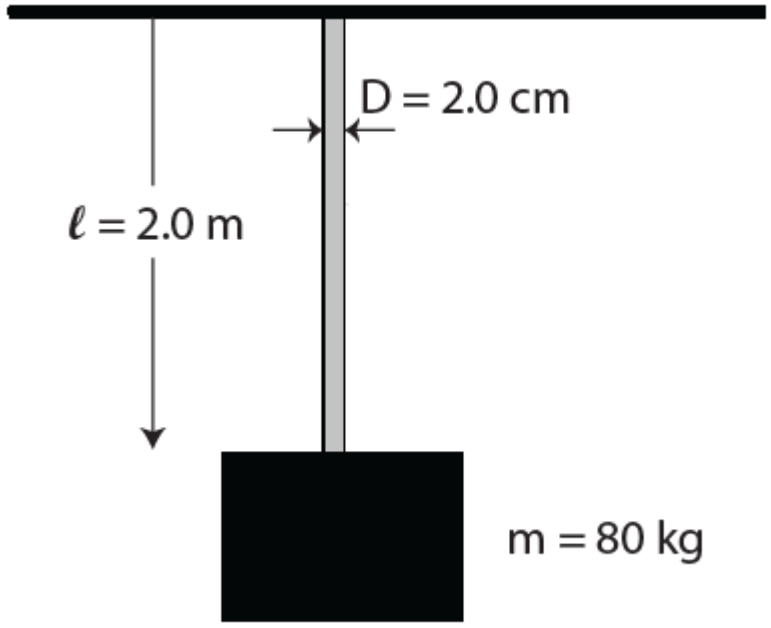
Q1.

Figure 1 shows a solid cylindrical steel rod of length $\ell = 2.0$ m and diameter D = 2.0 cm. What will be increase in its length when m = 80 kg block is attached to its bottom end? (Young's modulus of steel = 1.9×10^{11} Pa)

Fig#



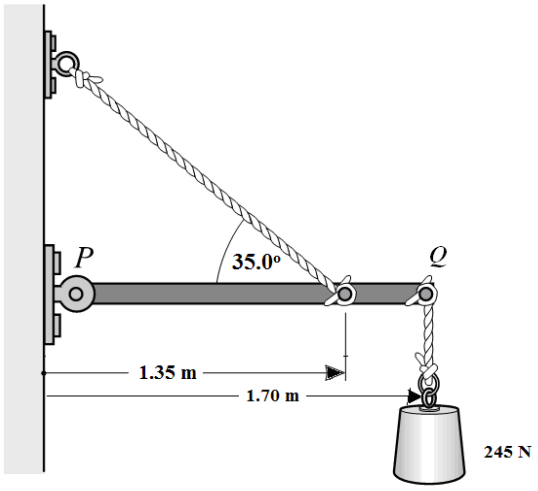
A) 2.6×10^{-5} m
B) 1.3×10^{-5} m
C) 4.8×10^{-5} m
D) 7.2×10^{-5} m
E) 3.5×10^{-5} m

Stat# A_64_DIS_0.61_PBS_0.48_B_15_C_7_D_5_E_8_EXP_55_NUM_880

Q2.

In F**ig. 2,** *PQ* is a horizontal uniform beam weighing 155 N. It is supported by a string and a hinge at point *P*. A 245 N block is hanging from point *Q* at the end of the beam. Find the horizontal component of net force on the beam from the hinge.

Fig#

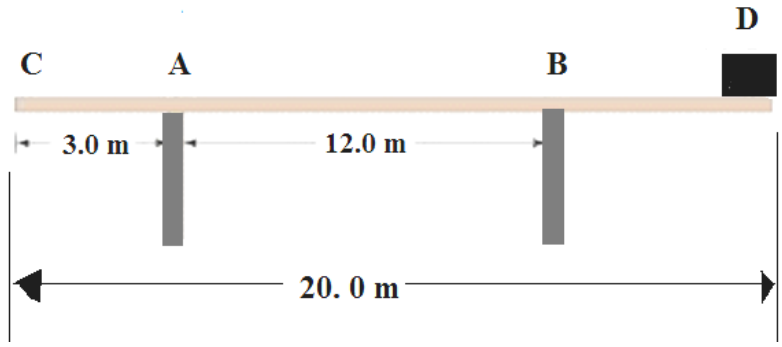


A) 580 N
B) 310 N
C) 491 N
D) 164 N
E) 200 N

Stat# A_35_DIS_0.68_PBS_0.55_B_18_C_19_D_16_E_12_EXP_50_NUM_880

Q3.
A 20.0 m long uniform beam weighing 550 N rests on supports “A” and “B”, as shown in **Figure 3**. Find the magnitude of the force that the support “A” exerts on the beam when the block of weight 200 N is placed at **D**.

