TUD-AESB1320, Mechanics I (TUDAESB1320)

Exam April 2015 [Edit]

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Due: --

You will receive no credit for items you complete after the assignment is due. Grading Policy

Conceptual Question 2.18

Description: (a) Two objects are thrown from the top of a tall building and experience no appreciable air resistance. One is thrown up, and the other is thrown down, both with the same initial speed. What are their speeds when they hit the street?

Part A

Two objects are thrown from the top of a tall building and experience no appreciable air resistance. One is thrown up, and the other is thrown down, both with the same initial speed. What are their speeds when they hit the street?

ANSWER:

- ○ The one thrown up is traveling faster.
- ◉ They are traveling at the same speed.
- ○ The one thrown down is traveling faster.

Problem 2.23

Description: (a) A soccer ball is released from rest at the top of a grassy incline. After v1 seconds, the ball travels v4 meters and 1.0 s after this, the ball reaches the bottom of the incline.What was the magnitude of the ball's acceleration, assume it to be...

Part A

A soccer ball is released from rest at the top of a grassy incline. After 2.9 seconds, the ball travels 84 meters and 1.0 s after this, the ball reaches the bottom of the incline.
What was the magnitude of the ball's acceleration, assume it to be constant?

Express your answer using two significant figures.

ANSWER:

$a =$ $v10 = 20$ m/s^2

Part B

How long was the incline?

Express your answer using two significant figures.

ANSWER:

$l =$ $v11 = 150$ m

Conceptual Question 3.17

Description: (a) A pilot drops a package from a plane flying horizontally at a constant speed. Neglecting air resistance, when the package hits the ground the horizontal location of the plane will...

Part A

A pilot drops a package from a plane flying horizontally at a constant speed. Neglecting air resistance, when the package hits the ground the horizontal location of the plane will

ANSWER:

- ○ be in front of the package.
- ○ be behind the package.
- ○ depend of the speed of the plane when the package was released.
- ◉ be over the package.

Problem 3.29

Description: (a) A hockey puck slides off the edge of a table with an initial velocity of v1 m/s and experiences no air resistance. The height of the tabletop above the ground is 2.00 m. What is the angle below the horizontal of the velocity of the puck just...

Part A

A hockey puck slides off the edge of a table with an initial velocity of 27.7 m/s and experiences no air resistance. The height of the tabletop above the ground is 2.00 m. What is the angle below the horizontal of the velocity of

the puck just before it hits the ground?

ANSWER:

- (•) 12.7°
- ( ) 72.6°
- ( ) 31.8°
- ( ) 22.8°
- ( ) 77.2°

Conceptual Question 4.09

Description: (a) Consider what happens when you jump up in the air. Which of the following is the most accurate statement?

Part A

Consider what happens when you jump up in the air. Which of the following is the most accurate statement?

ANSWER:

- (•) When you push down on the earth with a force greater than your weight, the earth will push back with the same magnitude force and thus propel you into the air.
- ( ) Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself that propels your body into the air.
- ( ) You are able to spring up because the earth exerts a force upward on you that is greater than the downward force you exert on the earth.
- ( ) It is the upward force exerted by the ground that pushes you up, but this force cannot exceed your weight.
- ( ) When you jump up the earth exerts a force F_1 on you and you exert a force F_2 on the earth. You go up because $F_1 > F_2$.

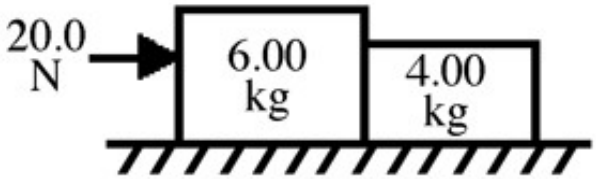
Problem 4.20

Description: (a) A 6.00-kg block is in contact with a 4.00-kg block on a horizontal frictionless surface as shown in the figure. The 6.00-kg block is being pushed by a horizontal 20.0-N force as shown. What is the magnitude of the force that the 6.00-kg block...

