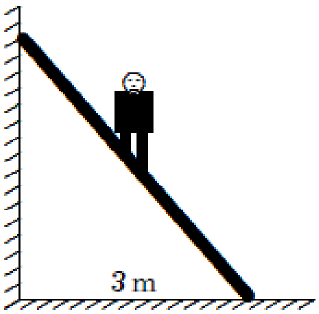
Q1.
An 800-N man stands half-way up a 5.0-m long ladder of negligible weight. The base of the ladder is 3.0m from the wall as shown in **Figure 1**. Assuming that the wall-ladder contact is frictionless, then the magnitude of normal force of the wall on the ladder is:

Fig#



A) 300 N
B) 150 N
C) 400 N
D) 600 N
E) 800 N

Stat# A_28_DIS_0.39_PBS_0.34_B_7_C_33_D_13_E_19_EXP_60_NUM_457

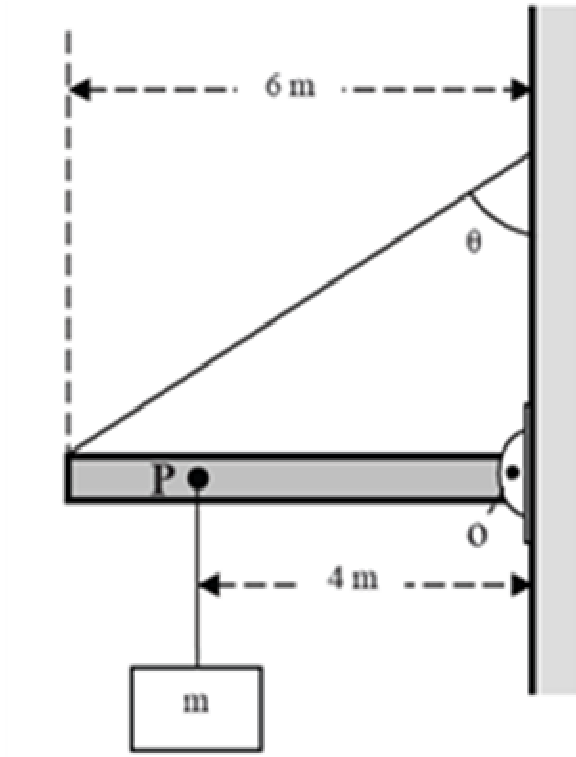
Q2.
A cube with edges exactly 2.0 m long is made of material with a bulk modulus of 3.5×10^{9} N/m^2. When it is subjected to a pressure of 7.0×10^{5} Pa its change in the volume is:

A) -1.6×10^{-3} m^3
B) -1.2×10^{-3} m^3
C) -3.2×10^{-3} m^3
D) -4.8×10^{-4} m^3
E) -8.0×10^{-4} m^3

Stat# A_73_DIS_0.48_PBS_0.38_B_5_C_7_D_8_E_6_EXP_55_NUM_457

Q3.
A uniform beam of length 6.0 m and mass 150 kg is pivoted to a vertical wall at point O and is suspended horizontally by a rope of negligible mass making an angle θ = 60° with the wall as shown in **Figure 2**. An unknown mass m is hanged at point P, 4.0 m away from the pivot point O. If the system is in equilibrium as shown with the tension in the rope equal to 2.15×10^{3} N, what is the value of mass m?

Fig#

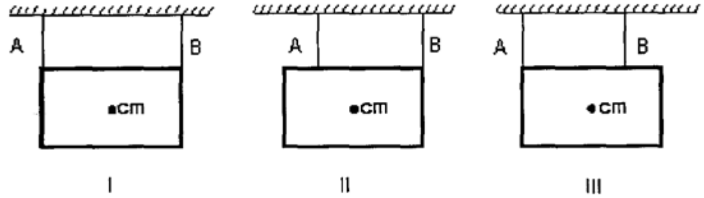


A) 52 kg
B) 39 kg
C) 26 kg
D) 100 kg
E) 23 kg

Stat# A_46_DIS_0.60_PBS_0.46_B_17_C_13_D_13_E_11_EXP_55_NUM_457

Q4.
A picture is to be hung from the ceiling by means of two wires as shown in **Figure 3**. Order the following arrangements of the wires according to the tension in wire B, **from least to greatest**.

