A ball is thrown at an original speed of 8.0 m/s at an angle of 30° above the horizontal. What is the speed (m/s) of the ball when it returns to the same horizontal level? use g=10 m/s^2 *

(2 نقطة)

- 6
- 5
- 8
- 7

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From given information, $u = 8$ m/s $\theta = 30°$ Then, $T = \frac{2u\sin\theta}{g}$

Then, $T = \frac{2 \times 8 \times \sin 30}{9.8} = \frac{2 \times 8 \times 1/2}{9.8} = 0.81633653S$

and, $v_x = 8$ m/s, and $v_y = 8 - (9.8)(0.816336)$

$= 8 - 8 = 0$

Then $v = \sqrt{v_x^2 + v_y^2} \Rightarrow$ $\boxed{v = 8 \text{ m/s}}$

A ballistic pendulum consists of a (2 kg) block hanging vertically on a (1.5 m) length string. A (10 g) bullet is fired horizontally into a block with a velocity of (500 m/s). the bullet embedded in the block, and the entire system swings through a height h. The height h (in m) above its initial position will the block *

(2 نقطة)

0.31

0.45

0.79

0.60

Here, the momentum is conserved. The collision is inelastic. So, the principle of conservation of energy could not be used here.

According to law of conservation of momentum,

$m \times u = (m+M) \times v$ $w = m \times u / (u+M)$ Here, $m = 10g = 0.01$ Kg $M = 2$ Kg $u = 500$ m/s So, $v = 2.4876$ m/s The height of the pendulum, $h = v^2/2g$

$= 0.3154$ m

The height of ~~momentum~~ pendulum would be 0.31 m

A mass m is traveling at an initial speed Vo = 25.0 m/s. It is brought to rest in a distance of 62.5 m by a force of 15.0 N. The mass **(in Kg)** is:

Select one:

3.00

1.50

3.75

37.5

6.00

$v_0 = 25\ m/s$

$S = 62.5\ m$

$v_f = 0$

If acceleration is f. then:

$v_f^2 = v_0^2 - 2fs$

$\rightarrow f = \frac{(25)^2}{2 * 62.5} = \boxed{5\ m/s}$

If m is the mass then,

$m \times 5 = 15$

$\boxed{m = 3\ kg}$

A mass m is traveling at an initial speed Vo = 20.0 m/s. It is brought to rest in a distance of 80.0 m by a force of 15.0 N. The mass (in :Kg) is

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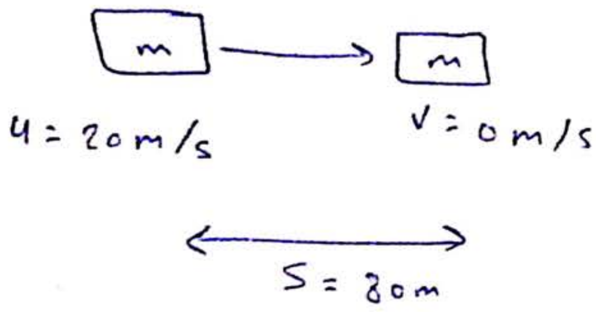
- 1.50
- 3.75
- ● 6.00
- 37.5
- 3.00



we have to apply is force (F) in opposite direction for retardation, So

$$F = ma \quad a = \frac{F}{m} = \frac{15}{m}$$

Now, from equ of Kinetics,

$$v^2 = u^2 - 2as \rightarrow u^2 = 2as$$

$$(20)^2 = 2 * \frac{15}{m} * 80$$

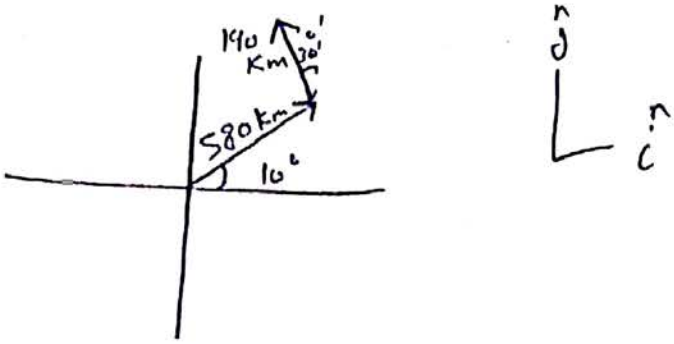
$$\rightarrow 400 = \frac{2 * 80 * 15}{m}$$