Part A

A 6.00-kg block is in contact with a 4.00-kg block on a horizontal frictionless surface as shown in the figure. The 6.00-kg block is being pushed by a horizontal 20.0-N force as shown. What is the magnitude of the force that the

6.00-kg block exerts on the 4.00-kg block?



ANSWER:

- ○ 10.0 N
- ○ 4.00 N
- ◉ 8.00 N
- ○ 20.0 N
- ○ 6.00 N

Conceptual Question 5.08

Description: (a) A crate is sliding down an inclined ramp at a constant speed of 0.55 m/s. The vector sum of all the forces acting on this crate must point down the ramp.

Part A

A crate is sliding down an inclined ramp at a constant speed of 0.55 m/s. The vector sum of all the forces acting on this crate must point down the ramp.

ANSWER:

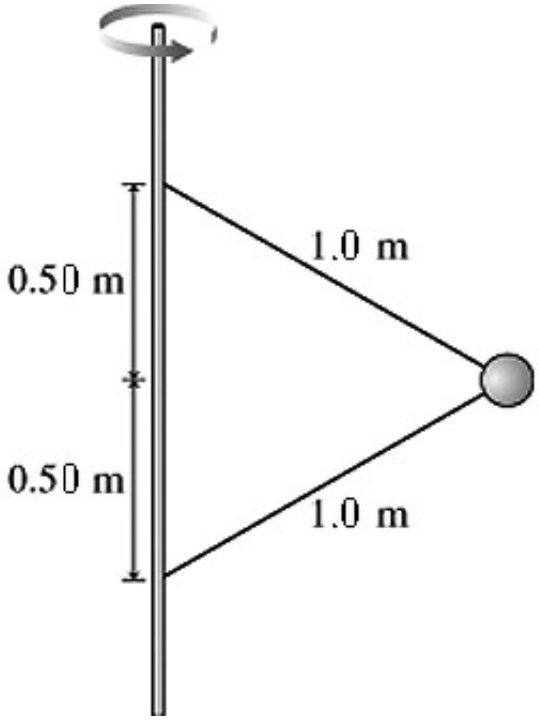
- ○ True
- ◉ False

Problem 5.60

Description: (a) The figure shows two wires that are tied to a v10 g mass that revolves in a horizontal circle at a constant speed of 7.5 m/s. What is the tension in the upper wire?

Part A

The figure shows two wires that are tied to a 180 g mass that revolves in a horizontal circle at a constant speed of 7.5 m/s. What is the tension in the upper wire?



ANSWER:

- 5.0 N
- 8.5 N
- 6.8 N
- 10 N

Conceptual Question 6.08

Description: (a) If a force always acts perpendicular to an object's direction of motion, that force cannot change the object's kinetic energy.

Part A

If a force always acts perpendicular to an object's direction of motion, that force cannot change the object's kinetic energy.

ANSWER:

- True
- False

Problem 6.28

Description: (a) A ball is thrown upward at an angle with a speed and direction such that it reaches a maximum

height of h m above the point it was released, with no appreciable air resistance. At its maximum height it has a speed of v m/s. With what speed was...

Part A

A ball is thrown upward at an angle with a speed and direction such that it reaches a maximum height of 16.5 m above the point it was released, with no appreciable air resistance. At its maximum height it has a speed of 15.0 m/s. With what speed was the ball released?

ANSWER:

- (•) 23.4 m/s
- ( ) 28.1 m/s
- ( ) 32.8 m/s
- ( ) 18.7 m/s
- ( ) 14.1 m/s

Conceptual Question 6.22

Description: (a) A girl throws a stone from a bridge. Consider the following ways she might throw the stone. The speed of the stone as it leaves her hand is the same in each case, and air resistance is negligible. Case A: Thrown straight up. Case B: Thrown...

