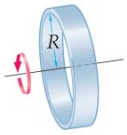
Physics 6A MWF Section
Winter 2012 Final

- Enter the answer to the multiple choice questions on the pink scantron sheet. Use a pencil, not a pen.
- There is no penalty for the wrong answer
- Write your name and perm number on the scantron sheet
- The scantron sheet has an entry box labeled "TEST FORM". There are 4 slightly different sets of multiple choice questions, different students get questions in different orders. Make sure to enter the appropriate "TEST FORM" (A, B, C, or D) on your scantron sheet.
- Take your test home with you. You may want to mark your answers so that you can check your score once the solutions are posted.

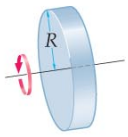
YOUR "TEST FORM" IS A

DO NOT TURN THIS SHEET OVER UNTIL YOU ARE INSTRUCTED TO DO SO

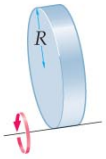
TABLE 10–1 Moments of Inertia for Uniform, Rigid Objects of Various Shapes and Total Mass M



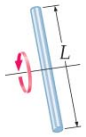
Hoop or cylindrical shell
$I = MR^2$



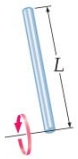
Disk or solid cylinder
$I = \frac{1}{2}MR^2$



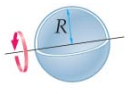
Disk or solid cylinder (axis at rim)
$I = \frac{3}{2}MR^2$



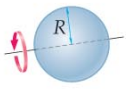
Long thin rod (axis through midpoint)
$I = \frac{1}{12}ML^2$



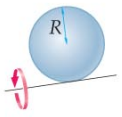
Long thin rod (axis at one end)
$I = \frac{1}{3}ML^2$



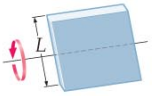
Hollow sphere
$I = \frac{2}{3}MR^2$



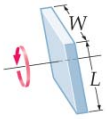
Solid sphere
$I = \frac{2}{5}MR^2$



Solid sphere (axis at rim)
$I = \frac{7}{5}MR^2$



Solid plate (axis through center, in plane of plate)
$I = \frac{1}{12}ML^2$



Solid plate (axis perpendicular to plane of plate)
$I = \frac{1}{12}M(L^2 + W^2)$

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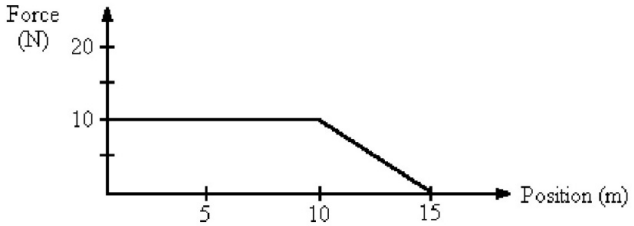
Question 1

A mass of 375 g hangs from a string that is wrapped around the circumference of a pulley with a moment of inertia of 0.0125 kg·m^2 and a radius of 26.0 cm. When the mass is released, the mass accelerates downward and the pulley rotates about its axis as the string unwinds. What is the tension in the string?

A) 1.21 N
B) 2.45 N
C) 3.68 N
D) 1.84 N
E) 0.605 N

Question 2



An object is under the influence of a force as represented by the force vs. position graph as shown in the Figure. What is the work done as it moves from 0 to 10 m?

A) 25 J
B) 50 J
C) 100 J
D) 80 J
E) 125 J

Question 3

A puck moves on a horizontal air table. It is attached to a string that passes through a hole in the center of the table. As the puck rotates about the hole, the string is pulled downward very slowly and shortens the radius of rotation, so the puck gradually spirals in towards the center. By what factor will the puck's angular speed have changed when the string's length has decreased by 1/2?

A) 2
B) 4
C) $\sqrt{2}$
D) 1
E) 1/2

Question 4

A ball is thrown horizontally with an initial velocity of 20.0 m/s from the edge of a building of a certain height. The ball lands at a horizontal distance of 82.0 m from the base of the building. What is the height of the building?