Fig#



A) II, I, III
B) I, II, III
C) III, I, II
D) I, III, II
E) III, II, I

Stat# A_53_DIS_0.36_PBS_0.32_B_11_C_21_D_6_E_9_EXP_60_NUM_457

Q5.
A satellite is put in a circular orbit about Earth with radius = 8 R_E and period of T_1. The satellite had been moved to another circular orbit of radius 2 R_E , and its period became T_2 . The ratio T_1 / T_2 will be equal to:

A) 8.00
B) 0.125
C) 0.250
D) 0.50
E) 4.00

Stat# A_62_DIS_0.50_PBS_0.39_B_4_C_7_D_7_E_21_EXP_60_NUM_457

Q6.
A planet X has radius and mass equal to $\frac{R_E}{4}$ and $\frac{M_E}{8}$ respectively, where R_E and M_E are Earth's radius and mass. If the escape velocity of an object from the surface of Earth is 11.2 km/s, then escape velocity of the same object from the surface of the planet X would be:

A) 7.92 km/s
B) 15.8 km/s
C) 5.60 km/s
D) 22.4 km/s
E) 1.01 km/s

Stat# A_71_DIS_0.35_PBS_0.31_B_8_C_9_D_8_E_3_EXP_45_NUM_457

Q7.
In space, sphere A of mass 20.0 kg is located at the origin of an x-axis and sphere B of mass 10.0 kg is located on the x-axis at x = 0.80 m. Sphere B is released from rest while sphere A is held at the origin. What is the kinetic energy of B when it has moved 0.20 m toward A?

A) 5.6×10^{-9} J
B) 5.0×10^{-8} J
C) 8.3×10^{-8} J
D) 3.9×10^{-9} J
E) 1.8×10^{-9} J

Stat# A_32_DIS_0.39_PBS_0.38_B_12_C_16_D_22_E_17_EXP_50_NUM_457

Q8.

If the radius of a star were to reduce by 50%, while it's mass remain the same, the acceleration due to gravity on the star's surface would:

A) increase by a factor of 4
B) decrease by a factor of 4
C) increase by a factor of 8
D) decrease by a factor of 8
E) decrease by a factor of 16

Stat# A_72_DIS_0.48_PBS_0.42_B_16_C_4_D_6_E_2_EXP_55_NUM_457

Q9.
A column of oil of height 70.0 cm supports a column of an unknown liquid as suggested in the **Figure 4** (not drawn to scale). Assume that both liquids are at rest and that the density of the oil is 8.40×10^2 kg/m^3. Determine the density of the unknown liquid.

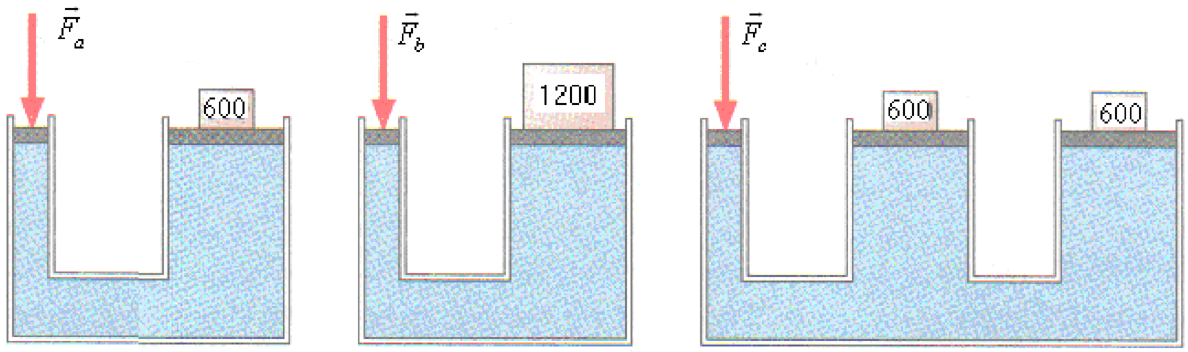
Fig#

A) 2.2×10^3 kg/m^3
B) 3.3×10^2 kg/m^3
C) 2.6×10^3 kg/m^3
D) 3.6×10^3 kg/m^3
E) 4.9×10^3 kg/m^3

Stat# A_68_DIS_0.40_PBS_0.34_B_10_C_6_D_12_E_4_EXP_60_NUM_457

Q10.
For the hydraulic lift systems shown in **Figure 5**, rank in order from largest to smallest, the magnitudes of the forces $\vec{F}_a$, $\vec{F}_b$ and $\vec{F}_c$ required to balance the masses? The masses are in kilograms.