$$\boxed{m = 6\,Kg}$$

A plane flies from a base a distance 580 km at a direction of 10.0° north of east for 2 hours and then flies 190 km 30.0° west of north for 1 hour. The magnitude and direction of the plane displacement at the end of this trip are:

Select one:

- 545 km at an angle 29° north of east
- 150 km at an angle 60° west of north
- 280 km at an angle 50° north of east
- 362 km at an angle 40° north of east
- 452 km at an angle 33° north of east



$\vec{d}_1 = 580(\cos 10\,\hat{i} + \sin 10\,\hat{j})$

$\vec{d}_1 = 571.2\,\hat{i} + 100.72\,\hat{j}$ Km

$\vec{d}_2 = 190(-\sin 30°\,\hat{i} + \cos 30\,\hat{j})$

$\vec{d}_2 = -95\,\hat{i} + 164.5\,\hat{j}$ Km

$\vec{d} = \vec{d}_1 + \vec{d}_2$

$= (571.2\,\hat{i} + 100.72\,\hat{j}) + (-95\,\hat{i} + 169.5\,\hat{j})$

$= 476.2\,\hat{i} + 265.22\,\hat{j}$ Km

$d = \sqrt{(476.2)^2 + (265.22)^2}$ Km

$d = 545$ Km

$\theta = \tan^{-1}\left(\dfrac{265.22}{476.2}\right) = 29°$

29° north of east

A rod with a cross sectional area $A = 4.0 \times 10^{-5}\ m^2$ and a length of $L = 5.00$ m stretches $\Delta L = 0.004$ m when subjected to a tension force of $F = 20000$ N. Young's modulus E for this rod is

a) $5.00 \times 10^{11}\ N/m^2$

b) $3.33 \times 10^{11}\ N/m^2$

c) $6.25 \times 10^{11}\ N/m^2$

d) $7.50 \times 10^{11}\ N/m^2$

e) $4.00 \times 10^{5}\ N/m^2$

Ans.

$Correct\ option\ is\ D\ \ E = 7.50 \times 10^{11} N/m^2$

$Given\ Data$

$Force\ F = 20000N \quad Area\ A = 4.0 \times 10^{-5}\ m^2$

$$Stress\ \sigma = \frac{F}{A} = \frac{20000}{4.0 \times 10^{-5}} = 500 \times 10^6\ \ N/m^2$$

$$Strain\ = \frac{Change\ in\ Length}{original\ length} = \frac{\Delta L}{L} = \frac{0.004}{6} = 6.66666 \times 10^{-4}$$

$From\ Hooke's\ Law\ \ \sigma = E\varepsilon$

$\varepsilon = Strain\ E = Young\ Modulus$

$$E = \frac{\sigma}{\varepsilon} = \frac{500 \times 10^6}{6.66666 \times 10^{-4}} = 7.50 \times 10^{11} N/m^2$$

$Correct\ option\ is\ D\ \ E = 7.50 \times 10^{11} N/m^2$

A box weighing 100 N made of Aluminum is pushed on a horizontal surface made of steel. Using the information given in the Table shown below, the minimum force needed to let the box start skidding is

a) 57 N

b) 47 N

c) 74 N

d) 61 N

e) 52 N.

