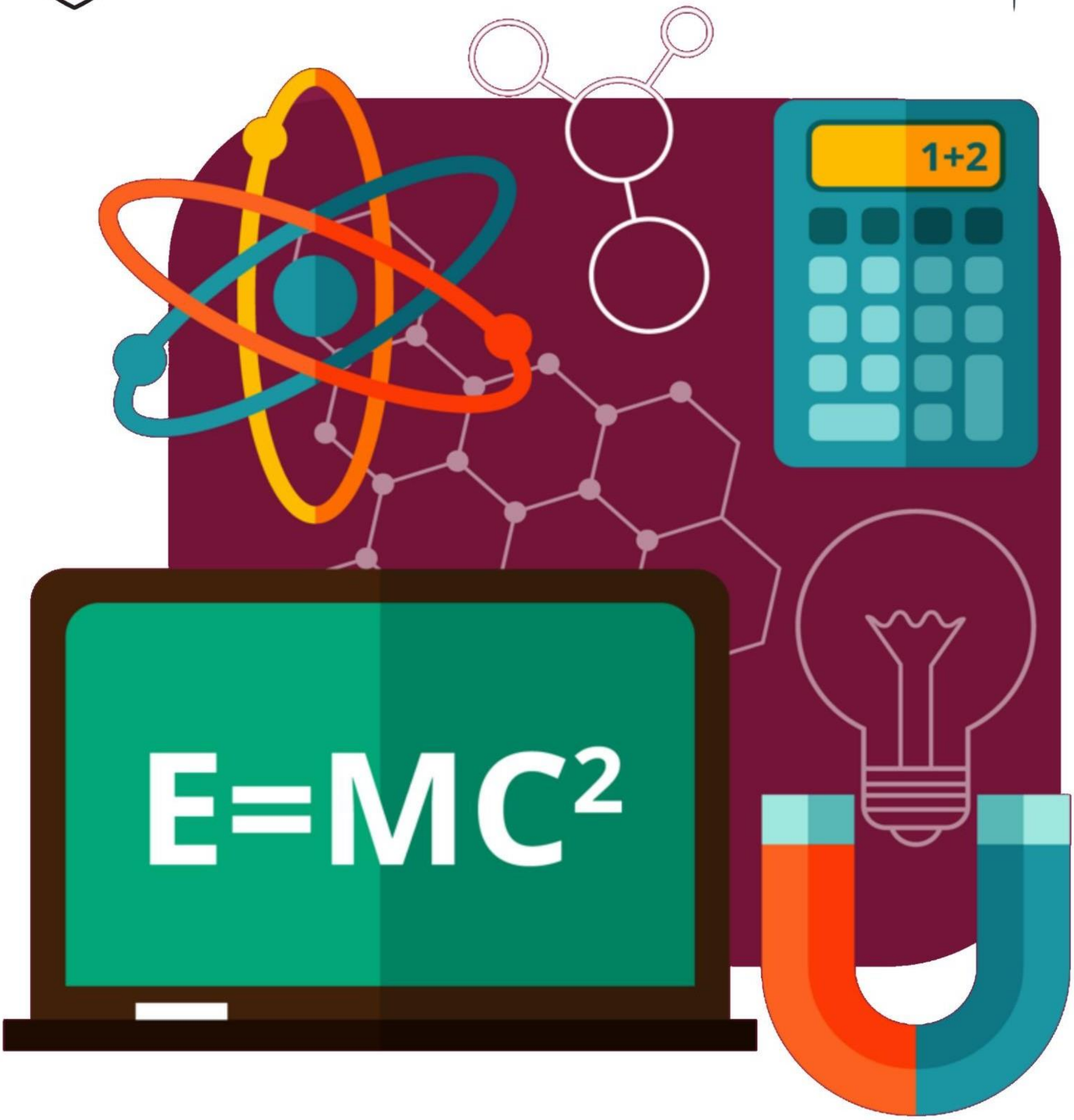
PAST PAPERS



PHYSICS

(CHAPTERS 6/8/9/10)

1. A man pushes an 80 N box a distance of 5.0 m upward along a frictionless slope that makes an angle of 30 with the horizontal. his force (F_{man}) is parallel to the slope. If the speed of the box decreases at rate of 1.5 m/s², then the work (in J) done by the man is: Use g=10 m/s²

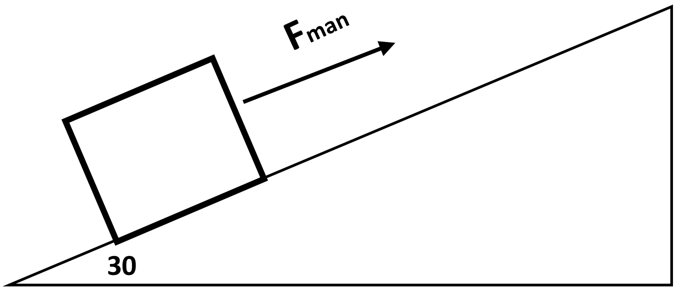
A) -200

B) +60

C) +200

D) +400

E) +140



2. A square metal plate 0.18 m on each side is pivoted about an axis through point O at its center and perpendicular to the plate. Calculate the net Torque about the axis (in m. N) due to the three forces shown in the figure if the magnitude of the forces are F_1 = 28 N , F_2 = 16 N and F_3 = 18 N The plate all forces are in the plane of the page.

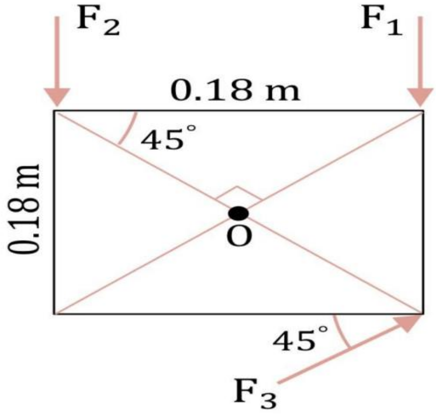
A) 1.2 Counterclockwise

B) 3.2 Counterclockwise

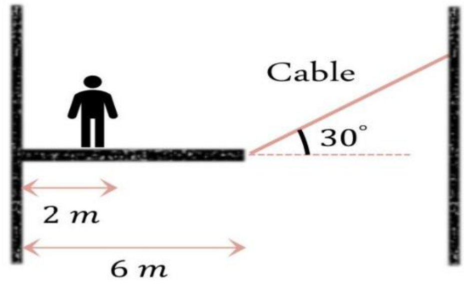
C) 1.2 clockwise

D) 3.2 clockwise

E) 2.0 clockwise



3. **A person with a mass of 55kg stands 2.0 m away from the wall on a 6.0 m beam as shown in the figure. The mass of the beam is 40.0 kg . If the whole system is in static equilibrium, Find the vertical component of the hinge force (in N) at point O.**



A) 555.3 down

B) 375.7 up

C) 555.3 up

D) 375.7 down

E) 731 up

4. A blood vessel of radius r is attached firmly to four vessels, each of radius r/3. If the velocity in the larger vessel is v, then the velocity in each of the smaller vessels is:

A) v   B) 4v/9   C) v/4   D) 4v   E) 9v/4

5. A 60kg student climbs 30 stairs at constant speed in 30 seconds.

If the height of each stair is 0.25 m, calculate the average power (in Watt) of the student. (use g = 9.8 m/s²)

A) 339   B) 147   C) 441   D) 370   E) 294

6. Determine the mass flow rate of a given fluid whose density is 800 kg/m³, velocity = 30 m/s, and area of cross section is 20 cm²:

A) 4800 kg/s   B) $4.8*10^5$ kg/s   C) 1200 kg/s   D) $1.2*10^5$ kg/s

7. The air of velocity 15 m/s and of density 1.3 kg/m³ is entering the Venturi tube (Placed in the horizontal position) from the left. The radius of the wide part of the tube is 1.0 cm ; the radius of the thin part of the tube is tube is 0.5 cm. The tube of shape U connecting wide and thin part of the main tube (see the picture) is filled with the mercury of the density 13600 kg/m³. Determine the height different Δh that stabilizes between the surface of the mercury in U Tube.

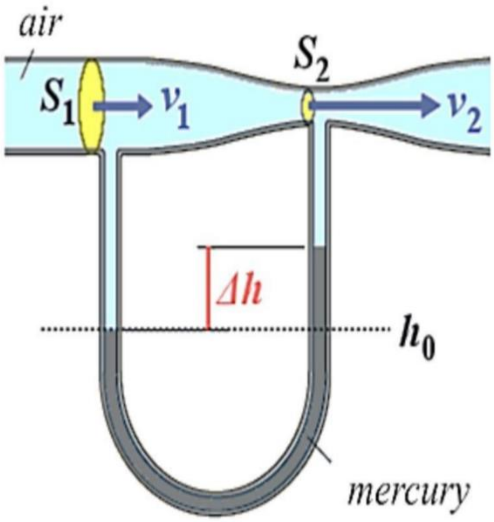
A) 0.6 cm

B) 1.6 cm

C) 2.2 cm

D) 1.1 cm

E) 7.6 cm



8. A rectangular block of mass m is placed in a fluid and acted upon by a force F such that the block is fully submerged and hangs in static equilibrium. If the density of the block is ½ that of the fluid, the magnitude of the force F is:

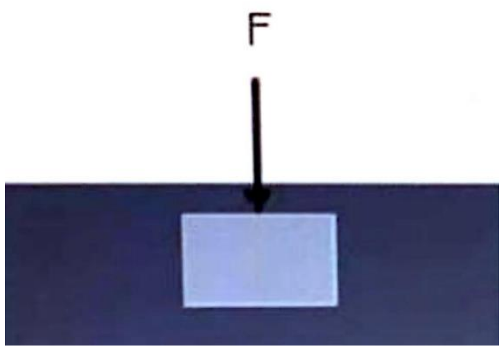
A) 2mg

B) 3mg

C) mg

D) mg/3

E) mg/2



9. A pipe filled completely with water passes up a hill that is 10 m high. At the bottom of the hill, a flowmeter measures the speed of the water to be 2 m/s. At the top of the hill, the flowmeter measures the speed of the water to be 1 m/s. The difference in the water pressure (in Pa) between the bottom and the top of the hill is: (use g = 10 m/s²)

A) $1.02*10^3$ B) $9.85*10^4$ C) $9.85*10^7$ D) $1.00*10^5$ E) $1.50*10^3$

10. A 3.90-kg block initially at rest the top of a 4.00-m incline with slope 45.0 degree begins to slide down the incline. The upper half of the incline is frictionless, while the lower half is rough, with a μ_k = 0.275. How fast is the block moving along the incline, before entering the rough section?

