PHYSICS 101 – TERM 112 – ZERO VERSION

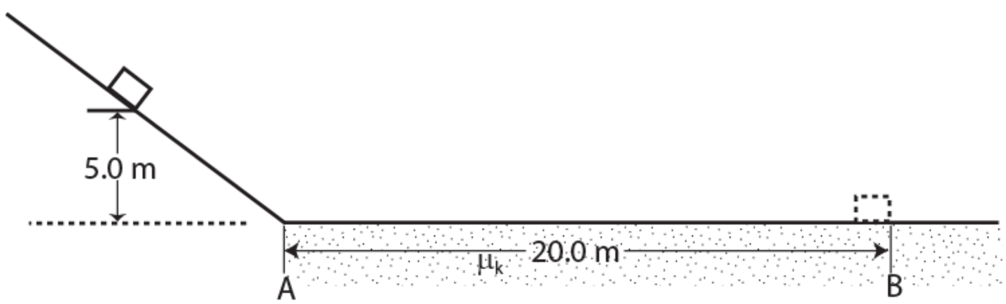
Q1.

A force $\vec{F} = \left(12\,\hat{i} + B\,\hat{j}\right)$ N , where B is a constant, acts on an object and does 46 joules work as the object moves from the origin to the point $\vec{r} = \left(13\,\hat{i} + 11\,\hat{j}\right)$ m . The value of B is:

A) −10 N
B) +10 N
C) −12 N
D) +15 N
E) +14 N

Q2.

A 9.00-kg box slides from rest down a frictionless incline from a height of 5.00 m as shown in **Figure 1**. A constant frictional force, introduced at point **A**, brings the block to rest at point **B**, 20.0 m to the right of point **A**. What is the coefficient of kinetic friction, μ_k , between the box and surface AB?



A) 0.25
B) 0.11
C) 0.33
D) 0.47
E) 0.52

Q3.
In **Figure 2**, a 5.0-kg block is moving at 5.0 m/s along a horizontal frictionless surface toward an ideal spring that is attached to a wall. After the block collides with the spring, the spring is compressed a maximum distance of x_m. What is the speed of the block when the spring is compressed to only $x_m/2$?
Fig#

A) 4.3 m/s
B) 3.4 m/s
C) 7.1 m/s
D) 5.2 m/s
E) 6.3 m/s

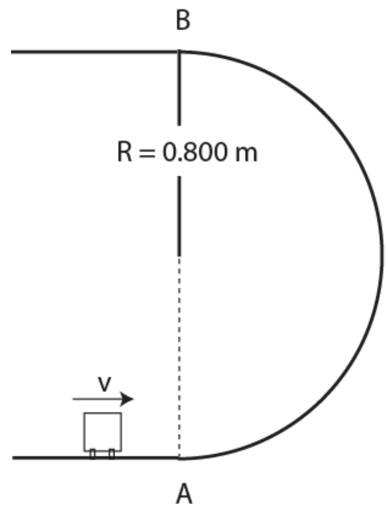
Q4.
A net force of $\left(50\,\hat{i}\right)$N is acting on a 2.0-kg box that was initially at rest at the origin. At the ***instant*** the object has the position vector $\left(2.0\,\hat{i}\right)$m, the rate at which the force is doing work on the box is:

A) 500 W
B) 250 W
C) 75 W
D) 100 W
E) 300 W

Q5.
The only force acting on a particle is a conservative force **F**. If the particle is at a point A, the potential energy of the system is 80 J. If the particle moves from point A to point B, the work done on the particle by **F** is +20 J. As the particle reaches point B, the potential energy of the system is:

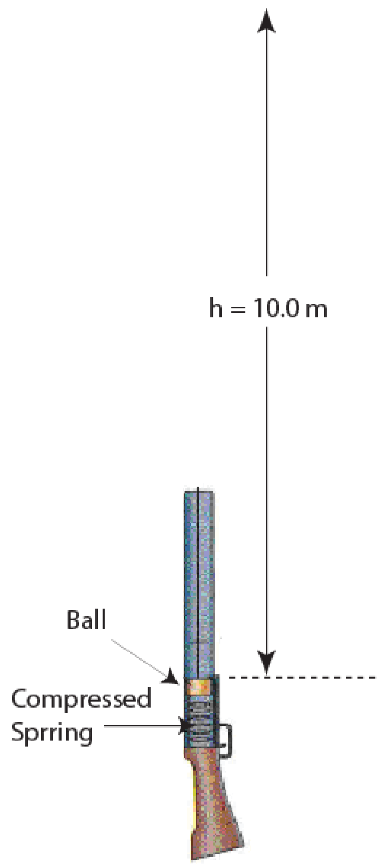
A) 60 J
B) 100 J
C) 20 J
D) −100 J
E) − 60 J