Fig#



A) 146 N
B) 241 N
C) 501 N
D) 315 N
E) 185 N

Stat# A_45_DIS_0.67_PBS_0.52_B_14_C_6_D_19_E_15_EXP_50_NUM_880

Q4.

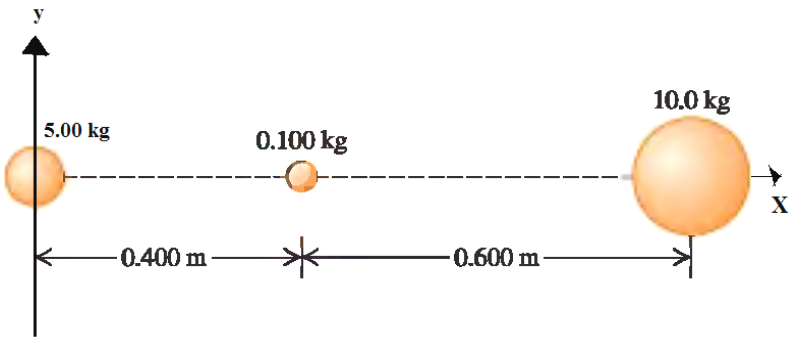
At what height above earth's surface would the gravitational acceleration be 0.980 m/s^2?

A) 1.38×10^7 m
B) 1.12×10^7 m
C) 7.12×10^7 m
D) 5.82×10^8 m
E) 4.05×10^8 m

Stat# A_73_DIS_0.56_PBS_0.50_B_6_C_6_D_5_E_9_EXP_50_NUM_880

Q5.
In **Figure 4**, what is the net gravitational force exerted on the 5.00 kg uniform sphere by the other two uniform spheres?

Fig#



A) $+3.54\times10^{-9}\ \hat{i}$ N
B) $+2.32\times10^{-11}\ \hat{i}$ N
C) $-2.32\times10^{-11}\ \hat{i}$ N
D) $-1.45\times10^{-13}\ \hat{i}$ N
E) $+1.45\times10^{-13}\ \hat{i}$ N

Stat# A_74_DIS_0.42_PBS_0.36_B_10_C_9_D_3_E_4_EXP_50_NUM_880

Q6.
A rocket is launched from the surface of a planet of mass M = 2.20×10^{28} kg and radius R = 5.35×10^6 m. What minimum initial speed is required if the rocket is to rise to a height of 6R above the surface of the planet? (Neglect the effects of the atmosphere).

A) 6.86×10^5 m/s
B) 3.44×10^5 m/s
C) 2.18×10^6 m/s
D) 8.20×10^6 m/s
E) 9.45×10^5 m/s