A) 4.2 m/s B) 5.26 m/s C) 3.73 m/s D) 7.45 m/s E) 0

11. A boat is floating in both water and oil, if the $\rho_{oil} < \rho_{water}$, which of the following statements is true:

A) $V_{water} = V_{oil}$

B) $V_{water} > V_{oil}$

C) $V_{water} < V_{oil}$

D) $FB_{oil} < FB_{water}$

E) non of the above

Notice that:

$$FB_{oil} = FB_{water}$$
$$\rho_{oil} * V_{oil} * g = \rho_{water} * V_{water} * g$$
$$\rho_{oil} / \rho_{water} = V_{water} / V_{oil}$$
$$< 1 \quad = \quad < 1$$
$$V_{water} < V_{oil}$$

12. A traffic light hangs from a pole AB as shown in the figure. The uniform aluminium pole AB is 7.20 m long and has a mass of 12.0 kg. The mass of the traffic light is 21.5 kg. Find the tension in the horizontal massless cable CD: ($g = 9.8\ m/s^2$)

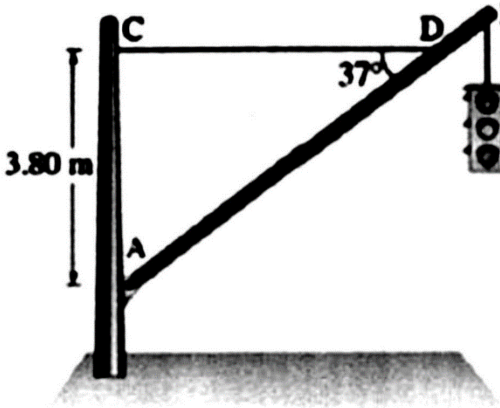
A) 608 N

B) 363 N

C) 570 N

D) 370 N

E) 408 N



13. A 2kg block slides down a ramp in the shape of a quarter-circle of radius 2m from rest, as shown. The block reaches the bottom of the ramp with speed 4m/s. The work (in J) done by friction during the slide down the ramp is:

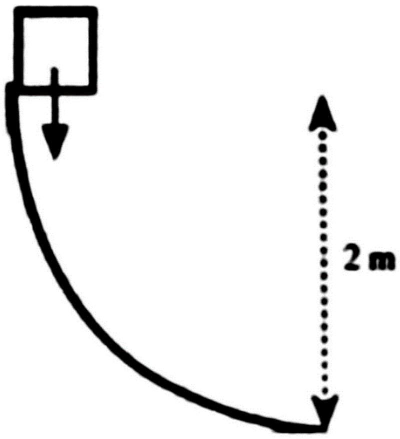
A) 12

B) 40

C) 0

D) 8

E) 24



Q12 solution:

→ The angle at A $= 90° - 37° = 53°$

weight of traffic light = mg

$= (21.5 * 9.8) = 210.7$ N

→ The horizontal distance from the vertical pole to the traffic light :

$= 7.2 * \sin 53° = 5.75$ m

Torque $= 210.7$ N $* 5.75$ m $= 1211.56$ N.m

→ The weight of pole AB = mg

$= 12 * 9.8 = 117.6$ N

The center of mass is 3.6 meters from point A.

Torque $= 117.6 * 3.6 * \sin 53° = 338.11$ N.m

→ The tension in cable CD produces a counter clockwise torque on the vertical pole at point A.

AC = 3.8 m

Torque = Tension * 3.8

Tension * 3.8 = 1211.56 + 338.11

Tension = 407.8 N

= 408 N (E)

Q13 solution:

$m = 2\ kg$ / $g = 10\ m/s^2$ / $h = 2\ m$

$v_i = 0$ (at rest) / $v_f = 4\ m/s$ (at bottom)

→ Applying work-energy theorem:

$$W_c + W_{nc} = \Delta KE \quad (1)$$

→ Work done by gravity $= mgh$ (conservative)

→ work done by normal force $= 0$ (conservative)

→ work done by friction force $= W_f$ (non-conservative)

→ $\Delta KE = \frac{1}{2} m (v_f^2 - v_i^2)$

Put it on (1) ⇒

$$mgh + 0 + W_f = \frac{1}{2} m (v_f^2 - v_i^2)$$

$$W_f = \frac{1}{2} m (v_f^2 - v_i^2) - mgh$$

$$W_f = \frac{1}{2} * 2 * (4^2 - 0^2) - 2 * 10 * 2$$

$$W_f = 16 - 40 = -24\ J$$

$$W_f = -24\ J$$

negative sign tells that work done was in opposite direction of movement of mass.

(E)

14. A 2.3 cm thick bar of soap is floating on a water surface so that 1.64 cm of the bar is underwater, as in Fig. Bath oil (specific gravity 0.6) is poured into the water and floats on top of the water , as in the second Figure what is the depth of the oil layer (y_{oil}) in cm when the top of the soap is just level with the upper surface of the oil?

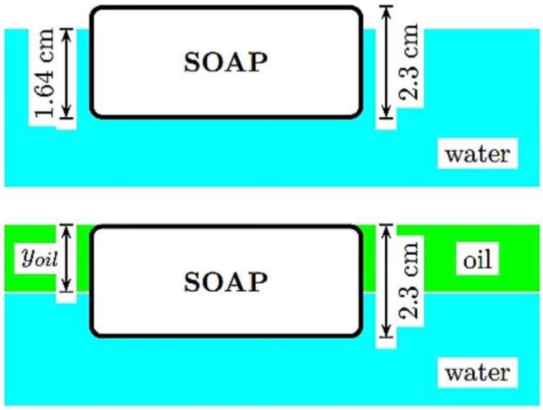
A) 0.66

B) 1.15

C) 1.1 cm

D) 0.34

E) 1.65



15. A bucket resting on the floor of an elevator contains a fluid of density ρ. When the elevator has a downward acceleration of magnitude (a) the pressure difference between two points in a fluid, separated by a vertical distance Δ h, is given by:

A) ρ a Δ h

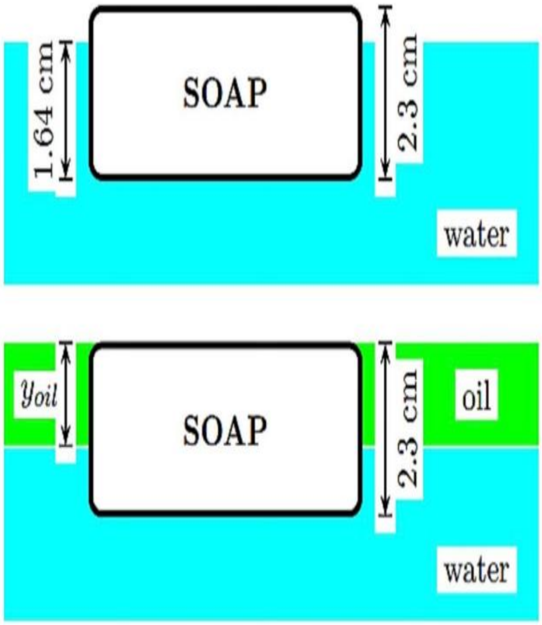
B) ρ g Δ h

C) ρ (a+g) Δ h

D) ρ ga Δ h

E) ρ (g-a) Δ h

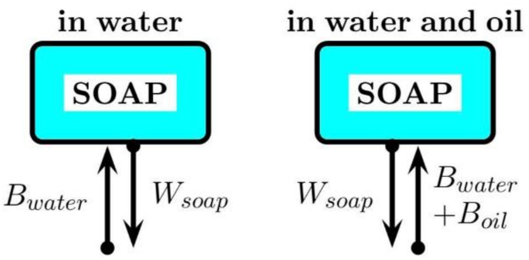
Q14 solution:



$$\text{Given}: \quad h = 2.3 \text{ cm},$$
$$y = 1.64 \text{ cm},$$
$$\text{specific gravity} = \frac{\rho_{oil}}{\rho_{water}} = 0.6.$$

Let A be the surface area of the top or bottom of the bar. The weight of the soap bar is equal to the buoyant force when it floats in water alone:

$$F_{net} = B - W_{soap} = 0$$
$$B = m_{fluid}\, g$$
$$\rho = \frac{m}{V}$$
$$V = A\, y$$



Before the oil is added:

$$W_{soap} = B_{water} \qquad (1)$$
$$= \rho_{water}\,(A\,y)\,g.$$

After the oil is added:

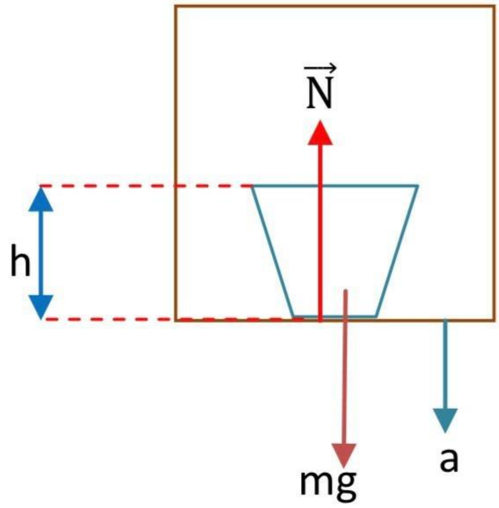
$$W_{soap} = B_{water} + B_{oil} \qquad (2)$$
$$= \rho_{water}\,[A\,(h - y_{oil})]\;g + \rho_{oil}\,(A\,y_{oil})\;g,$$

since y_{oil} is the depth of the oil layer.

Setting Eq. 1 equal to Eq. 2, we have

$$\rho_{water}(A\,y)\,g = \rho_{water}\,[A\,(h - y_{oil})]\;g + \rho_{oil}\,(A\,y_{oil})\,g$$
$$\rho_{water}\,y = \rho_{water}\,h - \rho_{water}\,y_{oil} + \rho_{oil}\,y_{oil}$$
$$(\rho_{water} - \rho_{oil})\;y_{oil} = \rho_{water}\;(h - y)$$
$$y_{oil} = \frac{h - y}{1 - \dfrac{\rho_{oil}}{\rho_{water}}} \qquad (3)$$
$$= \frac{(2.3 \text{ cm}) - (1.64 \text{ cm})}{1 - 0.6}$$
$$= 1.65 \text{ cm}$$

Q15 solution:



D; $\Delta P = \dfrac{\text{Force on the bottom}}{\text{Area of the bottom}}$

Where the force on the bottom is equal to the normal

$N - mg = -ma \Rightarrow N = m(g - a)$

$\Rightarrow N = \rho A h\,(g - a)$

So: $\Delta P = \frac{N}{A} = \frac{\rho \cancel{A} h\,(g-a)}{\cancel{A}} = \rho h\,(g - a)$

16. Consider that your average blood pressure is 1.33 N/Cm^2 and your blood flow rate is 105 cm^3/s. The energy your heart does provide in one day to lift a 72 kg box vertically to a height (h). Calculate the height h(in m):

A) 94

B) 12

C) 308

D) 3

E) 171

17. The density of salt water is 1.02 greater than that of the density of fresh water. A box floats in static equilibrium in both fluids. Which of the following statements is correct?