A) 40.5 m
B) 60.2 m
C) 87.9 m
D) 82.4 m
E) 50.4 m

Question 5
A locomotive is pulling a number of identical wagons along a level track and accelerating. Friction is negligible. Starting from the last wagon, the ratio of the forces between adjacent wagons is
A) 1:2:3:4 . . .
B) 1:2:4:8 . . .
C) 1:3:5:7 . . .
D) $1:\frac{1}{2}:\frac{1}{4}:\frac{1}{8}$ . . .
E) 1:1:1:1 . . .

Question 6
A car traveling with velocity *v* is decelerated by a constant acceleration of magnitude *a*. It travels a distance *d* before coming to rest. If its initial velocity were doubled, the distance required to stop would
A) double as well.
B) decrease by a factor of two.
C) stay the same.
D) quadruple.
E) decrease by a factor of four.

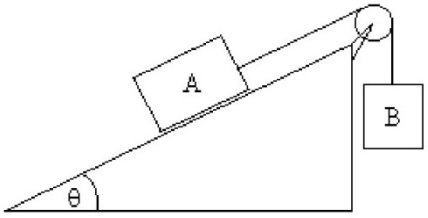
Question 7
A force of 4.0 N applied to a spring compresses it by 8.0 cm. What is the amount of work done to compress the spring by an additional amount of 5.0 cm?
A) 20 J
B) 0.26 J
C) 0.50 J
D) 2.0 J
E) 50 J

Question 8
A load is being lifted by means of two cables attached to it. The first cable exerts a force of 600 N at an angle of 35° to the left of the vertical. The second cable exerts a force of 1300 N. If the load is accelerating vertically, at what angle to the right of the vertical is the second cable pulling?
A) 15.4°
B) 16.2°
C) 30.8°
D) 67.8°
E) 75.8°

Question 9

Which of the following is a scalar quantity?
A) velocity
B) acceleration
C) displacement
D) mass
E) force

Question 10



Two masses are connected by a string which goes over an ideal pulley as shown in the Figure. Block A has a mass of 3.0 kg and can slide along a smooth plane inclined 30° to the horizontal. What is the mass of block B if the system is in equilibrium?
A) 1.5 kg
B) 3.0 kg
C) 2.6 kg
D) 3.5 kg
E) 6.0 kg

Question 11

Two children are riding on a merry-go-round. Child A is at a greater distance from the axis of rotation than child B. Which child has the larger angular speed?
A) Child A
B) Child B
C) They have the same zero angular speed.
D) They have the same non-zero angular speed.
E) There is not enough information given to answer the question.

Question 12

Vector $\vec{\mathbf{A}}$ is along the *x*-axis and vector $\vec{\mathbf{B}}$ is along the *y*-axis. Which one of the following statements is correct with respect to these vectors?
A) The *x*-component of vector $\vec{\mathbf{A}}$ is equal to the *x*-component of vector $\vec{\mathbf{B}}$.
B) The *y*-component of vector $\vec{\mathbf{A}}$ is equal to the *y*-component of vector $\vec{\mathbf{B}}$.
C) The *x*-component of vector $\vec{\mathbf{A}}$ is equal and opposite to the *x*-component of vector $\vec{\mathbf{B}}$.
D) The *y*-component of vector $\vec{\mathbf{B}}$ is equal and opposite to the *y*-component of vector $\vec{\mathbf{A}}$.
E) Vector $\vec{\mathbf{A}}$ does not have any component along the *y*-axis and vector $\vec{\mathbf{B}}$ does not have any component along the *x*-axis.

Question 13

A 2-kg ball is moving with a constant speed of 5 m/s in a horizontal circle whose radius is 50 cm. What is the acceleration of the ball?

A) 0 m/s^2

B) 10 m/s^2

C) 20 m/s^2

D) 50 m/s^2

E) 100 m/s^2

Question 14

A 5.00-kg box slides 4.00 m across the floor before coming to rest. What is the coefficient of kinetic friction between the floor and the box if the box had an initial speed of 3.00 m/s?

A) 1.13

B) 0.587

C) 0.115

D) 0.229

E) 0.267

Question 15

15) You need to load a crate of mass *m* onto the bed of a truck. One possibility is to lift the crate straight up over a height *h*, equal to height of the truck's bed. The work done in this case is W_1. The other possibility is to slide the crate up the frictionless ramp of length *L* as shown in the Figure**.** In this case you perform work W_2. What statement is true?