Stat# A_43_DIS_0.58_PBS_0.47_B_29_C_13_D_7_E_8_EXP_50_NUM_880

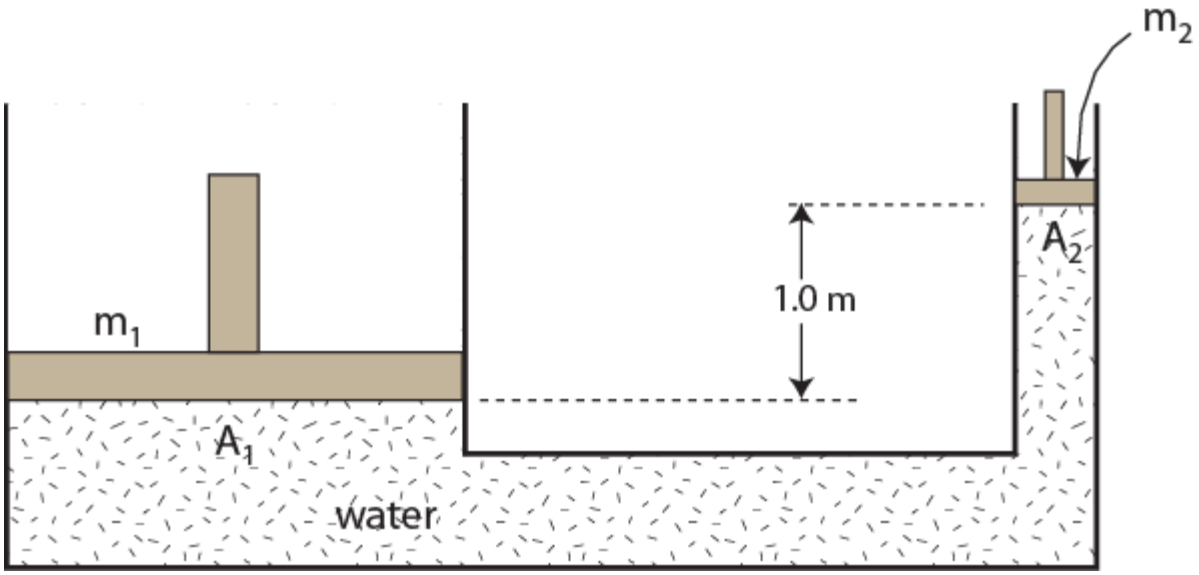
Q7.
A satellite of mass 200 kg is placed in Earth orbit at height of 200 km above the earth surface. How long does the satellite take to complete one circular orbit?

A) 1.47 hours
B) 2.77 hours
C) 8.14 hours
D) 9.56 hours
E) 7.38 hours

Stat# A_45_DIS_0.75_PBS_0.59_B_16_C_16_D_10_E_13_EXP_50_NUM_880

Q8.
In a hydraulic press, shown in **Figure 5**, the large piston has a cross sectional area of A_1 = 150 cm^2 and mass m_1 = 450 kg. The small piston has a cross sectional area of A_2 = 10 cm^2 and mass m_2. If the height difference between the two pistons is 1.0 m, what is the mass m_2? [Note: The fluid in the hydraulic press is water]

Fig#



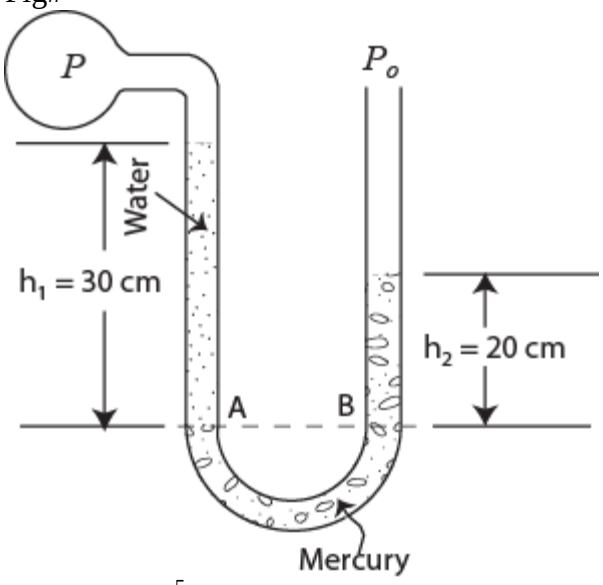
A) 29 kg
B) 33 kg
C) 15 kg
D) 40 kg
E) 11 kg

Stat# A_51_DIS_0.44_PBS_0.34_B_25_C_10_D_9_E_5_EXP_50_NUM_880

Q9.

Figure 6 shows an open-tube manometer containing water and mercury. The height of water in the left column above the interface A is 30 cm while the height of mercury in the right column above B is 20 cm. The right column is open to the atmosphere P_o. Find the pressure P in the bulb. (Take $P_o = 1.01 \times 10^5$ Pa and $\rho(\text{mercury}) = 1.36 \times 10^4$ kg/m^3).