A) The volume of the displaced water is the same in both cases

B) Buoyant force excreted by salt water is greater than that by fresh water

C) None of the statements is correct

D) Buoyant force excreted by the fresh water is greater than that by salt water

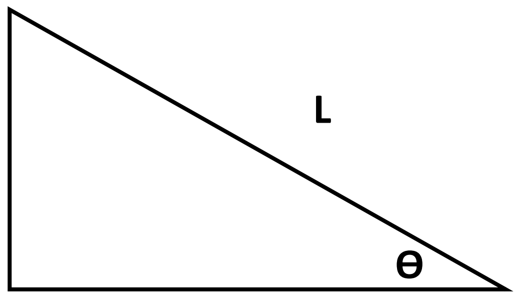
E) Buoyant force is the same for both.

The questions and answers will be numbers-free. Try to understand every question's trick.

Q1: A ladder is leaning against a vertical frictionless wall.

Given → mass of the ladder, ϴ, length (L)

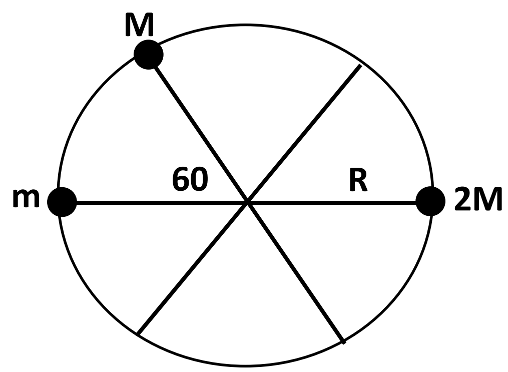
Find → μ_s with the floor



Q2: A rotating wheel, 2 masses (M) are hanging. Find the mass (m) in terms of (M) to ensure that the wheel is static.

Given → R

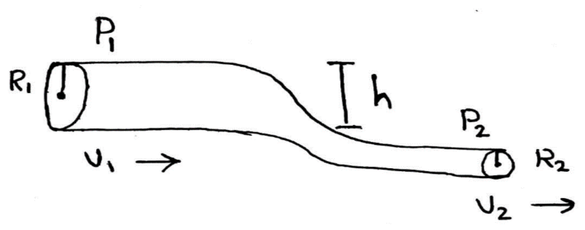
Find → m



Q3: Find the pressure at the top of this tube.

Given → R_1, V_2, R_2, P_2, h, ρ fluid

Find → P_1



Q4: A rock is suspended by a cable in a liquid. Find its density.

Given → real weight of the rock, apparent weight of the rock, the volume of the rock, the density of the liquid

Find → density of the rock

Q5: In a cylindrical pump.

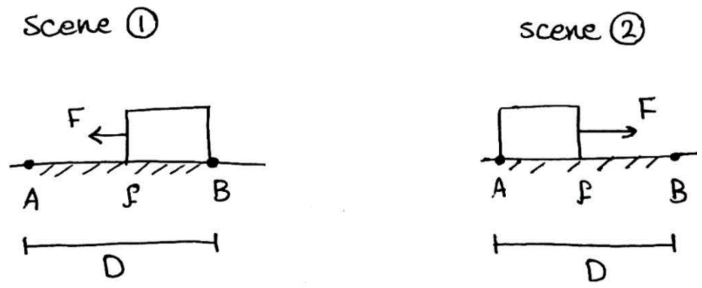
Given → ρ_{fluid}**, velocity, Area**

Find → mass flow rate

Q6: Moving a box with mass (m) along a horizontal floor. We moved the box from (B) to (A) and then pushed the box again to the starting point from (A) to (B). Find the total work done by the friction force.

Given → m, μ_k**, D**

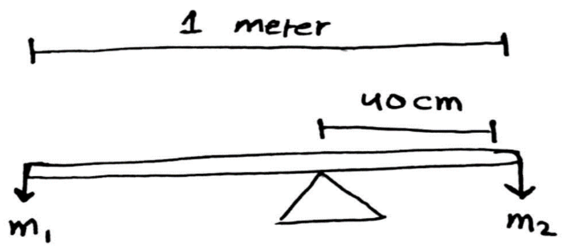
Find → W_f



Q7: A meter stick with mass (m2) hanging right on 40 cm from the pivot. Another mass (m1) is on the other end. Find the total torque. Ignore the mass of the stick.

Given → m_1**,** m_2

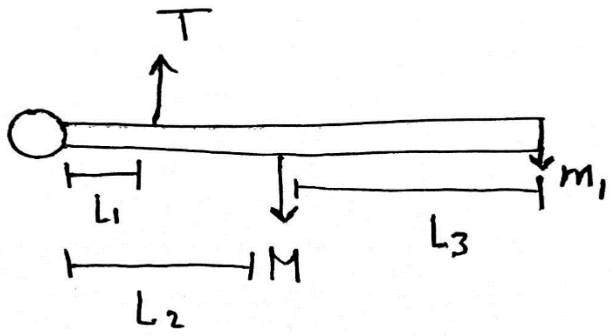
Find → total work



Q8: Forearm muscle.

Given → L_1, L_2, L_3, M, m_1

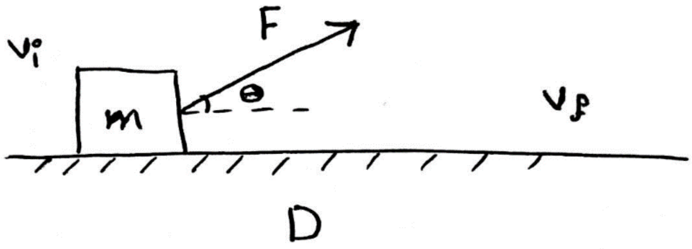
Find → T



Q9: A box with mass (m) is pulled with constant force (F). Ө is above the horizontal.

Given → m, Ө, V_i, V_f, F, D

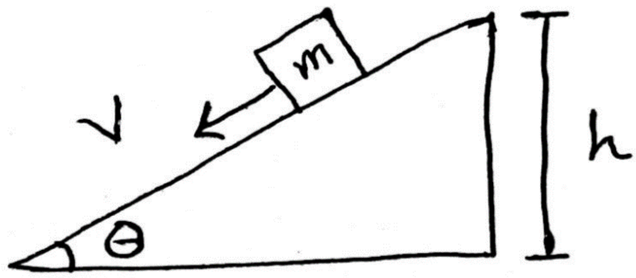
Find → work of friction



Q10: A box with mass (m) is sliding down an incline. Find the work of the gravitational force.

Given → h, Ө, work rate, V

Find → work of gravity



10.Two radioactive nuclides A and B with half-lives T_A and $T_B = 2T_A$.

Assuming the initial numbers of both nuclides are equal, which of the following statements is correct?

A) **Nuclide A decays faster than nuclide B.**
B) **Nuclide A decays slower than nuclide B.**
C) $\lambda_B = 2\,\lambda_A$
D) **The initial activities of A and B are the same.**
E) **None of the above is correct.**

11. The half-life of cobalt source ^{60}Co is $1.66*10^8$s and is widely used in the treatment of cancer. What is the mass (in grams) of a 1000 Ci cobalt source? (1Ci=$3.7*10^{10}$ decays/s, NA=$6.022*10^{23}$ mol^{-1}):

A) 0.761

B) 0.883

C) 0.612

D) 0.600

E) 0.928

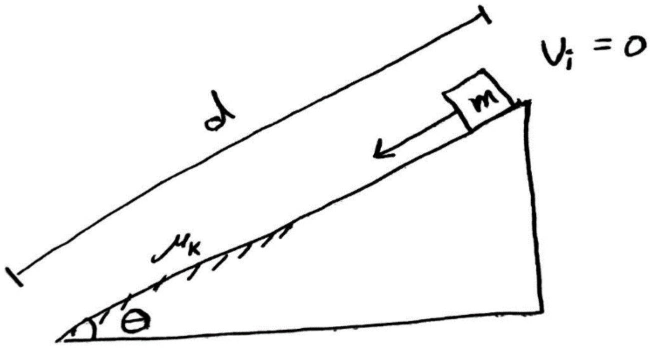
12. The radioactive ^{131}I isotope, which has a half-life of 8.02 days, is used for the diagnosis of the Thyroid gland. A patient was administered 10 micrograms of ^{131}I. After how long (in days) will the amount of iodine in his body become 4.0 micrograms?

A) 0 B) 4.6 C) 5.0 D) 3.1 E) 9.2

Q11: A box is sliding down an incline (half smooth, half rough).

Given → d, h, ϴ, V_i, μ_k, m

Find → V_f

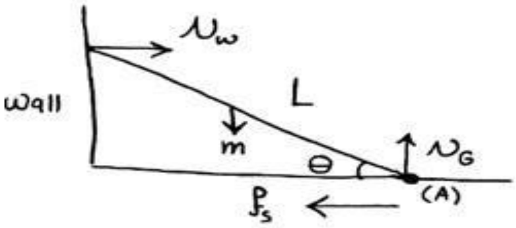


THE END

The only place where success comes before work is in the dictionary.

