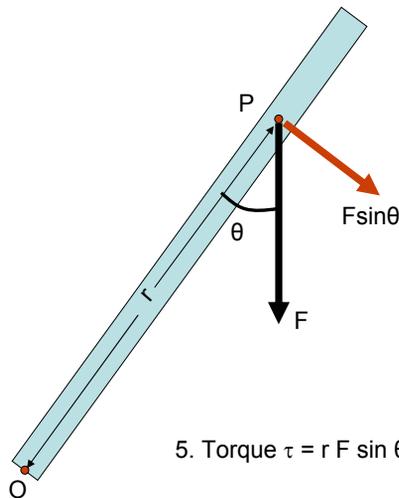
- A.  $42^\circ$
- B.  $22^\circ$
- C.  $18^\circ$
- D.  $51^\circ$
- E.  $39^\circ$

$\Sigma F_x = f_s - P = 0$   
 $\Sigma F_y = N - 100 = 0$   
 $\Rightarrow N = 100$   
 $f_s = P$   
 $\Rightarrow \mu_s N = P$   
 $\Rightarrow 0.4 \times 100 = P = 40 \text{ Newtons}$   
 $\Sigma \tau = -1/2 \times 100 \sin(90 - \theta) + L P \sin \theta = 0$   
 $\Rightarrow \tan \theta = 100/2P$   
 $\Rightarrow \theta = 51.3^\circ$



One end of a uniform 3.0 m long rod of weight  $w$  is supported by a cable. The other end rests against the wall at point A, where it is held by friction. The coefficient of static friction between the wall and the rod is  $\mu_s = 0.30$ . Determine the minimum distance,  $x$ , from point A at which an additional weight  $w$  (the same as the weight of the rod) can be hung without causing the rod to slip at point A.

Scanned solutions 4



1. Choose origin

2. Find distance of the point P (where the force is being applied to the beam) from the origin O. This is the value of  $r$ .

3. Find the angle  $\theta$  the force  $F$  makes **with the beam** i.e. **think of the beam as the x-axis**.

4. Find the component of the force  $F$  which is **perpendicular to the beam** i.e. **think of the beam as the x-axis and find the y-component of  $F$  which is  $F \sin \theta$** .

5. Torque  $\tau = r F \sin \theta$

6. If the force  $F$  is tending to rotate the beam clockwise then  $\tau$  is negative.