Fig#



A) $|\vec{F}_b| > |\vec{F}_a| = |\vec{F}_c|$

B) $|\vec{F}_a| > |\vec{F}_b| = |\vec{F}_c|$

C) $|\vec{F}_a| = |\vec{F}_b| = |\vec{F}_c|$

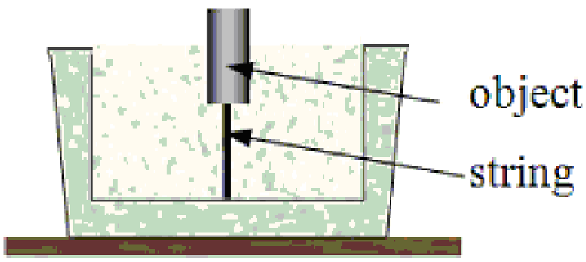
D) $|\vec{F}_b| < |\vec{F}_a| < |\vec{F}_c|$

E) $|\vec{F}_c| = |\vec{F}_b| > |\vec{F}_a|$

Stat# A_26_DIS_0.23_PBS_0.25_B_5_C_9_D_2_E_58_EXP_60_NUM_457

Q11.
Figure 6 shows a 2.00-kg block tied, by string, to a bottom of a container filled to the rim with water. If the displaced water has a mass of 5.00 kg, find the tension in the string.

Fig#



A) 29.4 N
B) 10.2 N
C) 22.8.N
D) 7.00 N
E) 100 N

Stat# A_68_DIS_0.53_PBS_0.40_B_11_C_10_D_7_E_4_EXP_45_NUM_457

Q12.

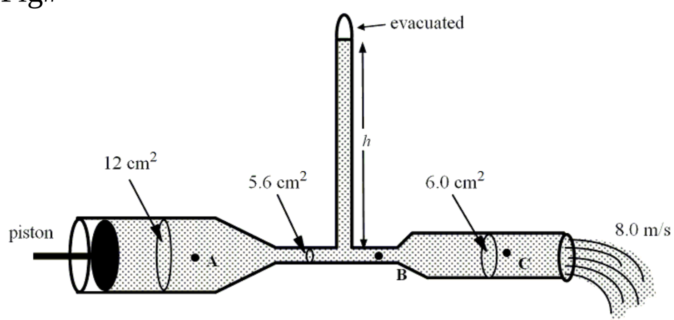
A bucket with 0.0189-m^3 is to be filled through a pipe with 0.00780 m radius. If the water flows through the pipe end with a speed of 0.610 m/s, how long does it take to fill the bucket completely?

A) 162 s
B) 170 s
C) 119 s
D) 280 s
E) 490 s

Stat# A_48_DIS_0.54_PBS_0.43_B_13_C_15_D_12_E_12_EXP_45_NUM_457

Q13.
A glass tube has several different cross-sectional areas with the values indicated in the **Figure 7**. A piston at the left end of the tube exerts pressure so that mercury within the tube flows from the right end with a speed of 8.0 m/s. Three points within the tube are labeled A, B, and C. What is the total pressure at point A? Atmospheric pressure is 1.01×10^5 N/m^2; and the density of mercury is 1.36×10^4 kg/m^3.

Fig#

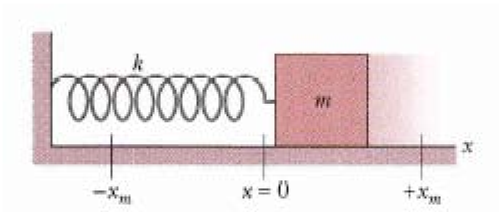


A) 4.27×10^5 Pa
B) 2.02×10^5 Pa
C) 2.25×10^5 Pa
D) 3.26×10^5 Pa
E) 1.01×10^5 Pa

Stat# A_21_DIS_0.24_PBS_0.29_B_18_C_21_D_19_E_20_EXP_40_NUM_457

Q14.
In **Figure 8**, the horizontal block-spring system has a kinetic energy of K = 5.0 J and an elastic potential energy of U = 3.0 J, when the block is at x = + 2.0 cm. What are the kinetic and elastic potential energy when the block is at x = – x_m?