Solutions:

Q1:



$\tau_{net} = 0$ (A) is axis

$$\tau_{N_w} = \tau_m$$

$$N_w * \sin\theta * L = m * g * \cos\theta * \frac{L}{2}$$

$$N_w = \frac{mg\cos\theta}{2\sin\theta}$$

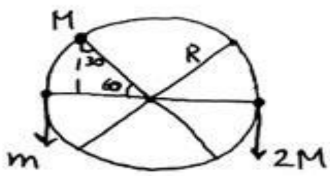
$\rightarrow F_{y_{axis}} = 0 \quad \therefore \quad mg = N_G$

$\rightarrow F_{x_{axis}} = 0 \quad \therefore \quad f_s = N_w \rightarrow f_s = \mu_s N_G$

$\rightarrow \mu_s N_G = N_w \rightarrow \mu_s * mg = \frac{mg}{2} * \tan\theta$

$$\mu_s = \frac{1}{2}\tan\theta$$

Q2:



$\tau_{net} = 0$

$R * Mg * \sin 30 + mg * R = 2Mg * R$

$mgR = 2MgR - MgR\sin 30$ ↳ 0.5

$m = 1.5M$

Q3:

$\left(\pi \frac{A_1}{2}\right)^2 V_1 = \left(\pi \frac{A_2}{2}\right)^2 V_2 \rightarrow$ Find V_1

↳ $P_1 + \rho \frac{V_1^2}{2} + \rho g h = P_2 + \rho \frac{V_2^2}{2} + \rho g h$ ∴

Find P_1

Q4 :

$$\rho_{object} = \frac{T}{T - T'} \rho_{fluid}$$

T → real weight

T' → apparent weight

Q5 :

mass flow rate = $\rho * A * V$

density * area * velocity

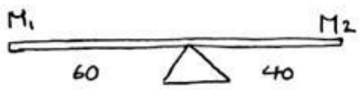
Q6 :

work of friction from A to B = $- M*g*\mu_K*D$

work of friction from B to A = $-M*g*\mu_K*D$

Total work = $-2\ (M*g*\mu_s*D)$

Q7 :



$\tau_{net} = M_1 * 60 * 10^{-2} * g - M_2 * 40 * 10^{-2} * g$

Q8 :

$\tau_{net} = 0$

$T * L_1 = M*g*L_2 + m_1*g*(L_2 + L_3)$

Q9:

$$W_{applied} + W_{friction} = \Delta KE$$

$$F * D * \cos\theta + W_{friction} = \frac{M}{2}(V_f^2 - V_i^2)$$

$$W_{friction} = \frac{M}{2}(V_f^2 - V_i^2) - F * D * \cos\theta$$

Q10:

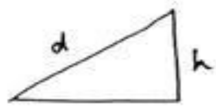
$$W_{Gravity} = F * D$$

$$\text{work rate} = F * V \rightarrow F = \frac{\text{work rate}}{V}$$

$$W_{Gravity} = \frac{\text{work rate}}{V} * D \qquad \rightarrow \sin\theta = \frac{H}{D}$$

$$W_{Gravity} = \frac{\text{work rate}}{V} * \frac{H}{\sin\theta} \qquad D = \frac{H}{\sin\theta}$$

Q11:



$$-W_{friction} = \Delta KE + \Delta PE$$

$$-mg\cos\theta * \mu_k * \frac{d}{2} = \frac{1}{2} * m * (V_f^2 - 0) + mg(0 - h)$$

$$\sin\theta = \frac{h}{d} \rightarrow h = d * \sin\theta$$

$$\hookrightarrow -g\cos\theta * \mu_k * \frac{d}{2} = \frac{1}{2} * V_f^2 - g * d * \sin\theta$$

(CHAPTERS 6/8/9 Continued)

1. The engine of a truck of mass 940 Kg can deliver an average power of exactly 104800 W . If the truck accelerates from rest , the speed in (m/s) after 4.5 s is : (Ignoring Air resistance)

A) 31.7 **B)36.6** **C)4.8** **D) 11.2** **E) 15.1**

2. kg ball is located at the top of 4 m plane inclined at 45 above the horizon as shown, the ball begins to slide down the plane from rest . The upper half of the inclined plane is frictionless, while the lower half is rough , with a coefficient of kinetic friction (μ(k)=0.3) . The speed in (m/s) of the ball at the bottom of the inclined plane is :

A)1.1

B)6.9

C)7.5

D)0.3

E)5.3

3. A horse drags a heavy cart (200 Kg) horizontally on a floor at a constant speed. The power delivered by the horse is 1.06 hp . The coefficient of kinetic friction between the cart and the floor is 0.115 . The speed in (m/s) with which the cart moves across the floor is : (HINT: 1 hp=746 W)

A)11.7 **B) 3.5** **C) 2.1** **D) 0.3** **E)9.0**

4. A box of mass (m) at a height (h) above the floor has a speed (v) . let the total mechanical energy be (E) . A second box of mass m at a height (4h) above the floor has a speed of (2v) . The total mechanica energy for the second box is :

A) **E** **B) 4E** **C)** $2^{\frac{1}{2}E}$ **D) 2E** **E)** $2^{\frac{-1}{2}E}$

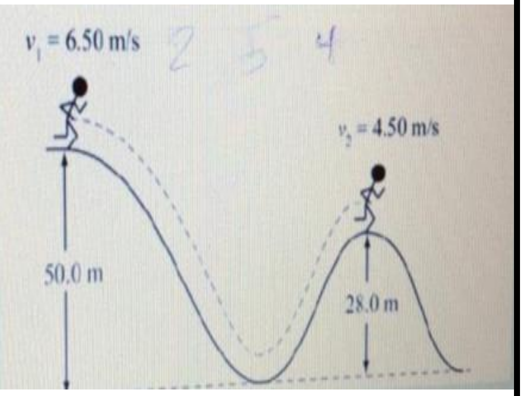
5. When a ball rises vertically to a height of (3h) and returns to its original position. the work done on it by the gravitational force is :

A)+6mgh **B)-6mgh** **C)3mgh** **D)-3mgh** **E)Zero**

6. A box of mass 18 kg is dropped from rest to a height of 80m above the floor . The box falls vertically downward and reaches the floor with a speed of 15m/s . The work done (10^3J) exerted by the air resistance force on the box is :

A)-12 **B)-14** **C)+12** **D)+16** **E)-16**

7. The figure shows a PHY-105student with a mass of 83 Kg . Determine the change in the total mechanical energy ($in\ 10^{+4}$J) between the initial state (speed of 6.5m/s and height of 50 m) and the final state (speed of 4.5m/s and height of 28m) :



A) 1.53

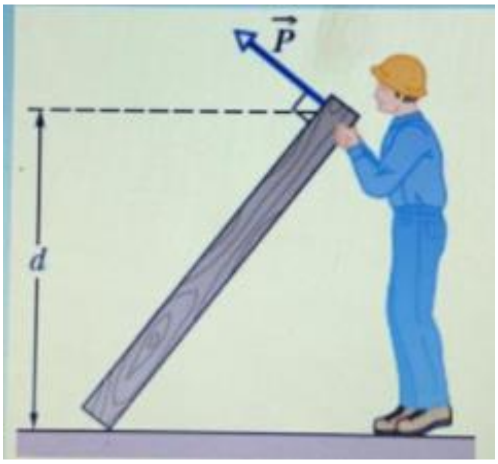
B) 1.89

C) -2.25

D) **-2.36**

E) **-1.80**

8. In order to hold a beam (of weight 500 N and length 2.5 m) at rest . a PHY-105 student exerts a Force P perpendicular to the beam as shown . The vertical distance is 1.5 m . The minimum value for the coefficient of static friction between the beam and the floor can have for the beam not to slip is :



A) **0.67**

B) **0.60**

C) **0.35**

D) **0.56**

E) **0.75**

9. A patient's foot shown in the figure does contact the floor only at P (the heel الكعب does not touch the floor) . The Calf muscle acts on the foot with a force at Point (A) , while the lower leg bones act on the foot with a force at Point (B) . if the patient's weight is 900 N , distance a=5 cm and distance b=15cm . the lower leg bones force (in N) is :

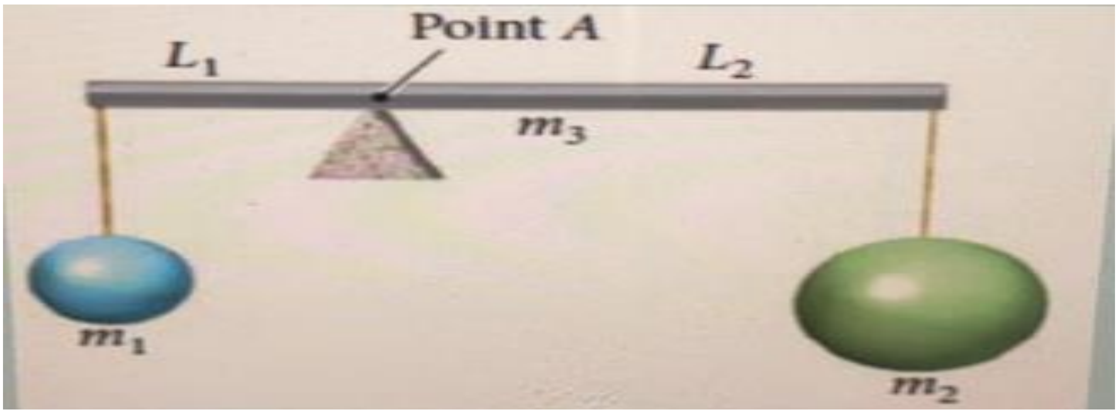
A) **3600 upward**

B) **900 Downward**

C) **5400 downward**

D) **3600 downward**

10. As shown, a rigid rod of mass (M3) is pivoted at point A , where t two masses (M1 and M2) are hanging from it . The hanging mass M2 is e equal to 2M1 , while the rod's mass M3 is equal to 3M1 .The distances L1 and L2 are measured from point A to M1 and M2 RESPECTIVELY. At static equilibrium, the Ratio (L1/L2) :



A) $\frac{2}{5}$ **B)** $\frac{5}{2}$ **C)** $\frac{5}{7}$ **D)** $\frac{7}{5}$ **E)** $\frac{3}{7}$

11. There are two forces acting upon a box as it moves down an incline from Point A to Point B : 2 N applied force directed down the incline and 10 N frictional force . Point A and B are 5 m apart. If the kinetic energy of the box increases by 35 J between A and B , the change in the gravitational potential energy (in J) between A and B is :

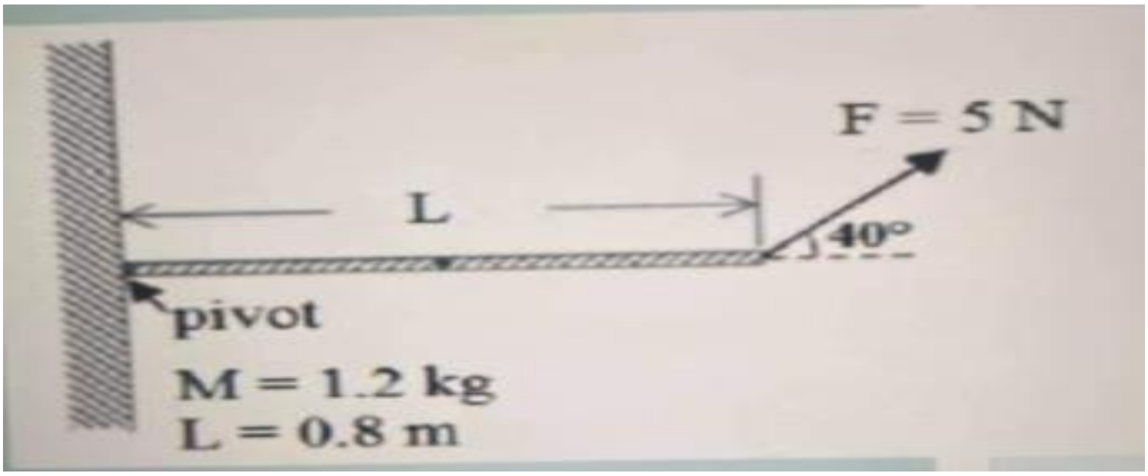
A)-75 **B)+75** **C)+95** **D)-10** **E)-95**

12. Imagine you push a box of mass (M) a distance across a floor with constant speed .the coefficient of kinetic friction between the box and the floor is μ_k . You then pick up the box ,raise it to a height H , carry it back to the starting point and put it back down on the floor. How much work have you done on the box ?