Coefficients of Friction*

	μ_s	μ_k
Steel on steel	0.74	0.57
Aluminum on steel	0.61	0.47
Copper on steel	0.53	0.36
Rubber on concrete	1.0	0.8
Wood on wood	0.25–0.5	0.2
Glass on glass	0.94	0.4
Waxed wood on wet snow	0.14	0.1
Waxed wood on dry snow	—	0.04
Metal on metal (lubricated)	0.15	0.06
Ice on ice	0.1	0.03
Teflon on Teflon	0.04	0.04
Synovial joints in humans	0.01	0.003

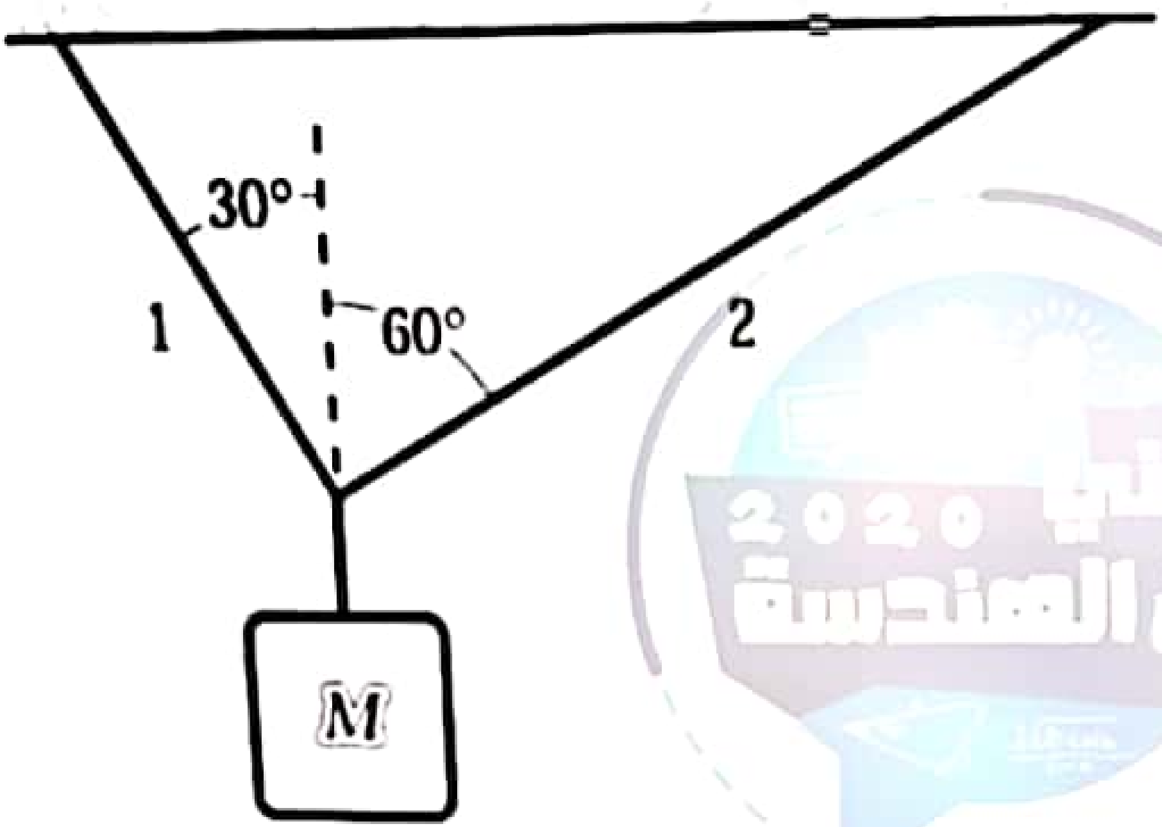
The minimum force needed to move the box

= static friction coefficient × weight of the box

$= 0.74 \times 100$ N

= 74 N

An object of mass M is suspended from the ceiling by two cords as shown. The ratio of the magnitude of the vertical component of the tension in T2 to the vertical component in T1 is:



Select one

- 2
- 1 3
- 3 /

F

$$T_1 \sin 30^\circ - T_2 \sin 60^\circ = 0 \quad -(1)$$

$$T_1 \cos 30^\circ + T_2 \cos 60^\circ = mg$$

From eq. (1)

$$\frac{T_2}{T_1} = \frac{\sin 30^\circ}{\sin 60^\circ}$$

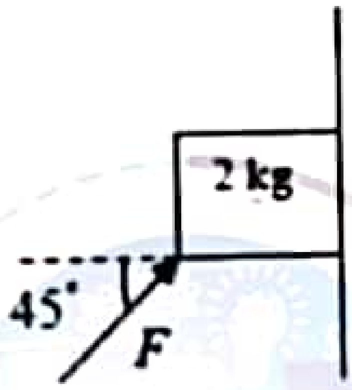
to find

$$= \frac{T_2 \cdot \cos 60^\circ}{T_1 \cos 30^\circ}$$

$$\Rightarrow \frac{\sin 30^\circ \cdot \cos 60^\circ}{\sin 60^\circ \cdot \cos 30^\circ} = \frac{1}{3} = 0.33$$

Ans.

In the figure below, the coefficient of static friction between the 2 kg block and the wall is 0.15. What is the minimum value of the force F (in N) necessary to prevent (يمنع) the block from sliding down?



Select one:

- a. 94.3
- b. 70.7
- c. 47.1
- d. 24.6
- e. 80.3

$\mu = 0.15$

Force of friction $= mg + (-F\cos\theta)$

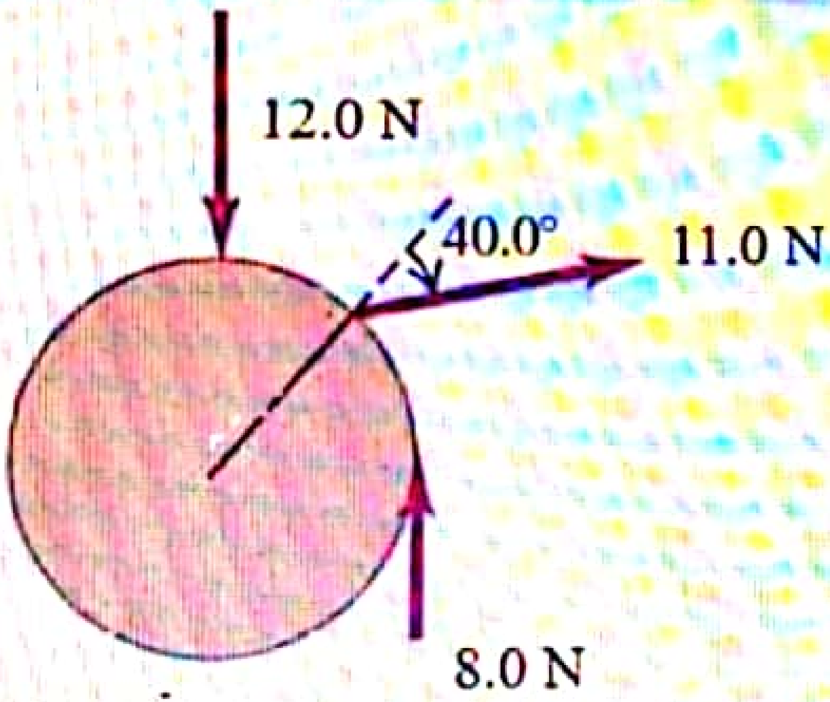
$\mu F \sin\theta = mg + (-F\cos\theta)$

$0.15 \times F \times (\sin 45^\circ) = 2 \times 9.8 + (-F(\cos 45^\circ))$

$$F = \frac{2 \times 9.8}{\left(0.15 \times \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}\right)}$$

$$= \boxed{24.6}\ N$$

The wheel of radius 0.70 m shown in the figure has three forces applied to it. Taking toques that produce counterclockwise rotation as positive, the net torque(in N m) on the wheel due to these three forces for an axis perpendicular to the wheel and passing through its center is:



Select one:

- -2.1
- 10.7

$\mu = 0.15$

Force of friction $= mg + (-F\cos\theta)$

$$\mu F \sin\theta = mg + (-F\cos\theta)$$

$$0.15 \times F \times (\sin 45^\circ) = 2 \times 9.8 + (-F(\cos 45^\circ))$$

$$F = \frac{2 \times 9.8}{\left(0.15 \times \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}\right)}$$

$$= \boxed{24.6}\ N$$

12

Assume that an object is in equilibrium. One of the following statements is false * ?.Which one

(2 نقطة)

The speed of the object remains .constant

The net force acting on the object .is zero

The acceleration of the object is constant

Acceleration of the object is constant is false among the statements.
As we know when object is in equilibrium net force acting on the object is zero as force is zero F=ma
Force is directly proportional to acceleration then the acceleration should also be zero.

An object I with a mass of 4 kg is lifted vertically 3 m from the ground level; another object II with a mass of 2 kg is lifted 6 m up. Which of the following * ?statements is true

(2 نقطة)

Object I has greater potential .energy since it is heavier

Object II has greater potential energy since it is lifted to a higher position

Two objects have the same .potential energy

.non of above

25) $m_1 = 4 kg$, $h_1 = 3 m$

$m_2 = 2 kg$, $h_2 = 6 m$

$(P.E)_I = 4 \times 9.8 \times 3 = 117.6 J$

$(P.E)_{II} = 2 \times 9.8 \times 6 = 117.6 J$

option 'c' is correct → Both object will have same potential energy

19

How many joules of energy are used by a 1.0 hp motor that runs for 1.0 hr? (1 hp = 746 W) *

(2 نقطة)

- 10.7×10^6
- 2.7×10^6
- 8.1×10^6
- 5.4×10^6

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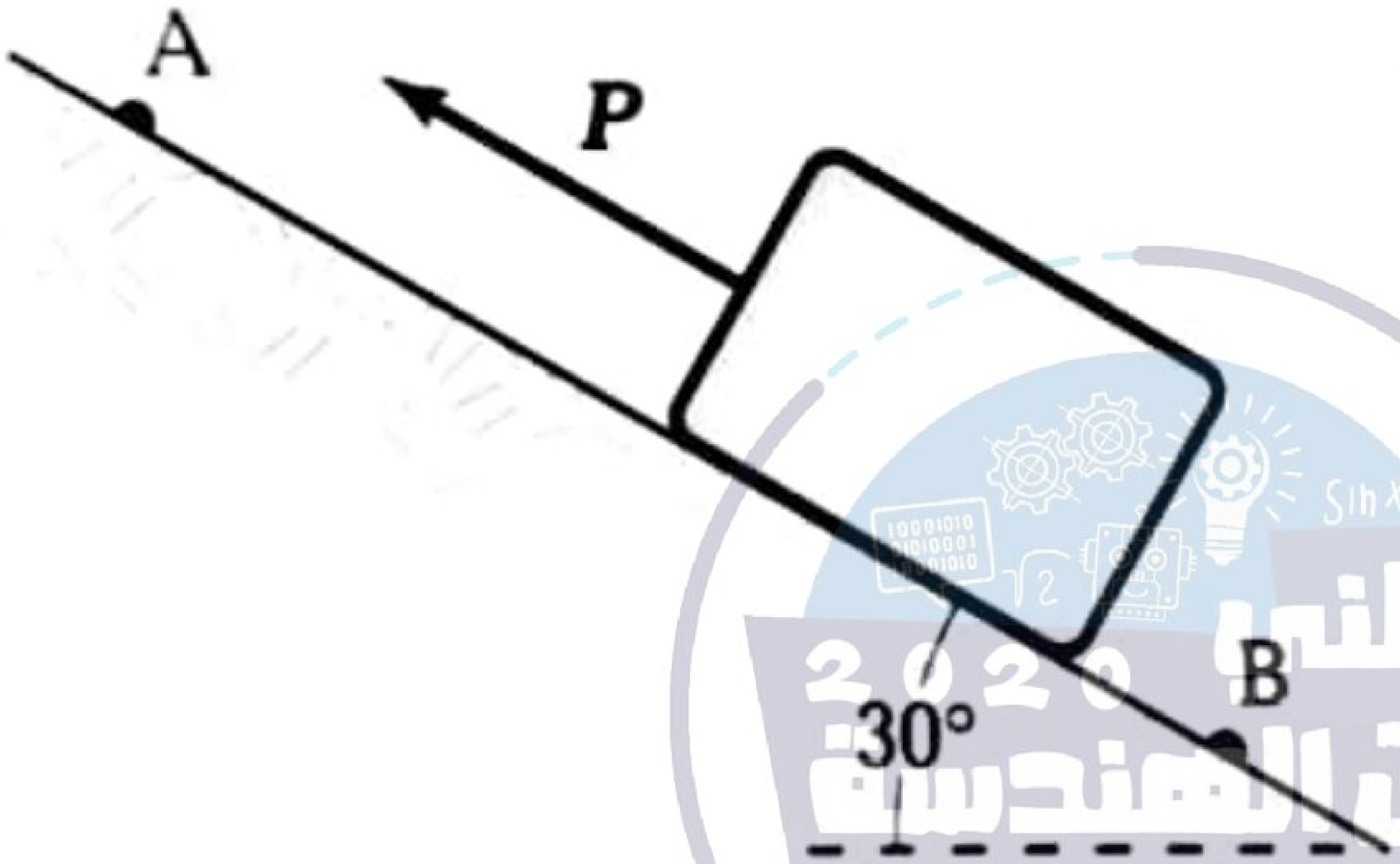
19) $1\,hp = 746\,W$ / $1\,h = 60 \times 60 = 3600\,s$