Fig#

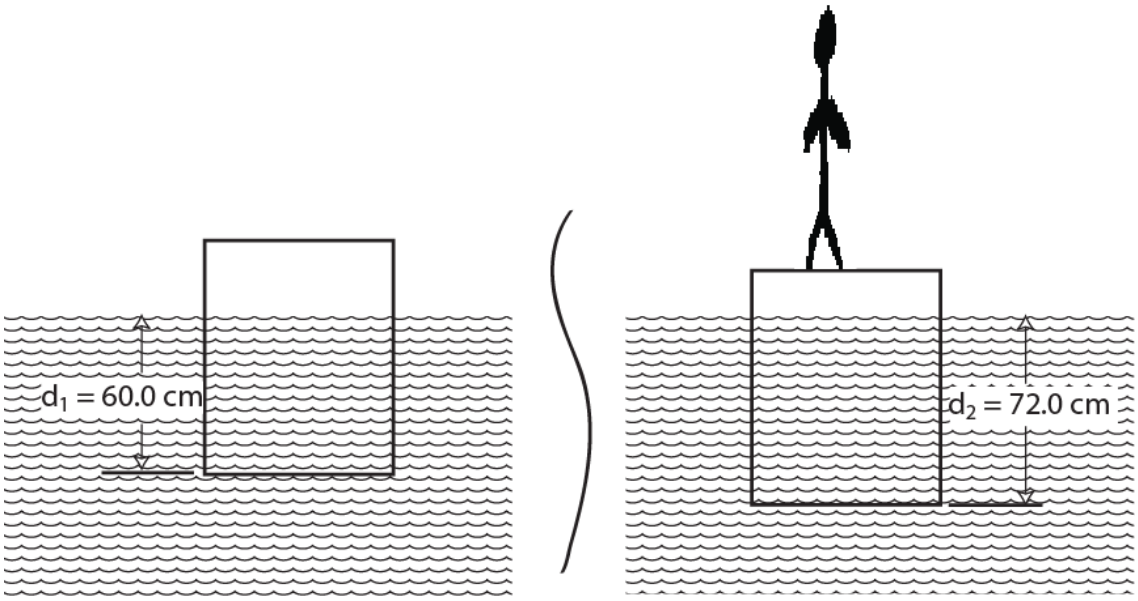


A) 1.25×10^5 Pa
B) 0.55×10^5 Pa
C) 0
D) 4.29×10^5 Pa
E) 2.46×10^5 Pa

Stat# A_61_DIS_0.65_PBS_0.51_B_6_C_9_D_8_E_16_EXP_50_NUM_880

Q10.
A rectangular block, of area A and mass 500 kg, floats in still water with its submerged depth $d_1 = 60.0$ cm. When a man stands on the block, the submerged depth of the block becomes $d_2 = 72.0$ cm (see **Figure 7**). What is the man's mass?

Fig#

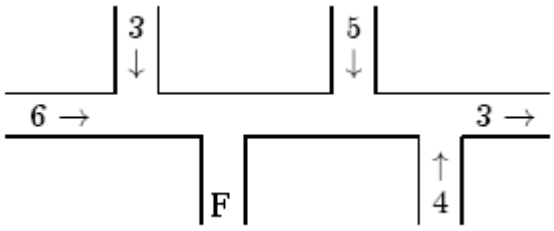


A) 100 kg
B) 200 kg
C) 150 kg
D) 500 kg
E) 250 kg

Stat# A_60_DIS_0.34_PBS_0.29_B_9_C_17_D_5_E_10_EXP_50_NUM_880

Q11.
Figure 8 shows a pipe of uniform cross section in which water is flowing. The directions of flow and the volume flow rates (in cm^3/s) are shown for various portions of the pipe. The direction of flow and the volume flow rate in the portion marked F are:

Fig#



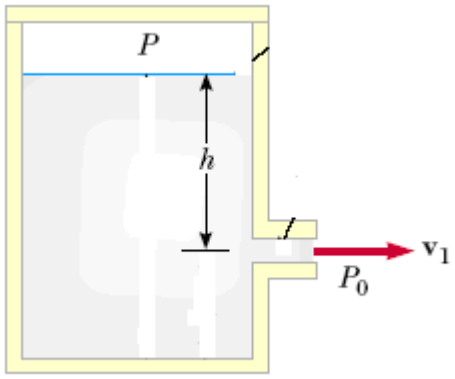
A) ↓ and 15 cm^3/s
B) ↓ and 9 cm^3/s
C) ↑ and 7 cm^3/s
D) → and 3 cm^3/s
E) ↑ and 6 cm^3/s

Stat# A_71_DIS_0.56_PBS_0.46_B_9_C_9_D_3_E_9_EXP_60_NUM_880

Q12.