A)Zero
B)$u_k mgd - 2mgh$
C) $u_k mgd + 2mgh$
D) $2u_k mgd + 2mgh$

E) $u_k mgd$

13. A uniform rod of mass M and length L is free to rotate about the pivot as shown in the figure , The net torque (in N.m) on the rod when the force F acts on it is **:**

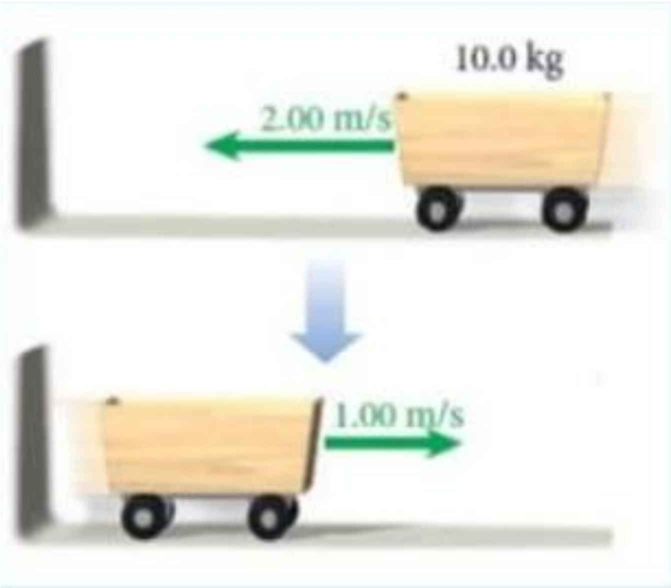


A) 4.7 clockwise
B) 2.1 clockwise
C) 2.6 counterclockwise
D) 7.3 counterclockwise
E) 7.3 clockwise

14. As shown , a bead of mass 0.5 Kg immersed in a certain liquid is released from rest at point A . At point B , the bead has a speed of 6 m/s. The work done on the bead (in J) by the viscosity (friction force) of the liquid is :

A)+9 **B)-15** **C)-5.7** **D)-9** **E)+5.7**

15. The cart shown is heading left towards a wall, colliding with it and bouncing back to the right . The loss in the mechanical energy (In J) during the bounce is : (Assume that right is the positive direction in the coordinate system) **.**



A) +15

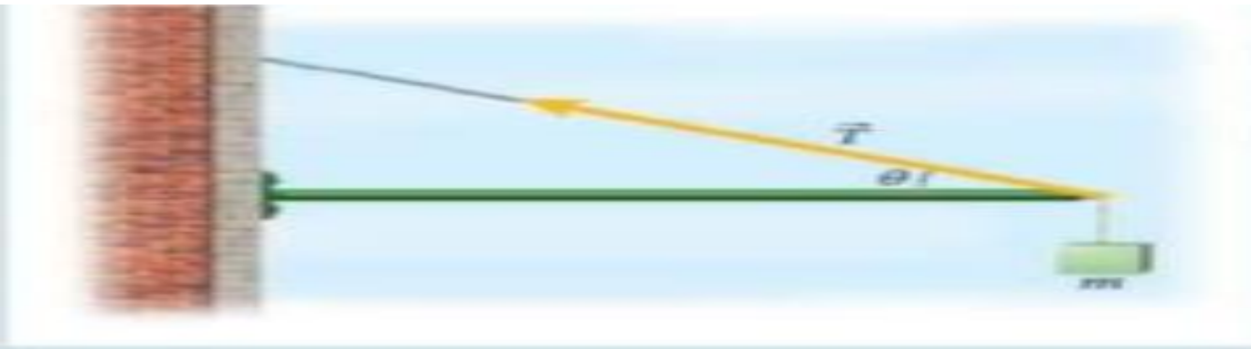
B) +20

C) -15

D) +5

E) +25

16. As shown , the massless bar is hinged to the wall . A cable supports a mass M by making an angle θ with the horizontal . One of the following statements is correct :



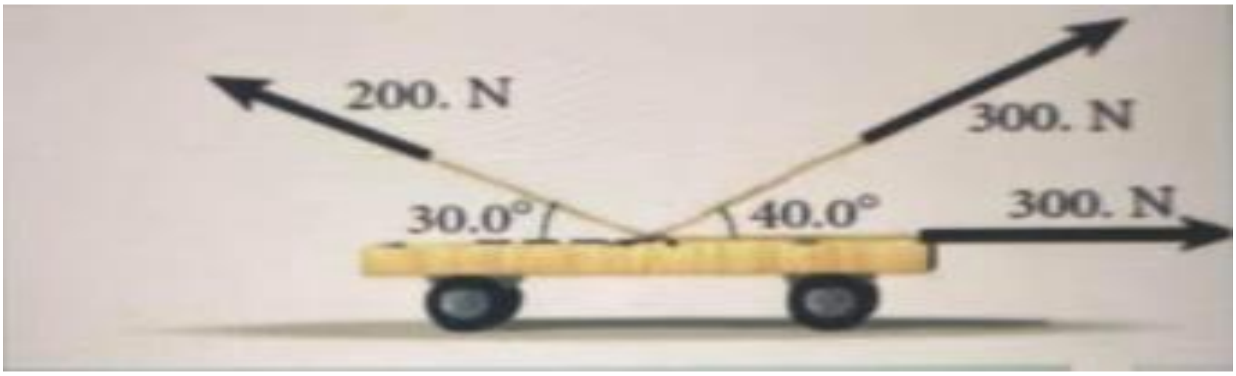
A) **As θ approaches zero the tension T in the cable approaches zero**

B) **As θ approaches zero , the tension T in the cable approaches MG**

C) As θ approaches 90 , then tension T in the cable approaches MG

D) As θ approaches zero,the force from the wall on the bar approaches zero

17. A 125 Kg cart initially at rest is pulled by three ropes at once as shown . When the cart moves a distance of 100 M horizontally on a frictionless level , its final speed (In Km/hr) :



A)19 B)27 C)70 E)24 D)86

18. As shown , a PHY-105 student holds a massive ball (M=7.2Kg) by his hand . The student's upper arm is vertical ,while his lower arm (of mass 1.8Kg) is horizontal .Both the biceps muscle and the bone of the upper arm do act on the lower arm with forces , each at a specific point as shown . The upper arm bone's force (In N) is :

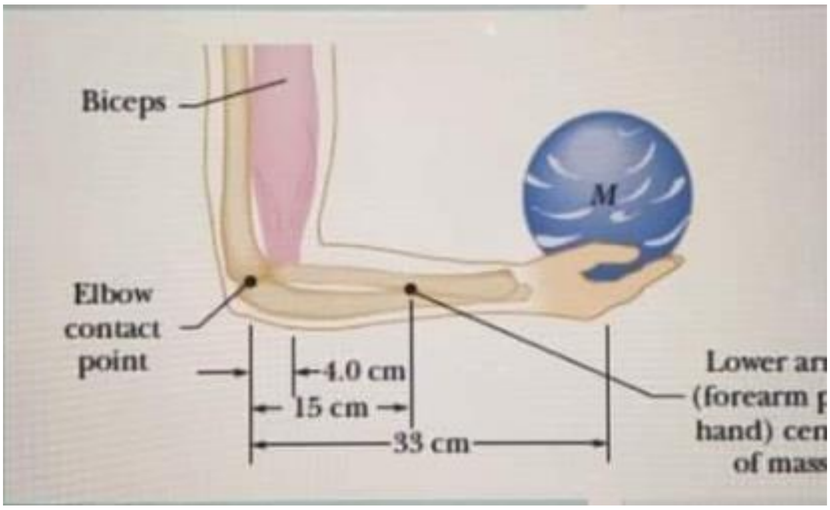
A)560 upward

B)560 downward

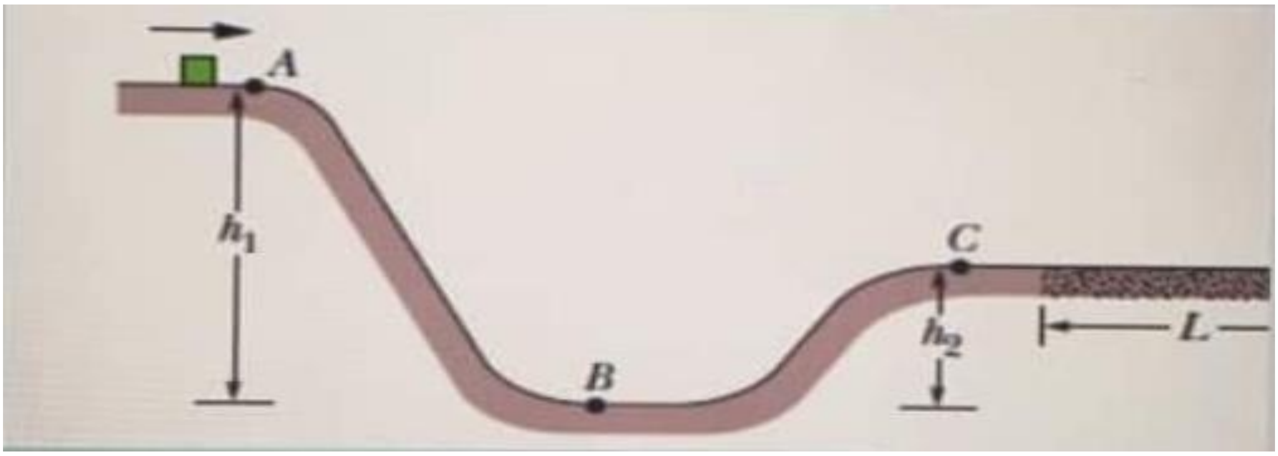
C)88 upward

D)320 downward

E)88 downward

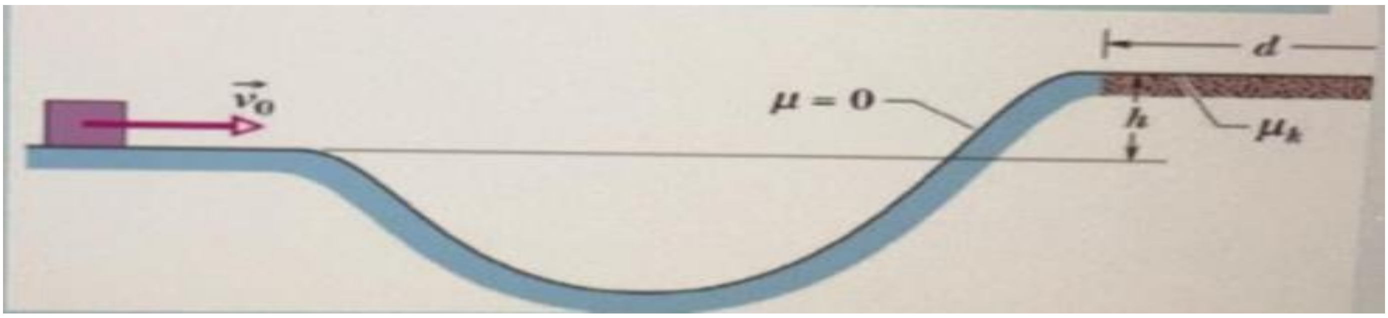


19. As shown , a block slides at point A with an initial speed of 7m/s along the track . All the sections of the track are frictionless until the block reaches the section L(Of length 12 m) ,where the coefficient of kinetic friction is 0.7 . If the height difference h_1, h_1 are 6m , 2m respectively , how far (In m) through the section of friction does the block travel before it comes to a complete stop ?



