PHYS 101 second major Exam – Term 102 (Zero Version)

Q1.
A 15.0-kg block is pulled over a rough, horizontal surface by a constant force of 70.0 N acting at an angle of 20.0° above the horizontal. The block is displaced 5.00 m, and the coefficient of kinetic friction between the block and the horizontal surface $\mu_k = 0.200$. Find the work done by the force of friction.

   A) − 123 J
   B) + 123 J
   C) − 147 J
   D) + 147 J
   E) − 329 J

Q2.
An elevator is designed to carry a load of 20.0×10^3 N from the ground to a height of 87.5 m in a time of 18.0 seconds. What is the average power that must be supplied by the motor of the elevator to lift this load?

   A) 97.2×10^3 W
   B) 78.4×10^3 W
   C) 65.6×10^3 W
   D) 89.2×10^4 W
   E) 45.7×10^4 W

Q3.
A certain force $\vec{F}$ is acting on a body of mass m = 3.0 kg and changes its velocity from an initial value $\vec{v}_o = \left(6.0\hat{i} - 2.0\,\hat{j}\right)$ m/s to a final value $\vec{v} = \left(8.0\hat{i} + 4.0\,\hat{j}\right)$ m/s . Find the work done by $\vec{F}$.

   A) 60 J
   B) 55 J
   C) 50 J
   D) 80 J
   E) 90 J

Q4.
A man pulls a box up a rough inclined plane at constant speed. Which one of the following statements is **FALSE**?

   A) The work done on the box by the gravitational force is zero.
   B) The gravitational potential energy of the box increases.
   C) The net work done by all the forces acting on the box is zero.
   D) The work done on the box by the normal force of the plane is zero.
   E) The man does positive work in pulling the box up the incline.

Q5.
A small mass suspended from a string of length 0.20 m is pulled sideways until the string makes an angle $\phi = 60°$ with the vertical. It is then released from rest. Find the speed of the mass when it passes through the lowest point of its path during its motion.

A) 1.4 m/s
B) 1.9 m/s
C) 2.4 m/s
D) 2.9 m/s
E) 3.4 m/s

Q6.
As shown in **Figure 1**, a 250 g mass is fired vertically upward using a spring. The spring must be compressed d =10.0 cm from its relaxed position if the mass is to just reach a maximum height H = 51.0 cm above the mass's initial position on the compressed spring. Find the spring constant of the spring.
Fig#

m = 250 g
d = 10.0 cm
H = 51.0 cm

H

d

m

compressed   relaxed
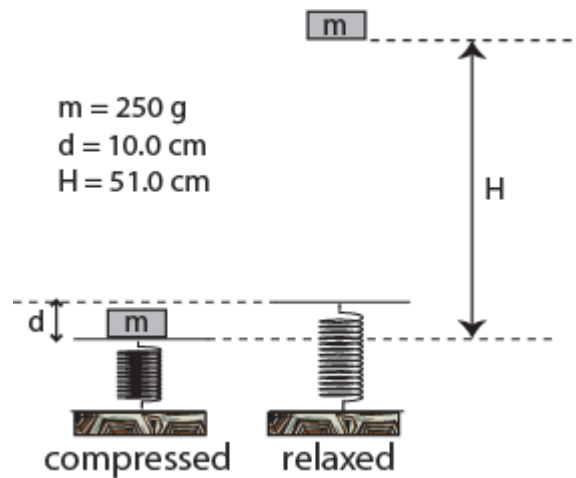
A) 250 N/m
B) 300 N/m
C) 150 N/m
D) 173 N/m
E) 223 N/m