A closed large tank containing a liquid of density $\rho = 1.50 \times 10^3$ kg/m^3 has a small hole in its side (See **Figure 9**) and is open to the atmosphere, P_o. The air above the liquid is maintained at a pressure of $P = 3\,P_o$. Determine the speed, v_1, of the liquid as it leaves the hole when the liquid's level is at a height $h = 3.00$ m above the hole. (take $P_o = 1.01 \times 10^5$ Pa)

Fig#



A) 18.1 m/s
B) 21.7 m/s
C) 29.1 m/s
D) 10.5 m/s
E) 5.50 m/s

Stat# A_53_DIS_0.70_PBS_0.53_B_25_C_6_D_9_E_7_EXP_50_NUM_880

Q13.

A simple harmonic oscillator has amplitude of 3.50 cm and a maximum speed of 28.0 cm/s. What is its speed when the displacement of the oscillator is 1.75 cm?

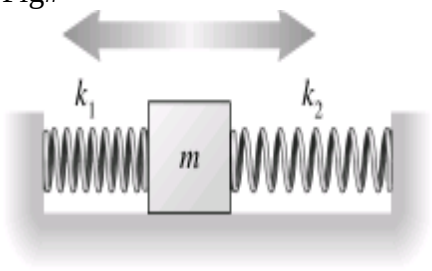
A) 24.2 cm/s
B) 12.0 cm/s
C) 14.2 cm/s
D) 15.0 cm/s
E) 17.0 cm/s

Stat# A_28_DIS_0.50_PBS_0.47_B_8_C_41_D_9_E_12_EXP_50_NUM_880

Q14.

A 2.0 kg block on a frictionless horizontal table is connected to two springs whose opposite ends are fixed to walls, as shown in **Figure 10**. If the spring constants $k_1 = 7.6$ N/m and $k_2 = 5.0$ N/m, what is the angular frequency of oscillation of the block?

Fig#



A) 2.5 rad/s
B) 3.5 rad/s
C) 0.56 rad/s
D) 0.40 rad/s
E) 1.3 rad/s

Stat# A_32_DIS_0.35_PBS_0.29_B_15_C_15_D_22_E_16_EXP_40_NUM_880

Q15.
The position of a 2.00 kg block, attached to spring and executing simple harmonic motion, is given by the equation:

$$x = (12.3\text{ cm})\cos\left[(1.26\text{ s}^{-1})t\right].$$

where t is the time in seconds. What is the total mechanical energy of the spring-block system at t = 0.815 s?

A) 2.40×10^{-2} J
B) 4.48×10^{-2} J
C) 1.12×10^{-2} J
D) 8.96×10^{-2} J
E) 6.72×10^{-2} J

Stat# A_53_DIS_0.55_PBS_0.42_B_12_C_12_D_11_E_12_EXP_50_NUM_880

Q16.
A simple pendulum of length **L** and mass **M** has frequency ***f***. In order to increase its frequency to **2*f*** we have to**:**

A) decrease its length to L/ 4
B) increase its length to 2L
C) decrease its length to L/2
D) increase its length to 4L
E) decrease its mass to M/4

Stat# A_58_DIS_0.44_PBS_0.34_B_7_C_11_D_18_E_5_EXP_50_NUM_880

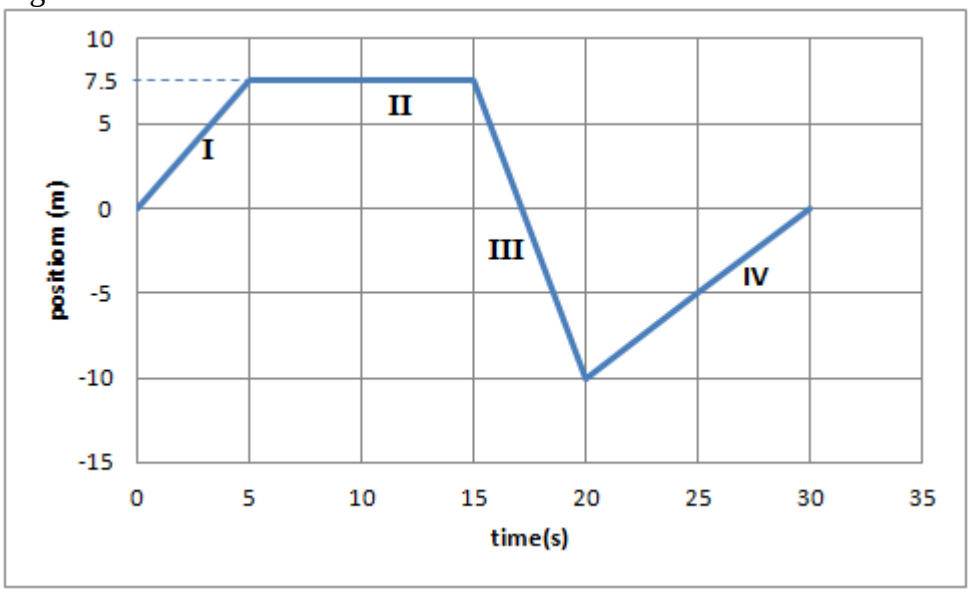
Q17.
The value of $\hat{i} \cdot \left(\hat{k} \times \hat{j} \right)$ is:

A) −1
B) +1
C) zero
D) 3
E) $\hat{i}$

Stat# A_63_DIS_0.41_PBS_0.35_B_13_C_17_D_1_E_6_EXP_50_NUM_880

Q18.
An object is moving along a straight line in the positive *x* direction. **Figure 11** shows its position from the starting point as a function of time. Various segments of the graph are identified by the roman numerals I, II, III, and IV. Which segment(s) of the graph represent(s) **a constant velocity** of +1.0 m/s?

Fig#



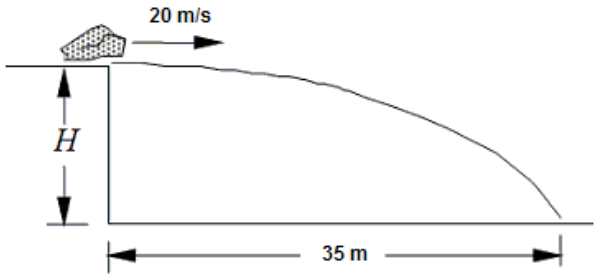
A) IV
B) II
C) III
D) I
E) I and III

Stat# A_70_DIS_0.48_PBS_0.41_B_19_C_2_D_6_E_3_EXP_50_NUM_880

Q19.

A rock is thrown horizontally at a speed of 20 m/s from the edge of a cliff of height ***H***. The rock strikes the ground 35 m from the foot of the cliff as shown in **Figure 12**. What is the **height *H*** of cliff edge? Neglect air resistance.

Fig#



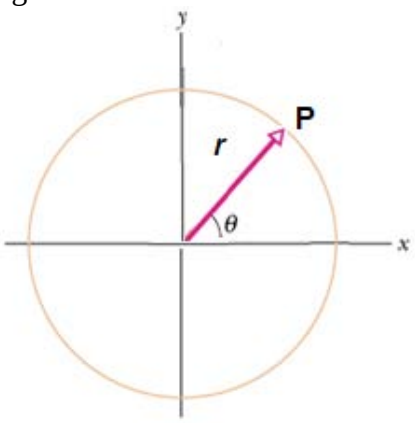
A) 15 m
B) 11 m
C) 21 m
D) 17 m
E) 19 m

Stat# A_39_DIS_0.59_PBS_0.47_B_10_C_22_D_16_E_13_EXP_50_NUM_880

Q20.

Figure 13 shows a particle **P** moving in a horizontal circle with uniform angular velocity about the origin of an **xy coordinate system**. At what values of θ, the y-component of the particle acceleration $\boldsymbol{a_y}$ have maximum magnitude. (θ is measured counter clockwise from the positive x-axis)

Fig#



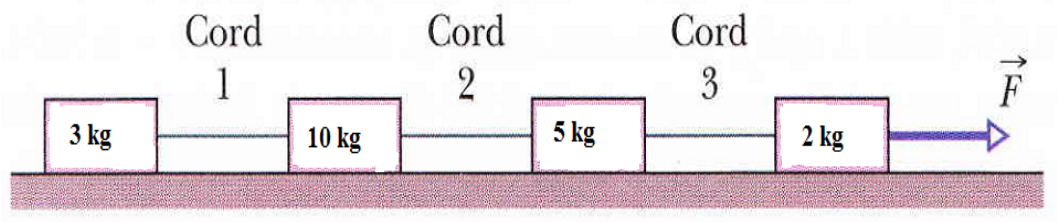
A) 90° and 270°
B) 0° and 90°
C) 90° and 180°
D) 0° and 180°
E) 0° and 270°

Stat# A_55_DIS_0.29_PBS_0.25_B_9_C_8_D_23_E_6_EXP_55_NUM_880

Q21.