A) $W_1 < W_2$

B) $W_1 = W_2$

C) $W_1 > W_2$

D) No simple relationship exists between W_1 and W_2.

Question 16

A meter stick balances at the 50.0-cm mark. If a mass of 50.0 g is placed at the 90.0-cm mark, the stick balances at the 61.3-cm mark. What is the mass of the meter stick?

A) 127 g

B) 178 g

C) 89.7 g

D) 32.6 g

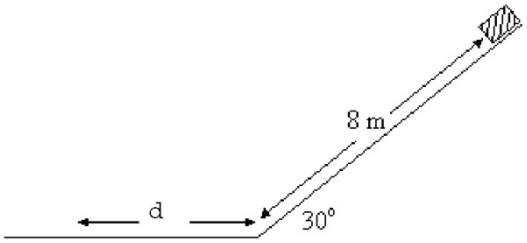
E) 73.4 g

Question 17

A 1200-kg car is pulling a 500-kg trailer along level ground. Friction is negligible. The car accelerates with an acceleration of 1.3 m/s^2. What is the force exerted by the car on the trailer?

A) 550 N
B) 600 N
C) 650 N
D) 700 N
E) 750 N

Question 18



An object with a mass of 10.0 kg is at rest at the top of a frictionless inclined plane of length 8.00 m and an angle of inclination 30.0° with the horizontal. The object is released from this position and it stops at a distance *d* from the bottom of the inclined plane along a horizontal surface, as shown in the Figure. The coefficient of kinetic friction for the horizontal surface is 0.400 and g = 10.0 m/s^2. At what horizontal distance from the bottom of the inclined plane will this object stop?

A) 5.00 m
B) 10.0 m
C) 15.0 m
D) 20.0 m
E) 25.0 m

Question 19

In a collision between two unequal masses, how does the impulse imparted to the smaller mass by the larger mass compare with the impulse imparted to the larger mass by the smaller one?

A) It is larger.
B) It is smaller.
C) They are equal.
D) The answer depends on the ratio of the masses.
E) The answer depends on how fast they are moving

Question 20

A rope is lying on a table. You pick up one end and start raising it with a constant velocity. The force you have to exert on the rope is

A) equal to the weight of the portion of the rope that is not on the table.
B) greater than the weight of the portion of the rope that is not on the table.
C) less than the weight of the portion of the rope that is not on the table but not zero N.
D) zero N.
E) Cannot be determined without additional information.

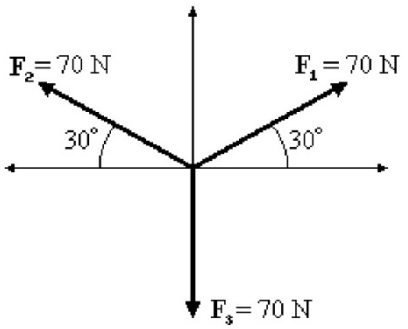
Question 21
Two air track carts move along an air track towards each other. Cart A has a mass of 450 g and moves toward the right with a speed of 0.850 m/s and air track cart B has a mass of 300 g and moves toward the left with a speed of 1.12 m/s. What is the total momentum of the system?
A) 0.047 kg·m/s toward the right
B) 0.719 kg·m/s toward the right
C) 0.719 kg·m/s toward the left
D) 0.750 kg·m/s toward the right
E) 0.750 kg·m/s toward the left

Question 22
A person is lowering a bucket into a well with a constant speed. The force exerted by the rope on the bucket is
A) equal to the bucket's weight.
B) greater than the bucket's weight.
C) less than the bucket's weight, but not zero N.
D) zero N.
E) Cannot be determined without additional information.