Q7.
As shown in **Figure 2**, a block of mass m = 1.35 kg is held against a compressed spring of spring constant k = 560 N/m. The spring is compressed by x = 0.110 m. The block is released and slides a distance d = 0.650 m to point A. Find the speed of the block at point A if the coefficient of kinetic friction between the block and the surface is μ_k = 0.200.
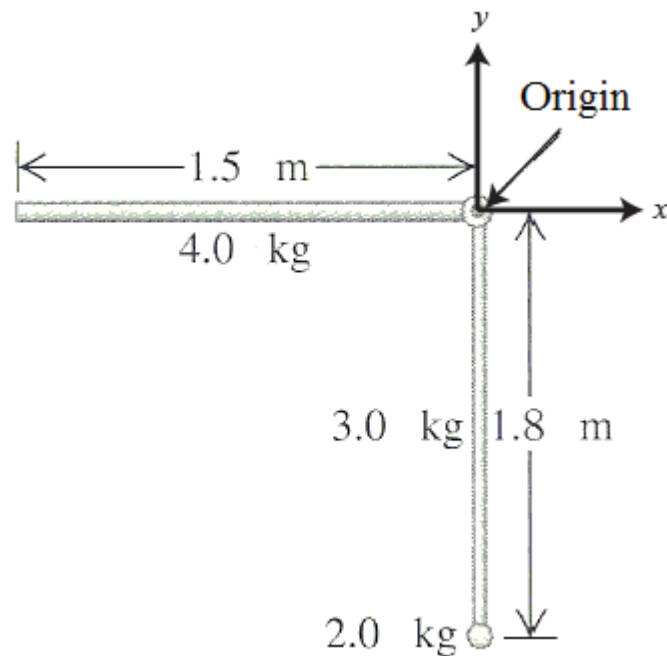Fig#

m = 1.35 kg
d = 0.650 m
x = 0.110 m
μ_k = 0.200
k = 560 N/m
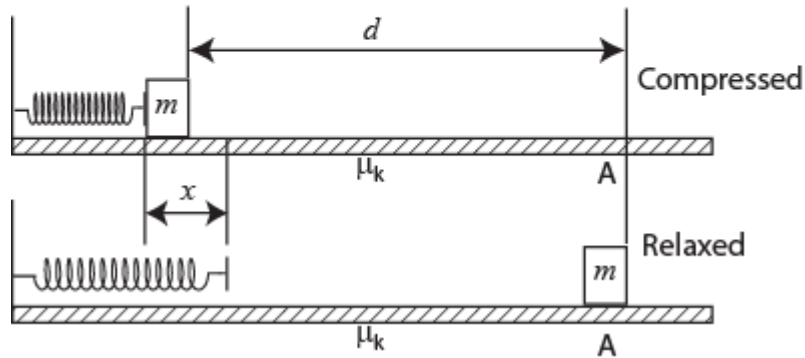
A) 1.57 m/s
B) 3.45 m/s
C) 7.54 m/s
D) 10.3 m/s
E) 4.21 m/s

Q8.
An object consists of a uniform 4.0-kg rod of length 1.5 m which is hinged perpendicular to another uniform rod of length 1.8 m and mass 3.0 kg (see **Figure 3**). The longer rod has a 2.0-kg ball at one end. What are the coordinates of the center of mass of the system? Treat the ball as a point particle.
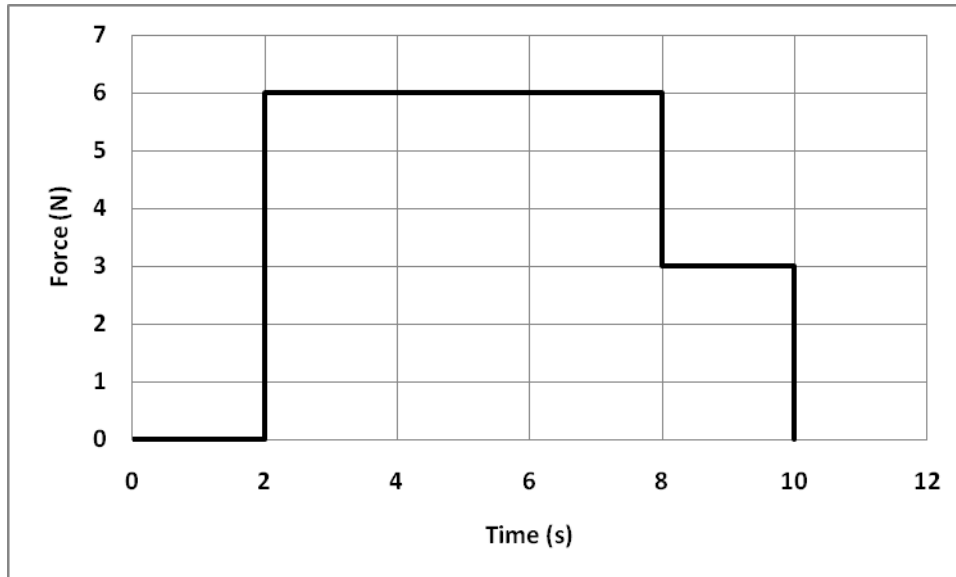Fig#