Q6.
A 2.00-kg mass is moved along a rough vertical circular track (radius R = 0.800 m) as shown in **Figure 3**. The speed of the mass at point A is $v_A = 8.00$ m/s, and at point B is $v_B = 5.00$ m/s. How much work is done on the mass between A and B by the force of friction?
Fig#



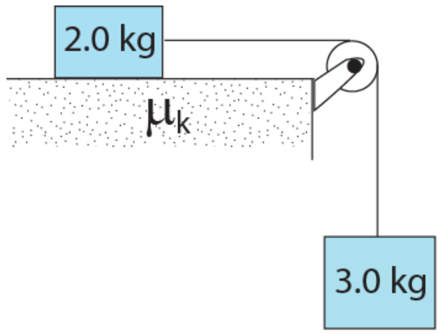
A) – 7.64 J
B) – 8.23 J
C) – 2.91 J
D) – 3.36 J
E) 0 J

Q7.
A compressed-spring-gun, with k = 300 N/m, is used to shoot a ball, of mass m = 10 g, straight up into the air, see **Figure 4**. If the ball reaches a maximum height h = 10.0 m, the compressed distance of the spring is: (neglect any friction and assume the spring obeys Hooke's law)?
Fig#



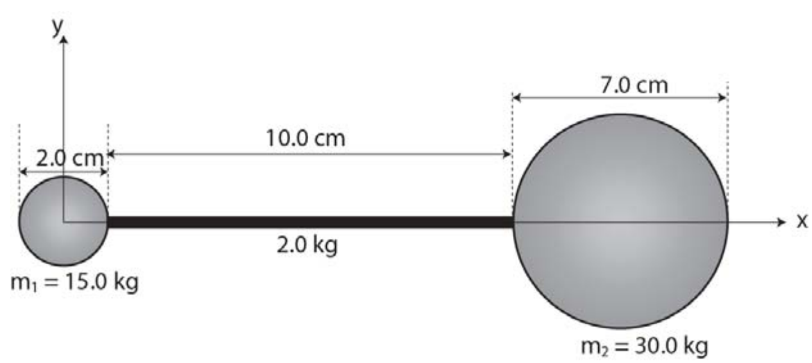
A) 8.1 cm
B) 5.5 cm
C) 12 cm
D) 3.0 cm
E) 1.3 cm

Q8.
The two masses in the **Figure 5** are released from rest. After the 3.0-kg mass had fallen 1.5 m, it reaches a speed of 3.76 m/s. How much work is done during this time interval by the frictional force on the 2.0 kg mass? (Assume that the pulley is frictionless and massless)



A) – 8.8 J
B) – 6.7 J
C) 20 J
D) – 12 J
E) 28 J

Q9.
Figure 6 shows a 10.0 cm long uniform rod with mass 2.0 kg, attached to two uniform spheres of masses m_1 = 15.0 kg and m_2 = 30.0 kg and diameters 2.0 cm and 7.0 cm, respectively. Find the x-coordinate of the COM of the system. Center of the small sphere (m_1) is at the origin of the coordinate system.



A) 9.51 cm
B) – 1.7 cm
C) 20 cm
D) – 12 cm
E) 2.8 cm

Q10.

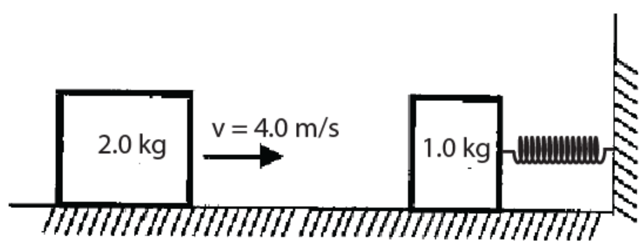
A 10.0 g object with initial velocity $\vec{v}_i = (24.0\,\hat{i})$ m/s has a collision with a wall. After collision, the final velocity of the object is $\vec{v}_f = -(12.0\,\hat{i})$ m/s. If the collision lasted 0.01 s, what is the average force acted on the object during the collision?