Part A

A girl throws a stone from a bridge. Consider the following ways she might throw the stone. The speed of the stone as it leaves her hand is the same in each case, and air resistance is negligible.
Case A: Thrown straight up.
Case B: Thrown straight down.
Case C: Thrown out at an angle of 45° above horizontal.
Case D: Thrown straight out horizontally.
In which case will the speed of the stone be greatest when it hits the water below?

ANSWER:

- ( ) Case A
- ( ) Case B
- ( ) Case C
- ( ) Case D
- (•) The speed will be the same in all cases.

Problem 7.17

Description: (a) A car on a roller coaster starts at zero speed at an elevation above the ground of 26 m. It coasts down a slope, and then climbs a hill. The top of the hill is at an elevation of 16 m. What is the speed of the car at the top of the hill? Neglect ...

Part A

A car on a roller coaster starts at zero speed at an elevation above the ground of 26 m. It coasts down a slope, and then climbs a hill. The top of the hill is at an elevation of 16 m. What is the speed of the car at the top of the hill? Neglect any frictional effects.

ANSWER:

- ○ 6.0 m/s
- ○ 9.0 m/s
- ○ 18 m/s
- ○ 10 m/s
- ◉ 14 m/s

Conceptual Question 8.05

Description: (a) Two planets having equal masses are in circular orbit around a star. Planet A has a smaller orbital radius than planet B. Which statement is true?

Part A

Two planets having equal masses are in circular orbit around a star. Planet A has a smaller orbital radius than planet B. Which statement is true?

ANSWER:

- ◉ Planet A has more kinetic energy, less potential energy, and less mechanical energy (potential plus kinetic) than planet B.
- ○ Planet A and planet B have the same amount of mechanical energy (potential plus kinetic).
- ○ Planet A has more kinetic energy, less potential energy, and more mechanical energy (potential plus kinetic) than planet B.
- ○ Planet A has more kinetic energy, more potential energy, and more mechanical energy (potential plus kinetic) than planet B.

Problem 8.07

Description: (a) By how many newtons does the weight of a 100-kg person change when he goes from sea level to an altitude of 5.0 km if we neglect the earth's rotational effects? (The mean radius of the Earth is 6.38 × 106 m, G = 6.67 × 10-11 N · m2/kg.) 2...

Part A

By how many newtons does the weight of a 100-kg person change when he goes from sea level to an altitude of 5.0 km if we neglect the earth's rotational effects? (The mean radius of the Earth is 6.38×10^6 m, $G = 6.67 \times 10^{-11}$ N · m^2/kg^2.)

ANSWER:

- -5.2 N
- -3.6 N
- -1.5 N
- -2.6 N
- -0.60 N

Conceptual Question 9.11

Description: (a) A shell explodes into two fragments, one fragment 25 times heavier than the other. If any gas from the explosion has negligible mass, then...

Part A

A shell explodes into two fragments, one fragment 25 times heavier than the other. If any gas from the explosion has negligible mass, then

ANSWER:

- the momentum change of the heavier fragment is 25 times as great as the momentum change of the lighter fragment.
- the momentum change of the lighter fragment is exactly the same as the momentum change of the heavier fragment.
- the kinetic energy change of the heavier fragment is 25 times as great as the kinetic energy change of the lighter fragment.
- the kinetic energy change of the lighter fragment is 25 times as great as the kinetic energy change of the heavier fragment.
- the momentum change of the lighter fragment is 25 times as great as the momentum change of the heavier fragment.

Problem 9.08

Description: (a) A 2.3-kg object traveling at 6.1 m/s collides head-on with a 3.5-kg object traveling in the opposite direction at 4.8 m/s. If the collision is perfectly elastic, what is the final speed of the 2.3-kg object?

Part A

A 2.3-kg object traveling at 6.1 m/s collides head-on with a 3.5-kg object traveling in the opposite direction at 4.8 m/s. If the collision is perfectly elastic, what is the final speed of the 2.3-kg object?