A) (− 0.33, − 0.70) m
B) (− 0.33, + 0.70) m
C) (+ 0.33, − 0.70) m

D) (+ 0.33, + 0.70) m
E) (− 0.70, + 0.33) m

Q9.
At time t = 0, a 3.0-kg block slides along a frictionless surface with a constant speed of 5.0 m/s in the positive x-direction. A horizontal, time dependent force is applied along the positive x-direction to the block as shown in **Figure 4**. What is the speed of the block at $t = 10$ seconds?
Fig#

Time (s)

A) 19 m/s
B) 5.0 m/s
C) 25 m/s
D) 75 m/s
E) 16 m/s

Q10.
An object is at rest at the origin. It explodes into three equal pieces. One piece moves to the west. What are the possible directions of motion of the other two pieces?

A) north, south-east
B) north, north-east
C) south, south-east
D) south, south-west
E) east, north

Q11.
Two objects with the same mass move along the same line in opposite directions. The first object is moving with speed v to the right. The two objects collide in a perfectly inelastic collision and move with speed 0.40 v to the right, just after the collision. What was the speed of the second object before the collision?

A) 0.20 v
B) 0.60 v

C) 1.8 *v*
D) 2.0 *v*
E) 0.50 *v*

Q12.
A uniform disk is rotating about an axis perpendicular to its plane and passing through a point on its edge. Find the ratio of its moment of inertia about this axis of rotation to its moment of inertia about a parallel axis passing through its center of mass.

A) 3
B) 9
C) $\sqrt{3}$
D) 3/4
E) 1/3

Q13.
Two objects of masses m_1 = 1.00 kg and m_2 = 2.00 kg hang at the ends of a massless string that passes over a pulley of radius R = 10.0 cm and moment of inertia I = 0.010 kg.m², as shown in **Figure 5**. What is the linear acceleration of the masses?
Fig#

R = 10.0 cm
I = 0.010 kg·m²
m_1 = 1.00 kg
m_2 = 2.00 kg
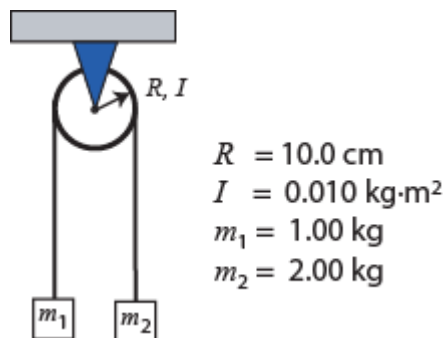
A) 2.45 m/s²
B) 9.80 m/s²
C) 4.50 m/s²
D) 2.00 m/s²
E) 3.34 m/s²

Q14.
A constant torque of 10.0 N·m accelerates an object from rest to an angular speed of 10.0 rad/s after a rotation of $\pi/2$ radians. What is the moment of inertia of the object about the rotational axis?

A) 0.314 kg.m²
B) 2.14 kg.m²
C) 41.3 kg.m²
D) 14.3 kg.m²
E) 0.123 kg. m²

Q15.
The angular position of a rotating disk is given by $\theta(t) = t^2 - 10t + 2$, where θ is in radians and t is in seconds. Find the time at which the disk reverses its rotational direction.