Fig#



A) K = 0 and U = 8 J
B) K = 5 J and U = 3 J
C) K = 5 J and U = −3 J
D) K = 8 J and U = 0
E) K = 0 and U = − 8 J

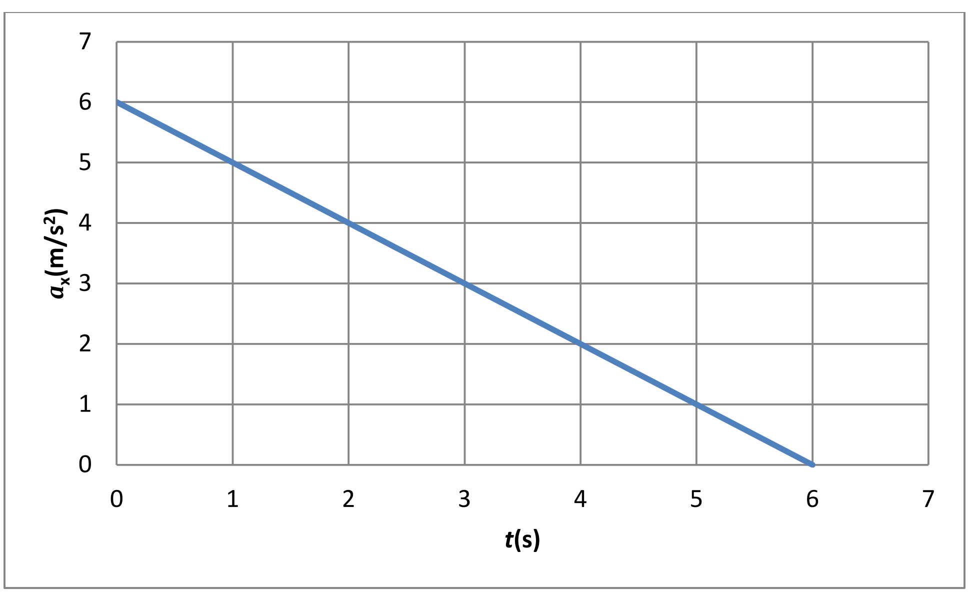
Stat# A_57_DIS_0.54_PBS_0.41_B_10_C_10_D_6_E_17_EXP_60_NUM_457

Q15.
A thin rod of length L = 1.5 m and mass M is pivoted at one end of the rod and is made to oscillate as a physical pendulum with frequency f . The value of f is:

A) 0.50 Hz
B) 2.5 Hz
C) 0.25 Hz
D) 1.0 Hz
E) 2.0 Hz

Stat# A_47_DIS_0.39_PBS_0.31_B_19_C_9_D_17_E_7_EXP_55_NUM_457

Q16.
At t = 0, a particle is located at x = 25.0 m and has a velocity of 12.5 m/s in the positive x direction. The acceleration (a_x) of the particle varies with time (t) as shown in **Figure 9**. What is the velocity of the particle at t = 5.00 s?

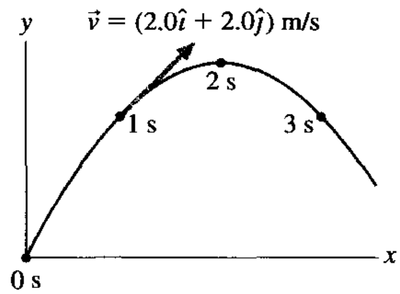


A) +30 m/s
B) –15 m/s
C) +15 m/s
D) 0
E) –1.2 m/s

Stat# A_24_DIS_0.26_PBS_0.29_B_23_C_22_D_7_E_23_EXP_55_NUM_457

Q17.
Figure 10 shows the trajectory of ball in Planet X. The ball's position is shown at 1.0 s intervals until t = 3.0 s. At t = 1.0 s, the ball's velocity is $\left(2.00\,\hat{i} + 2.00\,\hat{j}\right)$m/s . It reaches the maximum height at t = 2.0 s. What is the value of g (in m/s^2) on this planet?