Figure 14 shows four blocks connected with three cords, being pulled to the right on a horizontal frictionless floor by a horizontal force F. Rank the cords according to their tension, **Greatest to least**.

Fig#



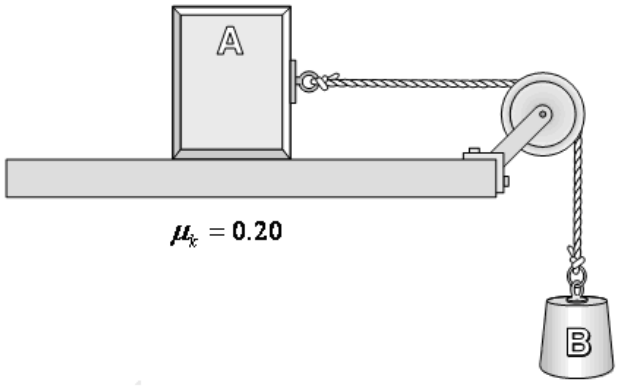
A) 3,2,1
B) All tie
C) 2,1,3
D) 1 and 2 tie then 3
E) 1,3,2

Stat# A_46_DIS_0.27_PBS_0.22_B_31_C_13_D_3_E_6_EXP_50_NUM_880

Q22.

In **Figure 15**, blocks "A" and "B" have masses of $m_A = 25.0$ kg and $m_B = 25.0$ kg, respectively. **Find the magnitude of the acceleration of mass "A"** if the coefficient of kinetic friction between the block "A" and the horizontal table is $\mu_k = 0.20$. Assume the pulley is massless and frictionless.

Fig#



A) 3.92 m/s^2
B) 4.65 m/s^2
C) 1.05 m/s^2
D) 2.57 m/s^2

E) 9.80 m/s^2

Stat# A_56_DIS_0.69_PBS_0.52_B_12_C_7_D_10_E_15_EXP_45_NUM_880

Q23.

At time $t = 0$ a 2.0-kg particle has a velocity of $\left(4.0\,\hat{\mathrm{i}} - 3.0\,\hat{\mathrm{j}}\right)$ m/s. At $t = 3.0$ s its velocity is $\left(5.0\,\hat{\mathrm{j}}\right)$ m/s. During this time interval the **work done** on it was:

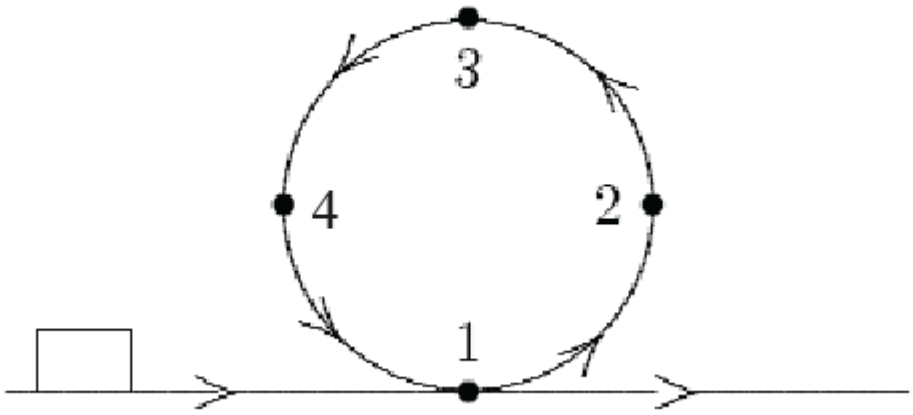
A) 0 J
B) 2.0 J
C) 25 J
D) 50 J
E) 12 J

Stat# A_67_DIS_0.46_PBS_0.36_B_6_C_11_D_4_E_12_EXP_50_NUM_880

Q24.

A block is moving along a frictionless horizontal track when it enters the circular vertical loop as shown in **Figure 16**. The block passes points 1, 2, 3, 4, 1 before returning to the horizontal track. Which one of the following statements describes the block at point 3 correctly?