A) 5 s
B) 2 s
C) 10 s
D) The rotational direction of the disk never changes
E) 0.20 s

Q16.
A small disk, tied to one end of a light string, moves with speed *v* in a circular path of radius *r*, on a horizontal, frictionless table. The string passes through a hole in the center of the table as shown in **Figure 6**. If the string is slowly pulled down, thereby reducing the radius of the path of the disk to half its initial value, the new speed of the disk is:
Fig#
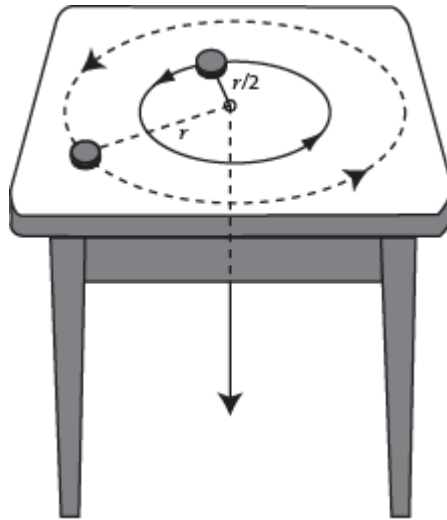


A) 2*v*
B) *v*/2
C) *v*/4
D) 4*v*
E) *v*

Q17.
A wheel of 0.25-m radius is rolling without sliding at a constant angular speed of 10 rad/s. What is the linear speed of a point at the top of the wheel?

A) 5.0 m/s
B) 10 m/s
C) 0.25 m/s
D) 2.5 m/s
E) 25 m/s

Q18.
Figure 7 shows a graph of a torque applied to a rotating body as a function of time. What is the angular momentum of the rotating body at t = 4.0 s, assuming it was initially at rest?
Fig#
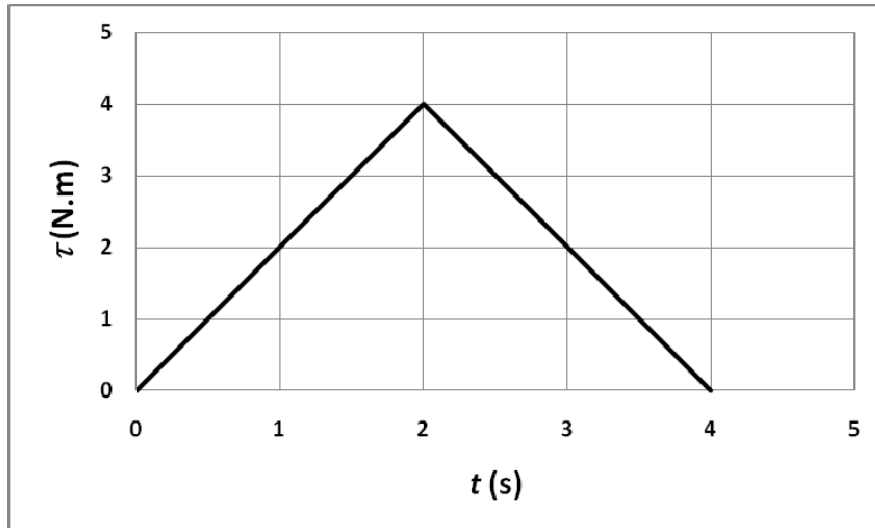
A) 8.0 kg·m²/s
B) 4.0 kg·m²/s
C) 16 kg·m²/s
D) 0
E) 2.0 kg·m²/s

Q19.
A 1.00 kg ball falls to the ground from a height of 10.0 m and bounces back to a height of 8.00 m. What is the total work done by the gravitational force on the ball?

A) +19.6 J
B) −19.6 J
C) −176 J
D) +176 J
E) Zero

Q20.
A rigid body is initially at rest. At time $t = 0$, it is given a constant angular acceleration of 0.060 rad/s². Find the magnitude of the centripetal acceleration of a point that is a distance of 2.5 m from the axis of rotation at $t = 8.0$ s.

A) 0.58 m/s²
B) 0.15 m/s²
C) 0.68 m/s²
D) 0.48 m/s²
E) 0.38 m/s²