Fig#



A) 2
B) 3
C) 4
D) 9.8
E) 1

Stat# A_36_DIS_0.42_PBS_0.33_B_14_C_15_D_16_E_18_EXP_45_NUM_457

Q18.
A 2.00-kg stone is tied to a string of length 0.500 m and whirled at a constant speed of 4.00 m/s in a vertical circle. The tension in the string at the bottom of the circle is:

A) 83.6 N, up
B) 44.4 N, up
C) 9.80 N, down
D) 44.4 N, down
E) 83.6 N, down

Stat# A_32_DIS_0.35_PBS_0.34_B_28_C_11_D_15_E_13_EXP_60_NUM_457

Q19.

A 6.00-kg block is in contact with a 4.00-kg block on a frictionless surface as shown in **Figure 11**. The 6.00-kg block is being pushed by a 20.0-N force toward the 4.00-kg block. What is the magnitude of the force of the 6.00-kg block on the 4.00-kg block?

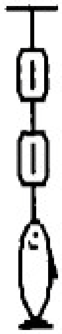
Fig#

A) 8.00 N
B) 12.0 N
C) 6.00 N
D) 4.00 N
E) 10.0 N

Stat# A_41_DIS_0.39_PBS_0.30_B_29_C_9_D_9_E_12_EXP_60_NUM_457

Q20.
A 16-kg fish is weighed with two identical, massless, spring scales, each of negligible weight, as shown in **Figure 12**. What will be the readings on the scales?

Fig#

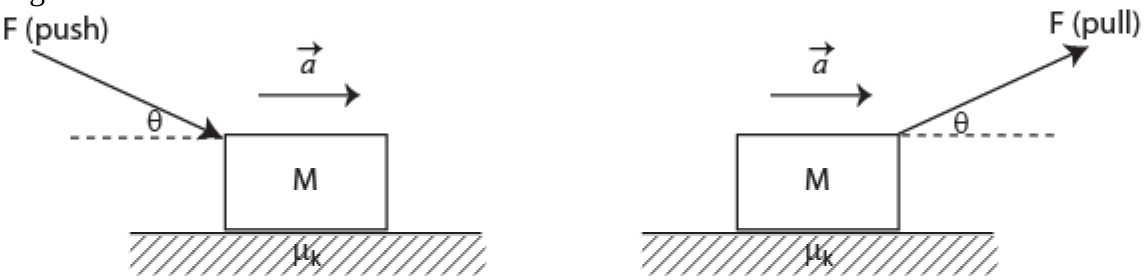


A) The sum of the two readings will be 32 kg
B) The bottom scale will read 16 kg, and the top scale will read zero
C) The top scale will read 16 kg, and the bottom scale will read zero.
D) Each scale will show a reading greater than zero and less than 16 kg, but the sum of the two readings will be 16 kg
E) Each scale will read 8 kg.

Stat# A_52_DIS_0.38_PBS_0.28_B_8_C_6_D_20_E_13_EXP_50_NUM_457

Q21.
When you travel, you always exert less force to pull a block M instead of pushing it, see **Figure 13**. That is F(pull) < F(push). Why?

Fig#

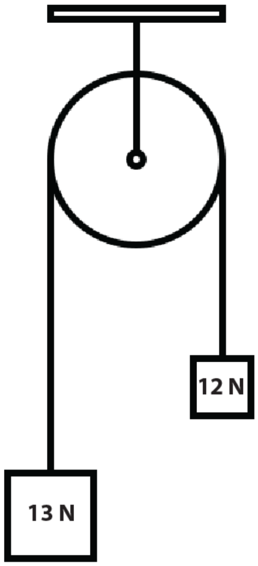


A) Because the normal force becomes less while pulling
B) Because the normal force becomes more while pulling
C) Because the normal force becomes zero while pulling
D) Because the gravitational forces decreases while pulling
E) No scientific reason it is just a habit.