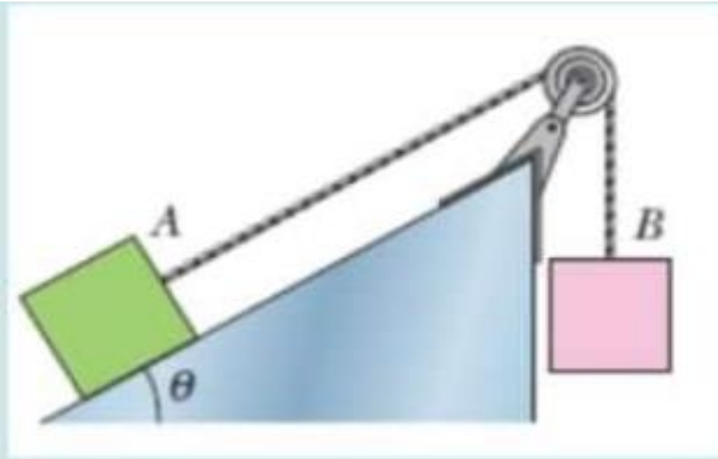
A)10.3 **B)9.3** **C)5.7** **D)6.3** **E)12**

20. As shown, 2 Kg block slides along the track with an initial speed Vo of 6 m/s . The blue section of the track is frictionless , while the horizontal brown section is rough . On the rough section , a frictional force stops the block in a distance Of (d) . If the height difference h is 1.1 m and μ_k is 0.60 . What is d (In m) ?



A)4.5 **B)3.4** **C)1.2** **D)5.7** **E)2.6**

21. The figure shows two blocks released from rest , block A(1 Kg) and block B (2 Kg). The frictionless surface is inclined at an angle of 30 above the horizon . If the pulley has a negligible mass , what is the total kinetic energy of the two blocks (In J) when block B has fallen 25 cm ?



A) 0.5

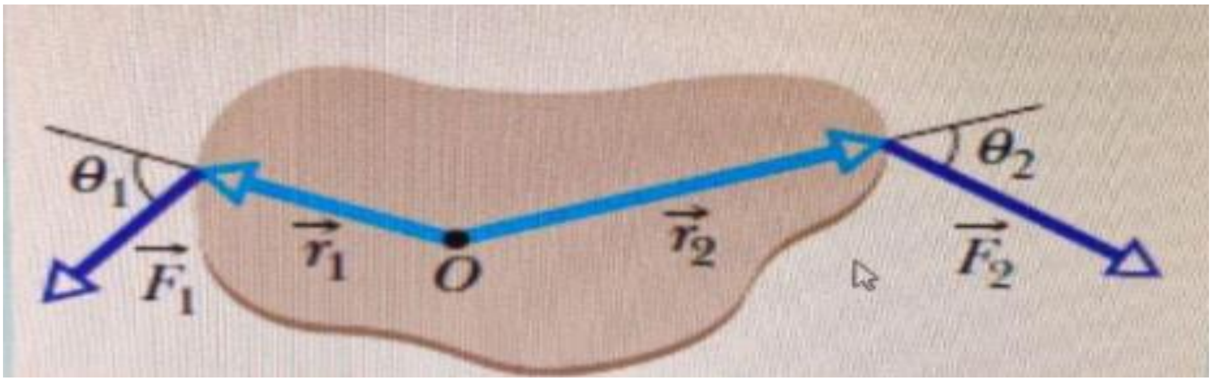
B) 2.78

C) 3.68

D) 7.35

E) 6.13

22. The rigid object shown lies in a horizontal plane and is free to rotate around the pivot .Two forces act on it denoted by $F_1 = 4{,}2N, F_2 = 4{,}9N$ Let $r_1 = 1{,}3m\; r2 = 2{,}15m\; \theta_1 = 75^0\; \theta_2 = 60^0$, then the net torque (In N.m) about O is :



A))-14.37

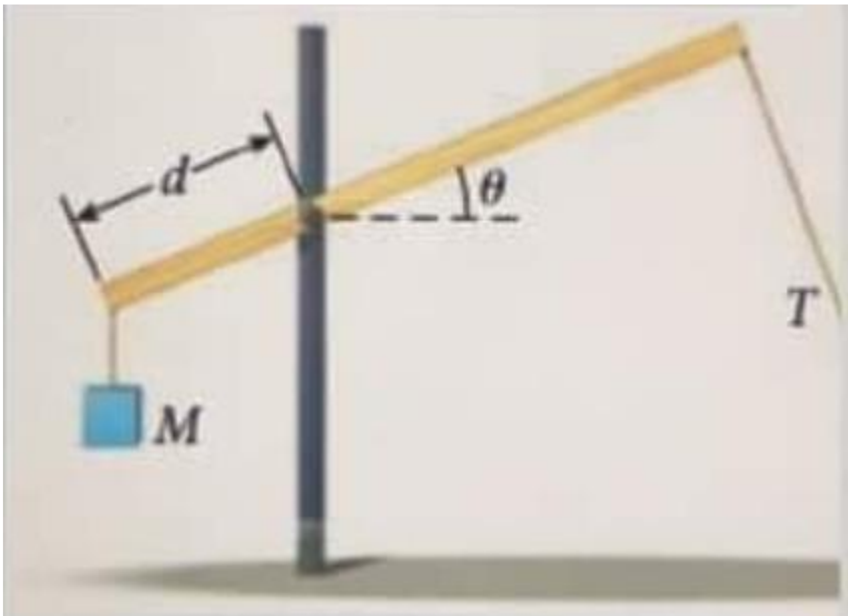
B) -1.07

C) 5.27

D) 14.37

E) -3.85

23. As shown ,a wooden beam with a length of 8 m and a mass of 100 kg is attached by a strong bolt to vertical steel support at a distance d=3 m from the left end . The beam makes an angle (θ=30) wit the horizontal . A huge mass M=500 Kg is attached with a rope to the left end of the beam and a second rope is attached to a right angle (90^0) to the other end of the beam .If the whole system is in static equilibrium , the tension T (In N) in the second rope is approximately :



A)7950

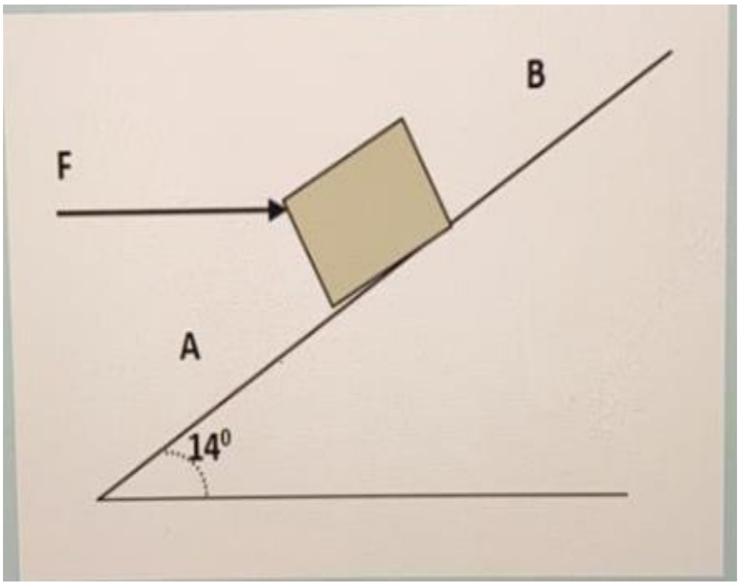
B)1190

C)2380

D)3010

E)14070

24. As shown , a horizontal force F in pushing a 1.4 Kg block up a frictionless 14^0 incline from the point A to point B which are 1.2 m apart .The work exerted by a force denoted by F on the block is 5 J . If the kinetic energy at point B is 4 J. The kinetic energy (In J) at point A is :



A) **0**

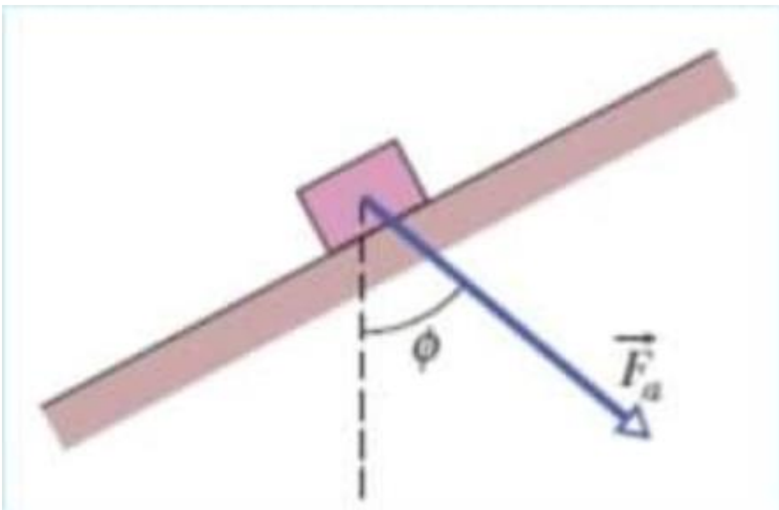
B) **4**

C) **7.2**

D) **3**

E) **5**

25. The figure shown a constant Force denoted by F_a (82 N) acts on a box (3.00 Kg) at angle (∅=53) .As a result , the box moves up the frictionless hill at a constant speed .The work (In J) exerted by that force on the box when the box has inclined a vertical distance of h=0.150 is **:**