Fig#



A) Its speed is a minimum
B) The forces on it are balanced
C) It is not accelerating
D) Its mechanical energy is a minimum
E) It experiences a net upward force

Stat# A_44_DIS_0.44_PBS_0.35_B_25_C_10_D_10_E_10_EXP_50_NUM_880

Q25.

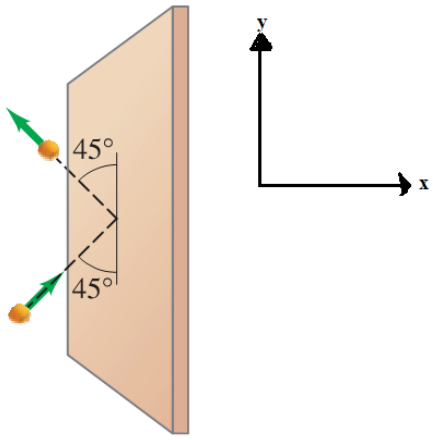
A block of mass $m = 4.0$ kg, initially moving to the right on a horizontal frictionless surface at a speed $v = 2.0$ m/s, is heading towards a spring of spring constant $k = 200$ N/m. At the instant when the kinetic energy of the block is equal to the potential energy of the spring, the spring is compressed by a distance of:

A) 20 cm
B) 10 cm
C) 15 cm
D) 5.0 cm
E) 100 cm

Stat# A_57_DIS_0.57_PBS_0.43_B_11_C_15_D_11_E_5_EXP_45_NUM_880

Q26.
A tennis ball of mass m = 0.060 kg and speed 25 m/s strikes a wall at 45° angle and rebound with the same speed at 45° as shown in **Figure 17**. What is the magnitude and direction of the impulse given to the ball?

Fig#



A) 2.1 kg .m /s , negative x-axis
B) 5.4 kg. m/s , negative x-axis
C) 1.0 kg .m/s, positive x-axis
D) 2.1 kg. m/s, positive y-axis
E) 5.4 kg.m/s, negative y-axis

Stat# A_52_DIS_0.56_PBS_0.44_B_10_C_11_D_23_E_4_EXP_50_NUM_880

Q27.
If the total momentum of a system is changing:

A) a net external force must be acting on the system
B) particles of the system must be exerting forces on each other
C) The center of mass must be at rest
D) the center of mass must have constant velocity

E) none of the other answers

Stat# A_74_DIS_0.33_PBS_0.29_B_11_C_3_D_4_E_9_EXP_50_NUM_880

Q28.
A disc, initially rotating at an angular speed of 120 rev/min about an axis passing through its symmetry axis, slows down with constant deceleration and stops 30 s later. How many revolutions did the disc make during this 30 s interval?

A) 30
B) 40
C) 10
D) 15
E) 25

Stat# A_56_DIS_0.63_PBS_0.48_B_11_C_7_D_15_E_11_EXP_55_NUM_880

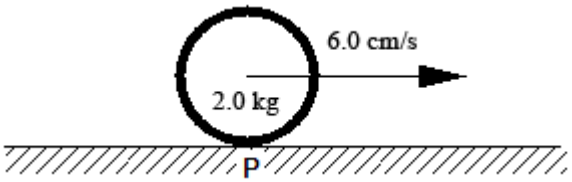
Q29.
A disk has a radius of 1.90 m. An applied torque of 96.0 N· m gives the disk an angular acceleration of 6.20 rad/s^2 about its central axis. What is the mass of the disk?

A) 8.58 kg
B) 21.5 kg
C) 14.3 kg
D) 110 kg
E) 172 kg

Stat# A_77_DIS_0.43_PBS_0.40_B_8_C_8_D_5_E_3_EXP_55_NUM_880

Q30.
Figure 18 shows a hoop with mass M = 2.0 kg rolling without slipping on a horizontal surface so that its center proceeds to the right with a constant speed of 6.0 cm/s. Which one of the following statements is **true** concerning the direction of angular momentum of this hoop about the contact point P?

Fig#



A) It points into the paper.
B) It points out of the paper.
C) It points to the left.
D) It points to the right

E) It points up.

Stat# A_39_DIS_0.29_PBS_0.24_B_21_C_17_D_17_E_6_EXP_55_NUM_880