Stat# A_59_DIS_0.49_PBS_0.37_B_24_C_4_D_9_E_5_EXP_50_NUM_457

Q22.
A 13-N weight and a 12-N weight are connected by a massless string over a massless, frictionless pulley as shown in **Figure 14**. The downward acceleration of 13-N weight is: (g is acceleration due to gravity)

Fig#



A) g/25
B) g/12
C) g/13
D) g
E) g/2

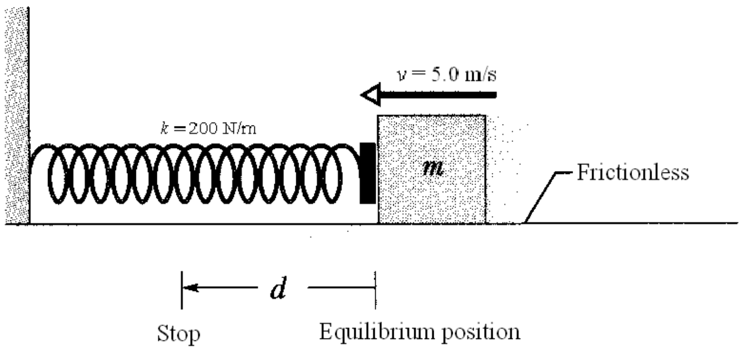
Stat# A_32_DIS_0.45_PBS_0.39_B_15_C_14_D_32_E_6_EXP_60_NUM_457

Q23.
At t = 0, a force F acts on 2-kg particle that has an initial velocity of $\left(4.0\hat{i} - 3.0\hat{j}\right)$ m/s . The velocity became $\left(2.0\hat{i} + 3.0\hat{j}\right)$ m/s at t = 3 s. During this time interval the work done by the external force was:

A) –12 J
B) – 4 J
C) –18 J
D) – 40 J
E) $\left(4.0\hat{i} + 36.0\hat{j}\right)$ J

Stat# A_67_DIS_0.38_PBS_0.29_B_11_C_9_D_5_E_9_EXP_55_NUM_457

Q24.
Figure 15 shows a block of mass m = 2.0 kg attached to a horizontal ideal spring with a spring constant of k = 200 N/m. When the spring in its equilibrium position, the block is given a speed of v = 5.0 m/s. What is the maximum **compression** (d) of the spring?



A) 0.50 m
B) 0.05 m
C) 0.25 m
D) 10 m
E) 0.12 m

Stat# A_63_DIS_0.55_PBS_0.44_B_8_C_16_D_4_E_9_EXP_60_NUM_457

Q25.
At t = 0, a horse pulls a cart with a force of 180 N at an angle of 30° above the horizontal and moves horizontally at a speed of 1.20 m/s. What is the instantaneous power (in Watts) of the force at t = 0?

A) 187
B) 150

C) 108
D) 216
E) 0

Stat# A_51_DIS_0.46_PBS_0.38_B_5_C_14_D_9_E_21_EXP_60_NUM_457

Q26.
Particle 1 with mass 2.0 kg and velocity $v_{1i} = \left(5.0\,\hat{i}\right)$ m/s m/s undergoes a one-dimensional elastic collision with particle 2 with mass 2.0 kg and velocity $v_{2i} = \left(-6.0\,\hat{i}\right)$ m/s. After the collision, the final velocities of particle 1 (v_{1f}) and particle 2 (v_{2f}) are:

A) $v_{1f} = \left(-6.0\,\hat{i}\right)$ m/s, $v_{2f} = \left(5.0\,\hat{i}\right)$ m/s
B) $v_{1f} = \left(6.0\,\hat{i}\right)$ m/s, $v_{2f} = \left(-5.0\,\hat{i}\right)$ m/s
C) $v_{1f} = \left(-11.0\,\hat{i}\right)$ m/s, $v_{2f} = \left(0.0\,\hat{i}\right)$ m/s
D) $v_{1f} = \left(0.0\,\hat{i}\right)$ m/s, $v_{2f} = \left(11.0\,\hat{i}\right)$ m/s
E) $v_{1f} = \left(-6.0\,\hat{i}\right)$ m/s, $v_{2f} = \left(-5.0\,\hat{i}\right)$ m/s