A) **4.41**

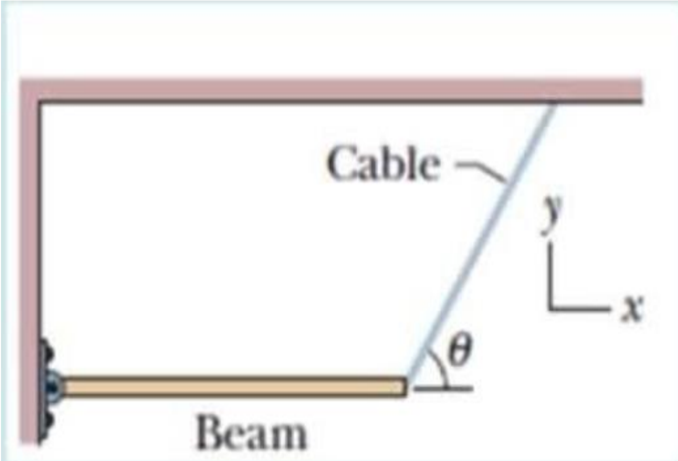
B) **9.8**

C) **7.4**

D) **Zero**

E) **12.3**

26. The 53-Kg uniform beam shown is about 5.0-m long and is supported in a horizontal position by a hinge and a cable .The beam is in a complete static equilibrium when the angle is(θ=60) .As a result, the x-component force (In N) exerted by the hinge on the beam is about:



A) +520

B) +150

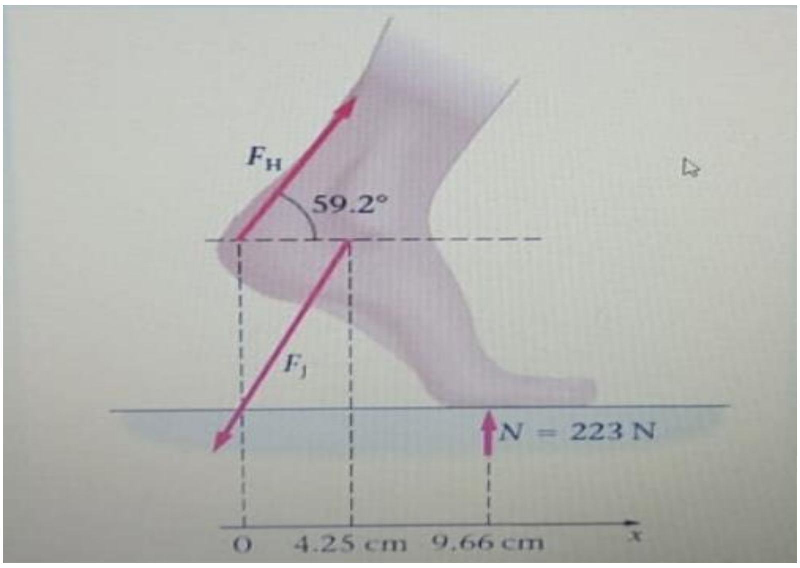
C) +260

D) -260

E) -150

Note :The following questions on the topics of Chapters (6/8/9) are from the final exam 2020 :

27. Three forces act on the foot as shown . F_H is the force exerted by the Achilles tendon on the heel , F_j is the force exerted by the ankle joint on the foot .N is the force exerted by the ground on the toes. The foot is in a complete static equilibrium at the moment of consideration . The magnitude of F_j (In terms of the magnitude of the force N) is :



A) 0.76*N

B) 1.07*N

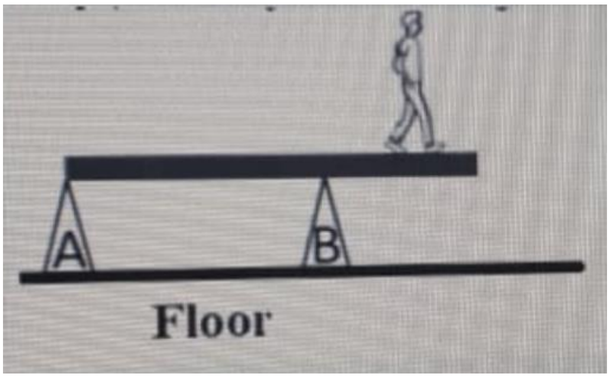
C) 3.11*N

D) 2.39*N

E) 2.80*N

اصعب سؤال بفاينل 020 :(

28. The board shown is at a complete static equilibrium as it rests on the two pivots A and B , which are 4-m apart . A 60-Kg 105-physics student walks slowly towards the right end of the board until he feels that the board is about to tip and lose contact with the pivot A .At the tipping moment , determine how far (In m) the student is from the pivot B .Assume that the length of the board is about 6-m and its mass is 90 Kg .



A) **2.0**

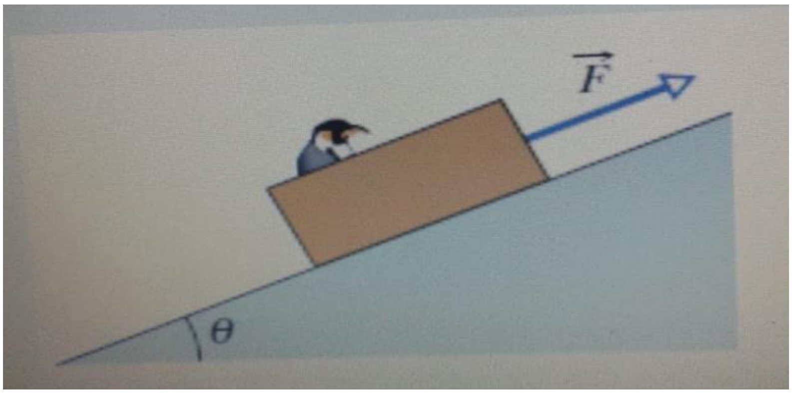
B) **1.5**

C) **1.0**

D) **0.5**

E) **0.8**

29. As shown , a penguin inside a box (total load mass 4-Kg) . initially with zero kinetic energy , is displaced up a frictionless inclined plane by a 50-N force .The magnitude of the normal force on the loaded box from the incline is 13.41 N. When the loaded box is displaced 3 m up the incline , it's speed (In m/s) is :



A) **4.41**

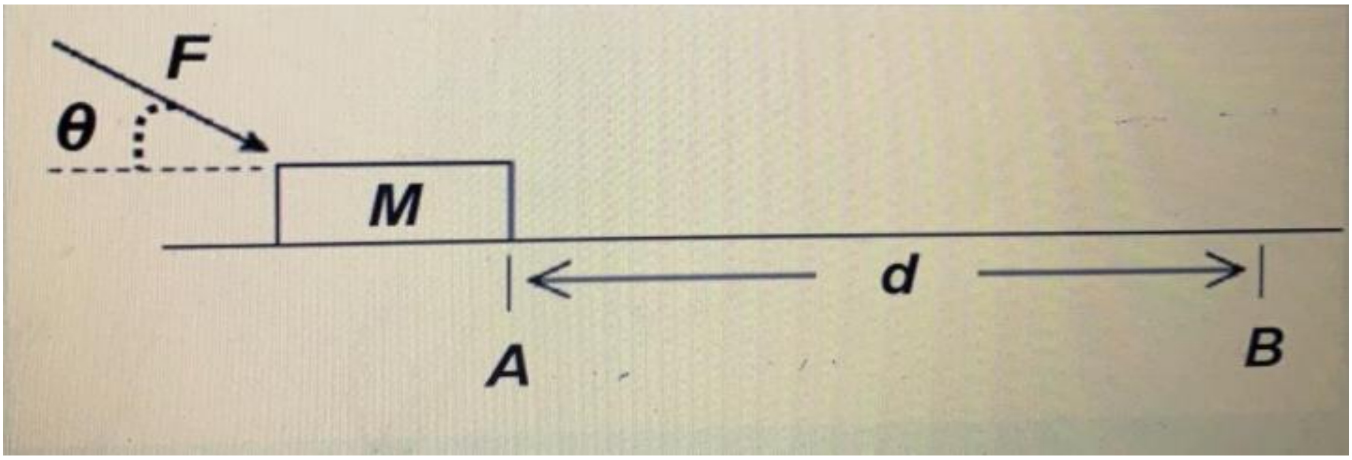
B) **11.41**

C) **7.41**

D) **70.0**

E) **3.29**

30. A box of mass M is pushed on a rough horizontal surface by an external force (F=9.5 N And the angle theta =60 degrees) as shown in the figure below . As the force F pushed the box a distance d=1.0m , the kinetic energy of the box changes from 4 J at point A to 6 J at point B , find the work done on the box by the frictional force between Point A and B :



A) **-2.5**

B) **-2.8**

C) **+2.5**

D) **+2.8**

E) **-3.0**

31. A horizontal plate OAB of a triangular shape is pivoted at point O . Three forces act on the plate as shown in the figure . F1=6.0N ,F2=7.0N and F3=7.0N .F2 is perpendicular to OB . Find the net torque about the vertical axis passing through point O .

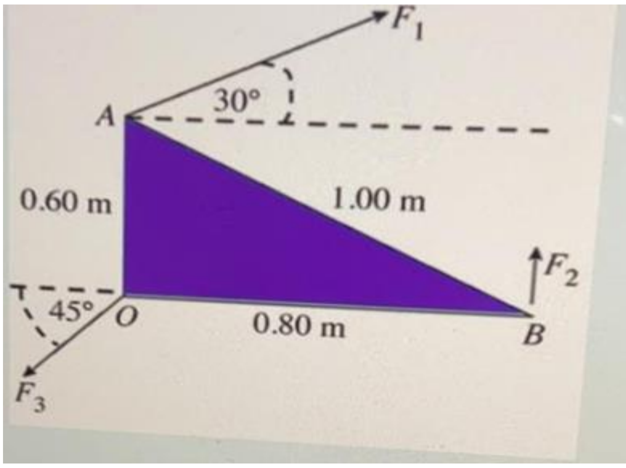
A) **+2.5**

B) **+4.3**

C) **+2.8**

D) **-2.5**

E) **+3.3**



32. A PHY-105 student is investigating the rotational motion of a yo-yo with a mass of 100 g . The outer radius (R) of the yo-yo is 4.7 times greater than the inner radius (r) , as shown in the figure . The PHY-105 student noticed that the yo-yo had reached a complete static equilibrium when a mass m was suspended from its outer edge . The hanging mass m (In g) is :