energy $= 746 \times 3600 = 2685600 \simeq 2.7 \times 10^{6}\,J$

A 2.0-kg block slides down a frictionless incline from point A to point B. A force(magnitude P = 3.0 N) acts on the block between A and B, as shown. Points A and B are 2.0 m apart. If the kinetic energy of the block at A is 10 J, then the Kinetic energy (In J) of the block at B, is:



Select one:

- ○ 17.6
- ○ 26.6
- ◉ 23.6
- ○ 20.6
- ○ 11.6

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A box of mass m = 5.0 kg is pulled by a girl on a horizontal floor a distance 13.0 m with constant velocity. If the coefficient of kinetic friction $\mu_k = 0.5$, the work dor by the girl is

a) 117.6 J
b) 176.4 J
c) 274.4 J
d) 318.5 J
e) 24.5 J

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$Work = W_1 + W_2 = F_1 d \cos\theta + F_2 d \cos\theta$

$0 + 24.5 \times 13 = \boxed{318.5}$

(0 because velocity is constant)

$Friction = F_2 = \mu_K * F_\perp = .5 \times 9.8 \times 0.5 = 24.5\,N$

$F_\perp = g \cdot m \cdot \cos\theta$

A small box of mass m and moving in the positive x-direction with a speed y makes an elastic one-dimensional collision with a box that has four times its mass, and rebounds with a speed 5v in the opposite direction. The initial velocity of the larger box is:

Select one:

- (7/2) v
- (-11/4) v
- 14 v
- 11 v
- (-7/2) v

The car of an elevator has a mass of 3.0×10^3 kg and moves 210 m up the shaft in 21 s at a constant speed. The average power of the engine force is

a) 2.68×10^5 W,
b) 2.94×10^5 W,
c) 2.68×10^5 W,
d) 2.68×10^5 W,
e) 6.17×10^6 W.