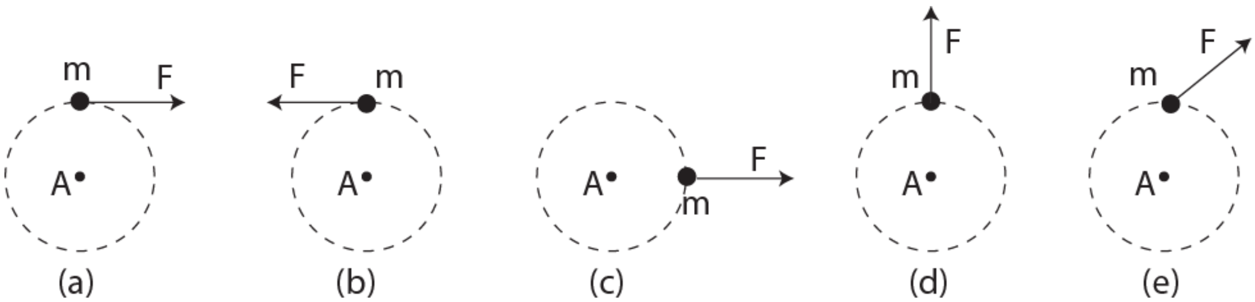
Stat# A_63_DIS_0.42_PBS_0.35_B_10_C_6_D_9_E_11_EXP_60_NUM_457

Q27.
A 2.00 kg particle has the xy coordinates (−1.20 m, 0.500 m), and a 4.00 kg particle has the xy coordinates (0.600 m, −1.0 m). Both lie on a horizontal plane. At what (x,y) coordinates must you place a 3.00 kg particle such that the center of mass of the three-particle system has the coordinates (0.00 m, 0.00 m)?

A) (0.0, 1.0) m
B) (1.0, 2.0) m
C) (0.5, −1.0) m
D) (−1.2, 1.0) m
E) (− 0.5, -1.5) m

Stat# A_67_DIS_0.51_PBS_0.41_B_7_C_10_D_8_E_7_EXP_60_NUM_457

Q28.
Five objects of mass m are under a force F at a distance from an axis of rotation perpendicular to the page through the point A, as shown in **Figure 16**. The one (or ones) that has zero torque about the axes through A is:



A) c, d
B) b, a
C) a, e
D) d
E) e

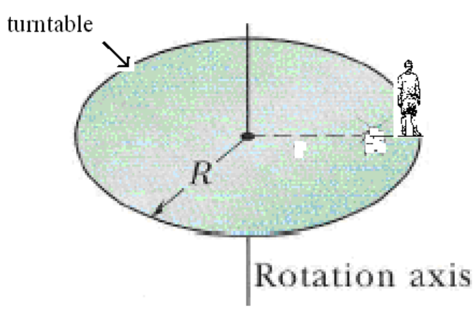
Stat# A_68_DIS_0.48_PBS_0.40_B_15_C_2_D_12_E_3_EXP_60_NUM_457

Q29.
A wheel rotates through an angle of 315° as it slows down uniformly from 90.0 rev/min to 30.0 rev/min. What is the magnitude of the angular acceleration of the wheel?

A) 7.18 rad/s^2
B) 2.34 rad/s^2
C) 6.50 rad/s^2
D) 8.35 rad/s^2
E) 10.9 rad/s^2

Stat# A_46_DIS_0.53_PBS_0.41_B_14_C_14_D_13_E_13_EXP_60_NUM_457

Q30.
Figure 17 shows a boy of mass M= 50 kg standing at rest on the rim of a stationary turntable holding a rock of mass 2.0 kg in his hand. The turntable has a radius of R =1.2 m and a rotational inertia of I = 36 kg·m^2 about its axis. The boy then throws the rock horizontally in a direction tangent to the rim of the turntable. Now the turntable starts to rotate with the boy with an angular speed of ω. If the speed of the rock relative to the ground is 5.0 m/s, find ω.



A) 0.11 rad/s
B) 0.33 rad/s

C) 0.16 rad/s
D) 0.22 rad/s
E) 0.38 rad/s

Stat# A_22_DIS_0.23_PBS_0.24_B_23_C_19_D_18_E_18_EXP_55_NUM_457