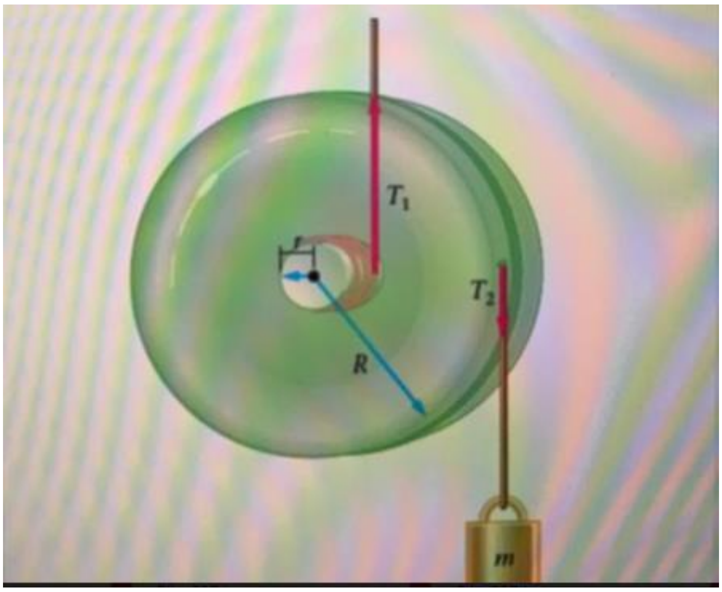
A) **104**

B) **39**

C) **27**

D) **8**

E) **19**



33. We wish to put a car in equilibrium by putting it with a cable as shown in the figure . The 1130-KG car is held in place when the cable makes an angle 31.0 with the frictionless incline . The incline itself makes an angle 25.0 with the horizontal .The normal force in (N) exerted on the car by the incline :

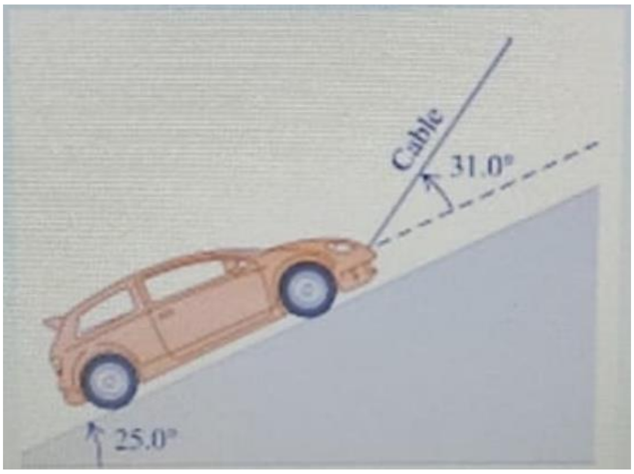
A) $7,2 * 10^3$

B) $1,1 * 10^4$

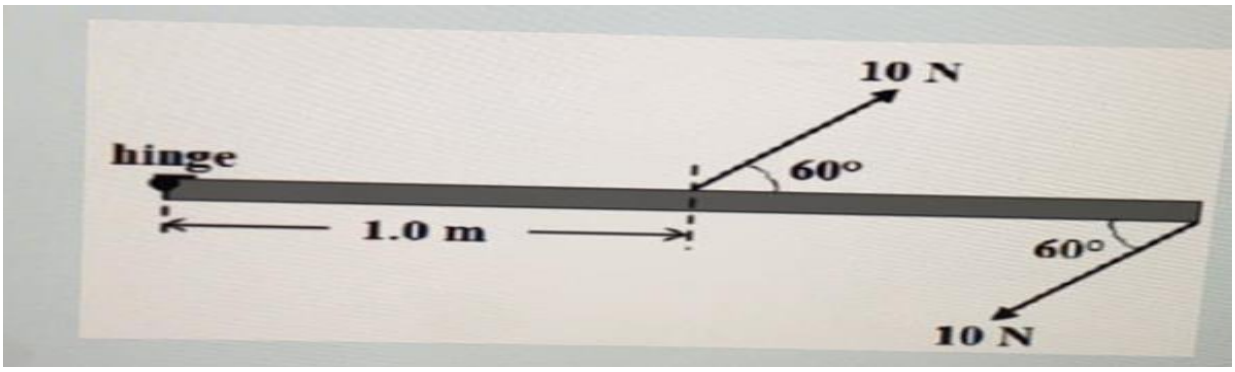
C) $1,1 * 10^3$

D) $2,4 * 10^3$

E) $4,8 * 10^3$



34. A 2 m steel rod is hinged as shown . The net torque (In N.m) exerted by the two forces on the rod about a vertical axis passing through that hinge is :



A) 8.7, clockwise

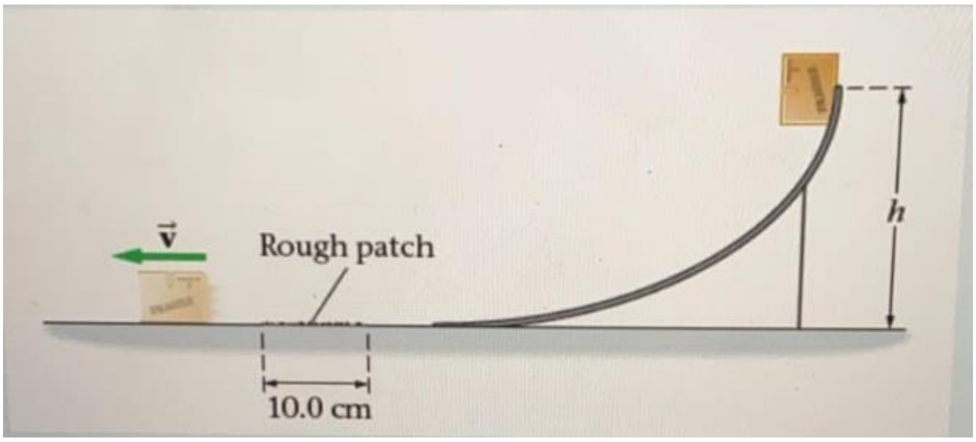
B) 26, clockwise

C) Zero

D) 8.7, counterclockwise

E) 26, counterclockwise

35. From rest, a 2,3 Kg block slides down a frictionless hill and across and then across a rough patch with a length of about 10.00 cm , which has a kinetic coefficient of 0.64 . As shown, the velocity of the block after crossing the rough patch is about 3.5 m/s directed to the left. What is the vertical height of the hill denoted by h in (m/s) :



A) 0.69

B) 0.56

C) 1.06

D) 0.96

E) 0.62

36. A 5.0 kg box slides down a 30.00 degrees incline with an initial speed of 3.5m/s. The coefficient of kinetic friction between the box and the incline is 0.38. What is the acceleration of the block in (m/s^2) ?

A) **1.67 up**

B) **1.67 down**

C) **0**

D) **1.24 up**

E) **1.24 Down**

37. The rod AB is 7.2m long and has a mass of 6 Kg. the 21.5 kg traffic light hangs from the rod. The tension (In N) in the horizontal massless cable CD is :

A) 370

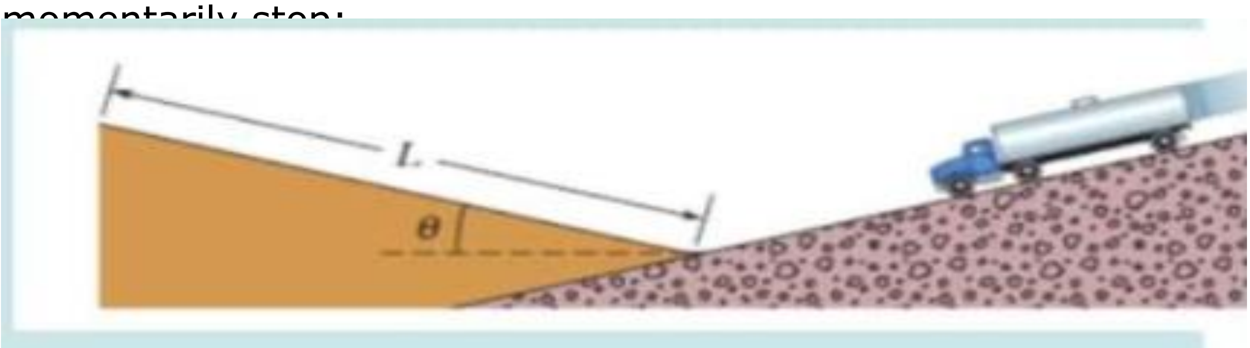
B) 363

C) 408

D) 608

E) 570

38. The speed of the truck just before it goes up a frictionless hill ($\theta = 15\, degrees$) is 130 km/h. The truck's mass is 1.2*10^4 kg. The minimum length of the hill, L (in m), needed so that the truck will momentarily stop:



A) **1808. 8**

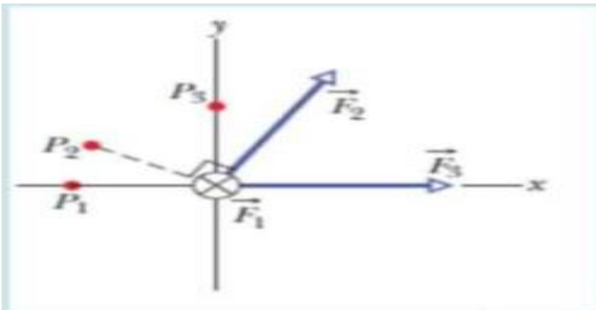
B) **1048.7**

C) **256.8**

D) **66.5**

E) **13.3**

39. As shown , three forces of equal magnitude act on an object at the origin. The force F1 points into the screen. Rank the magnitude of the torque created by these forces at point P1 in descending order (largest first):



A) **F3 ,F2,F1**

B) **F2,F1,F3**

C) **F1,F2,F3**

D) **F1=F2,**

E) **F1,F3,F2**

40. As shown, a wooden rod leans against a ball and rests on a rough horizontal level. The ball is made of pure silk and has a radius of 12.4cm. The rod is 76.2 cm long and has a mass of 333g. The rod is in a completely static equilibrium at the moment of consideration. The horizontal component of the force (in N) exerted by the rough level on the rod is:

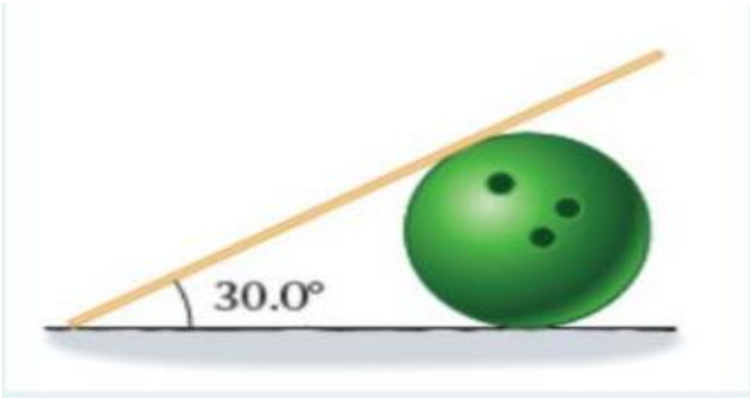
A) **0.47**

B) **0.78**

C) **1.16**

D) **3.02**

E) **1.9**



Success is not in what you have, but who you are!