A) $(-36\,\hat{i})$ N
B) $(-12\,\hat{i})$ N
C) $(24\,\hat{i})$ N
D) $(-16\,\hat{i})$ N
E) $(-48\,\hat{j})$ N

Q11.

A 1.0-kg block (at rest on a horizontal frictionless surface) is connected to a spring (k = 200 N/m) whose other end is fixed to a wall (see **Figure 7**). A 2.00-kg block, moving at 4.00 m/s, collides with the 1.00-kg block. If the two blocks stick together after the collision, what will be the maximum compression of the spring when the two blocks momentarily stop?

Fig#

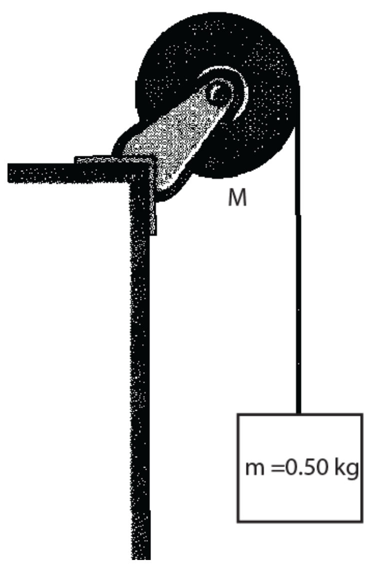


A) 0.33 m
B) 0.22 m
C) 1.12 m
D) 0.13 m
E) 0.08 m

Q12.
Block A with mass 2.0 kg and block B with mass 3.0 kg are moving towards each other along the x-axis. The velocity of block A is 50 m/s while block B velocity is −20 m/s. Both the blocks undergo inelastic collision. The velocity of the center of mass of the two blocks system after the collision is:

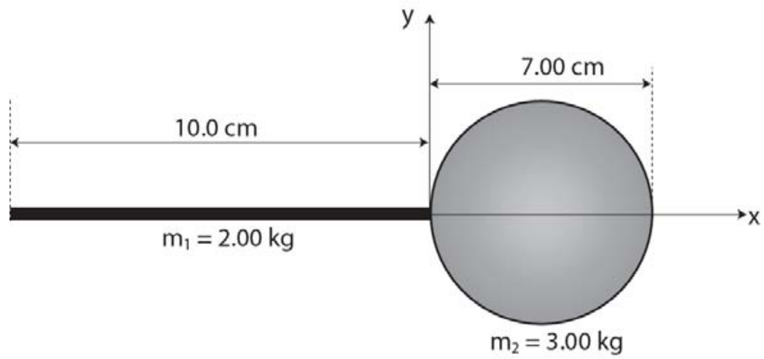
A) 8.0 m/s
B) 0
C) 5.0 m/s
D) 30 m/s
E) 70 m/s

Q13.
A wheel (of mass M and radius = 0.20 m) is mounted on a frictionless, horizontal axle. A light cord wrapped around the wheel supports a mass m = 0.50 kg, as shown in the **Figure 8**. When released from rest the mass m falls with a downward acceleration of 5.0 m/s^2. What is the moment of inertia of the wheel about its axle? [Consider the cord does not slip]
Fig#



A) 0.019 $kg{\cdot}m^2$
B) 0.027 $kg{\cdot}m^2$
C) 0.016 $kg{\cdot}m^2$
D) 0.023 $kg{\cdot}m^2$
E) 0.032 $kg{\cdot}m^2$

Q14.
Figure 9 shows a uniform thin rod, with mass $m_1 = 2.00$ kg and length L = 10.0 cm, attached to a uniform solid sphere, of mass $m_2 = 3.00$ kg and diameter 7.00 cm. Find the rotational inertia of the system about the y-axis.
Fig#



A) 0.0118 $kg.m^2$
B) 0.0103 $kg.m^2$
C) 0.00814 $kg.m^2$
D) 0.00980 $kg.m^2$
E) 0.00667 $kg.m^2$

Q15.
A wheel with a 0.10-m radius is rotating at an angular velocity of 36 rev/s. It then slows down uniformly to 15 rev/s over a 3.0-s interval. What is the magnitude of the tangential acceleration of a point on the edge of the wheel?