Question 23
A uniform piece of wire, 20 cm long, is bent in a right angle in the center to give it an L-shape. How far from the bend is the center of mass of the bent wire?
A) 2.5 cm
B) 3.5 cm
C) 4.5 cm
D) 5.0 cm
E) 7.1 cm

Question 24
A 40.0-kg suitcase is being pulled along the ground by means of a strap which exerts a force of 10.0 N at an angle of 43.0° above the horizontal. What is the normal force exerted by the ground?
A) 17.1 N
B) 15.7 N
C) 385 N
D) 272 N
E) 398 N

Question 25
A wheel rotates through an angle of 320° as it slows down from 78.0 rpm to 22.8 rpm. What is the magnitude of the average angular acceleration of the wheel?
A) 2.34 rad/s^2
B) 5.48 rad/s^2
C) 6.50 rad/s^2
D) 8.35 rad/s^2
E) 10.9 rad/s^2



Question 26

Refer to the Figure above Three forces $\vec{F}_1 = \vec{F}_2 = \vec{F}_3 = 70$ N are acting on an object O as shown in the figure. Which one of the following statements is true regarding the resultant force acting over the object O?

A) The resultant force is 35 N.
B) The resultant force is 70 N.
C) The resultant force is 140 N.
D) The resultant force is 210 N.
E) The resultant force is zero.

Question 27

Consider a hoop of radius *R* and mass *M* rolling without slipping. Which form of kinetic energy is larger, translational or rotational?

A) Translational kinetic energy is larger.
B) Rotational kinetic energy is larger.
C) Both are equal.
D) You need to know the speed of the hoop to tell.
E) You need to know the acceleration of the hoop to tell.

Question 28

An object is moving in a circular path with an angular speed of 1.52 rad/s. How long does it take the object to complete one revolution?

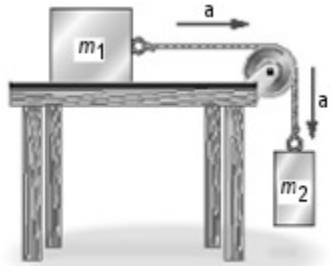
A) 4.13 s
B) 2.07 s
C) 118 s
D) 4.77 s
E) 8.26 s

Question 29

Earth's radius is 6.38×10^6 m, and it completes one revolution every day. What is the magnitude of the centripetal acceleration of a person standing on the equator?

A) 0.00844 m/s^2
B) 0.00343 m/s^2
C) 0.0337 m/s^2
D) 0.343 m/s^2
E) 0.000854 m/s^2

Question 30



Two masses, m_1 and m_2, are connected to each other as shown in the Figure above. Mass m_1 slides without friction on the table surface. The moment of inertia of the pulley can be neglected. Both masses have acceleration of magnitude *a* as shown. How does the tension in the string compare to the weight, $m_2 g$, of mass m_2?

A) The tension is equal to $m_2 g$.

B) The tension is larger than $m_2 g$.

C) The tension is smaller than $m_2 g$.

D) It depends on m_1 being smaller than m_2.

E) It depends on m_1 being larger than m_2.

Question 31

Neglecting air resistance, when you toss a stone straight up in the air from Earth's surface, which of the following statements is true for the upward motion of the stone.

A) The stone's total energy increases.

B) The stone's kinetic and gravitational potential energies increase simultaneously.

C) The stone's kinetic and gravitational potential energies decrease simultaneously.

D) The stone's kinetic energy decreases while its gravitational potential energy increases.

E) The stone's kinetic energy increases while its gravitational potential energy decreases.

Question 32

The rotating systems shown in the Figure differ only in that the two identical movable masses are positioned a distance *r* from the axis of rotation (left), or a distance *r*/2 from the axis of rotation (right). If you release the hanging blocks simultaneously from rest,

A) the block at left lands first.

B) the block at right lands first.

C) both blocks land at the same time.

D) it is impossible to tell which block reaches the bottom first.

Question 33

A merry-go-round spins freely when Janice moves quickly to the center along a radius of the merry-go-round. It is true to say that

A) the moment of inertia of the system decreases and the angular speed increases.
B) the moment of inertia of the system decreases and the angular speed decreases.
C) the moment of inertia of the system decreases and the angular speed remains the same.
D) the moment of inertia of the system increases and the angular speed increases.
E) the moment of inertia of the system increases and the angular speed decreases.

Question 34

A catcher stops a ball traveling at 40 m/s in a distance of 20 cm and feels a force of 600 N against his glove. What is the mass of the ball?

A) 0.10 kg
B) 0.15 kg
C) 0.20 kg
D) 0.25 kg
E) 0.30 kg