$work_T = W_1 + W_2 = F_1 d \cos\theta + F_2 d \cos\theta$

because speed is constant

$+ F mg d \cos\theta$

$3 \times 10^3 \times 9.8 \times 210$

average power $= \frac{6174 \times 10^3}{21} = 2.94 \times 10^5$

A 2.0-kg particle has a speed given by (t^2) m/s, t being in s. The rate (in W) at which the resultant force is doing work on this particle at t = 1.0 s is:

(A) 1.0
(B) 2.0
(C) 3.0
(D) 4.0
(E) 5.0

*Take g= 9.8 m/s²

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$m = 2\,kg \qquad v = t^2 \qquad a = \frac{dv}{dt} = 2t \quad , t = 1.0\,s$

$\text{rate} = m \times v \times a = 2 \times (1)^2 \times 2(1) = 4\,W$

In a given frictionless displacement of a particle, its kinetic energy increases by (35 J) while its potential energy decreases by (10 J). Determine the work (in J) of the non-conservative forces acting on the particle during this displacement? *

(2 نقطة)

- +15
- +25
- −25
- −15

$K_f = K_i + 35$

$P_f = P_i - 10$

$K_i + P_i = K_f + P_f + 35 - 10$

قوة محافظة .

$35 - 10 = 25$

non conservative .

A box with a mass m and moving with a speed of 6.00 m/s makes a completely inelastic collision with another stationary box that has a mass 3m. The final kinetic energy of the wreckage is 40% of the total initial kinetic energy. The final speed (in m/s) of the wreckage is:

Select one:

- (selected) 1.2
- 30
- 0.3
- 0.9
- 0.5

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$K_f = 0.4 * K_i = 0.4 * \frac{1}{2} * 36 * m = 7.2\,m$

$K_{f_I} = \frac{1}{2}(m + 3m) * (V_f)^2 = \frac{2 \times 7.2m}{4m} = V_f^2 = V_f = 1.8$

$\rightarrow K_{f_{II}} = \frac{1}{2} \times \frac{1}{4}\ 7.2 = \frac{1.8}{2} = \boxed{0.9} \rightarrow \frac{1.8}{4} = V^2 = 0.67$

$K_{f_I} - K_{f_{II}} = 1.89 - 0.67 = \boxed{1.2}$ ✓

A 2.0-kg block slides on a rough horizontal surface, as shown in the figure below. The speed of the block is 2.0 m/s before it touches the spring(k = 400 N/m), and 1.0 m/s when it has compressed the spring 0.10m. Determine the work done (in J) by friction on the block during this distance:

(A) -3.0
(B) +3.0
(C) -1.0
(D) -2.0
(E) -4.0

*Take g= 9.8 m/s²

A block of mass m = 1.6 kg initially moving to the right with a speed of 4 m/s on a frictionless, horizontal track collides with a spring attached to a second block of mass m = 2.1 kg initially moving to the left with a speed of 2.5 m/s. the spring constant is 600N/m. the velocity v_{1f} of block one after the collision is:

Select one:

- $3.12\ \hat{\imath}\ m/s$
- $-1.74\ \hat{\imath}\ m/s$
- $-3.38\ \hat{\imath}\ m/s$
- $5.12\ \hat{\imath}\ m/s$

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14

The force an ideal spring exerts on an object is given by Fx = -kx, where x measures the displacement of the object from its equilibrium (x = 0) position. If k = 80 N/m, how much work is done(in J) by this force as the object moves from x = * ?-0.40 m to x = 0

(2 نقطة)

5.6

6.4

7.2

4.8

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14) The work done is → $W = \frac{1}{2} K X^2 = 0.5 (80) (0.40)^2 =$

6.40 J

The net work done by a conservative force on an object around any closed path is: *

(2 نقطة)

- zero.
- positive.
- unknown it depends on the situation.
- negative.

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*The total work done by conservative force is independent of path resulting in a gives dis placment and is equal to zero when the path is closed loop

Ans: zero option A Is correct