ANSWER:

- 0.48 m/s
- 3.8 m/s
- 6.6 m/s
- 4.3 m/s
- 7.1 m/s

Conceptual Question 10.04

Description: (a) If two forces of equal magnitude act on an object that is hinged at a pivot, the force acting farther from the pivot must produce the greater torque about the pivot.

Part A

If two forces of equal magnitude act on an object that is hinged at a pivot, the force acting farther from the pivot must produce the greater torque about the pivot.

ANSWER:

- false
- true
- unable to decide without knowing the shape of the object

Problem 10.16

Description: (a) An extremely light rod 1.00 m long has a 2.00-kg mass attached to one end and a 3.00-kg mass attached to the other. The system rotates at a constant angular speed about a fixed axis perpendicular to the rod that passes through the rod 30.0 cm...

Part A

An extremely light rod 1.00 m long has a 2.00-kg mass attached to one end and a 3.00-kg mass attached to the other. The system rotates at a constant angular speed about a fixed axis perpendicular to the rod that passes through the rod 30.0 cm from the end with the 3.00-kg mass attached. The kinetic energy of the system is measured to be 100.0 J.
(a) What is the moment of inertia of this system about the fixed axis?

ANSWER:

1.25 $\mathrm{kg \cdot m^2}$

Part B

(b) What is the angular speed (in revolutions per second) of this system?

ANSWER:

2.01 rev/s

Conceptual Question 11.05

Description: (a) When you ride a bicycle, in what direction is the angular velocity of the wheels?

Part A

When you ride a bicycle, in what direction is the angular velocity of the wheels?

ANSWER:

- to your right
- to your left
- backwards
- up
- forwards

Problem 11.16

Description: (a) A record is dropped vertically onto a freely rotating (undriven) turntable. Frictional forces act to bring the record and turntable to a common angular speed. If the rotational inertia of the record is v1 times that of the turntable, what...

Part A

A record is dropped vertically onto a freely rotating (undriven) turntable. Frictional forces act to bring the record and turntable to a common angular speed. If the rotational inertia of the record is 0.87 times that of the turntable, what percentage of the initial kinetic energy is lost?

ANSWER:

- 61%
- 47%
- 24%
- 80%

Conceptual Question 12.01

Description: (a) If the torque on an object adds up to zero...

Part A

If the torque on an object adds up to zero

ANSWER:

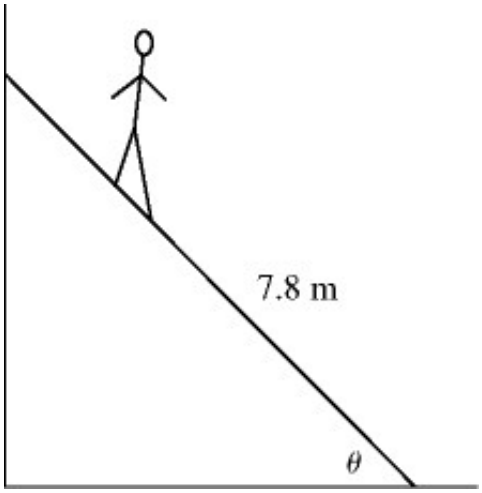
- the object is at rest.
- the object cannot be turning.
- the object could be both turning and accelerating linearly.
- the forces on it also add up to zero.
- the object could be accelerating linearly but it could not be turning.

Problem 12.22

Description: (a) In the figure, a uniform ladder 12 meters long rests against a vertical frictionless wall. The ladder weighs 400 N and makes an angle θ, of v1° with the floor. A man weighing v2 N climbs slowly up the ladder When he has climbed to a point that...

Part A

In the figure, a uniform ladder 12 meters long rests against a vertical frictionless wall. The ladder weighs 400 N and makes an angle θ, of 53° with the floor. A man weighing 861 N climbs slowly up the ladder When he has climbed to a point that is 7.8 m from the base of the ladder, the ladder starts to slip. What is the coefficient of static friction between the floor and the ladder?



Express your answer using two significant figures.

ANSWER:

μ_s = v11 = 0.45