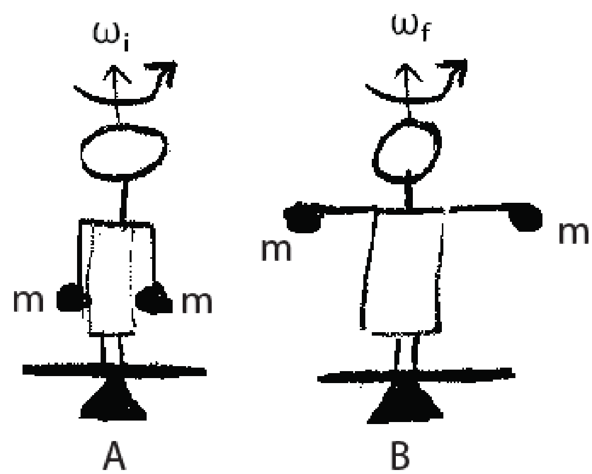
A) 4.4 m/s^2
B) 1.5 m/s^2
C) 41 m/s^2
D) 0.70 m/s^2
E) 7.0 m/s^2

Q16.
A fan, initially at rest, is accelerated to angular velocity $\omega = 2400$ rev/min in 40 s by an electric motor. The average power of the motor during this time is 1.2×10^5 W. What is the torque on the fan about the axis of rotation?

A) 955 N.m
B) 100 N.m
C) 723 N.m
D) 432 N.m
E) 600 N.m

Q17.

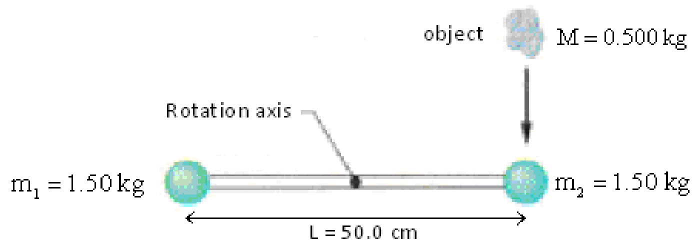
A man, holding equal mass m in each hand, is standing on a frictionless disk, rotating about an axis passing through its center. Initially, the man has both hands down, as shown in **Figure 10A**, and the system (man + disk) rotates with an angular velocity ω_i. Finally the man stretches his arms horizontally, as shown in **Figure 10B**, and the new angular velocity of the system is ω_f. The man's final rotational kinetic energy K_f with respect to his initial rotational kinetic energy K_i:



A) must decrease.
B) must increase.
C) must remain the same.
D) may increase or decrease depending on his initial angular velocity ω_i .
E) may increase or decrease depending on his final angular velocity ω_f .

Q18.

Two equal masses m_1= m_2 = 1.50 kg are joined with a massless rod with length L= 50.0 cm. The rod is free to rotate in a horizontal plane without friction about a vertical axis through its center. With the rod initially at rest, an object with mass M = 0.500 kg is moving horizontally towards m_2 with a velocity 4.50 m/s , as shown in **Figure 11** (top view). Finally the object collides with m_2 and sticks to it and the rod rotates. The angular speed of the rod-masses system after the collision is:

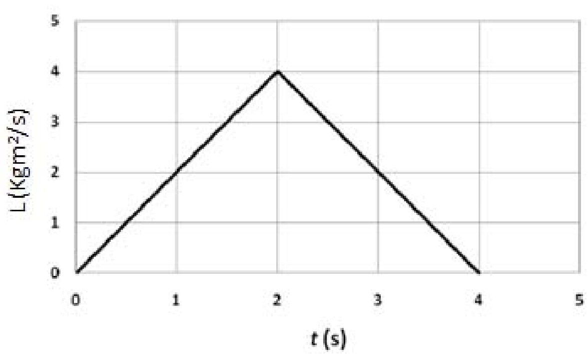


A) 2.57 rad/s
B) 1.24 rad/s
C) 0.541 rad/s
D) 5.14 rad/s
E) 1.41 rad/s

Q19.

A circular disc of mass 4.0 kg and radius 10 cm rotates about a vertical axis passing through its center. The variation of its angular momentum (L) with time (t) is given in the **Figure 12**. Find the angular acceleration of the disc at t = 3.0 s?

Fig#



A) − 100 rad/s^2
B) + 15 rad/s^2
C) + 50 rad/s^2
D) +100 rad/s^2
E) − 5.6 rad/s^2

Q20.

A hoop rolls smoothly, along a horizontal surface, with constant center of mass speed v_{com}. Its rotational kinetic energy is:

A) the same as its translational kinetic energy
B) half its translational kinetic energy
C) twice its translational kinetic energy
D) four times its translational kinetic energy
E) one-third its translational kinetic energy