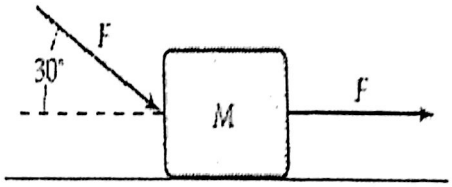
5- The horizontal surface (shown in the diagram) on which the block of mass M slides is frictionless. If F = 20 N and M = 5 kg, what is the magnitude of the resulting acceleration of the block?



a) 5.3 m/s²

b) 6.2 m/s²

c) 7.5 m/s²

d) 4.7 m/s²

e) 3.2 m/s²

14) Three forces, given by $\mathbf{F}_1 = (-2\,\mathbf{i} + 2\,\mathbf{j})$ N, $\mathbf{F}_2 = (5\,\mathbf{i} - 3\,\mathbf{j})$ N, and $\mathbf{F}_3 = (-45\,\mathbf{i})$ N, act on an object to give it an acceleration of magnitude 3.75 m/s^2.

a) What is the direction of the acceleration?
b) What is the mass of the object?
c) If the object is initially at rest, what is its speed after 10 s?
d) What are the velocity components of the object after 10 s?

14) $\sum \mathbf{F} = m\,\mathbf{a}$

$$\left(-2.00\hat{\mathbf{i}} + 2.00\hat{\mathbf{j}} + 5.00\hat{\mathbf{i}} - 3.00\hat{\mathbf{j}} - 45.0\hat{\mathbf{i}}\right) \text{N} = m\left(3.75\ \text{m/s}^2\right)\hat{\mathbf{a}}$$

where $\hat{\mathbf{a}}$ represents the direction of **a**

$$\left(-42.0\hat{\mathbf{i}} - 1.00\hat{\mathbf{j}}\right) \text{N} = m\left(3.75\ \text{m/s}^2\right)\hat{\mathbf{a}}$$

$$\sum \mathbf{F} = \sqrt{(42.0)^2 + (1.00)^2}\ \text{N} \text{ at } \tan^{-1}\left(\frac{1.00}{42.0}\right) \text{ below the } -x\text{-axis}$$

$$\sum \mathbf{F} = 42.0\ \text{N at} 181^\circ = m\left(3.75\ \text{m/s}^2\right)\hat{\mathbf{a}}.$$

a) $\therefore$ $\boxed{\hat{\mathbf{a}} \text{ is at} 181^\circ}$ counterclockwise from the x-axis

b) $$m = \frac{42.0\ \text{N}}{3.75\ \text{m/s}^2} = \boxed{11.2\ \text{kg}}$$

7- The apparent weight (normal force n) of a fish in an elevator is greatest when the elevator

a) moves downward at constant velocity. **b)** moves upward at constant velocity. **c)** accelerates downward. **d)** accelerates upward. **e)** is not moving

Give a detailed answer for the following question

8- A 3.00-kg block starts from rest at the top of a 30.0° incline and slides a distance of 2.00 m down the incline in 1.50 s. Find:

a) The magnitude of the acceleration of the block,

b) The coefficient of kinetic friction between block and plane,

c) The friction force acting on the block.

(a) $x = \frac{1}{2}at^2$:

$$2.00\ \text{m} = \frac{1}{2}a(1.50\ \text{s})^2$$

$$a = \frac{4.00}{(1.50)^2} = \boxed{1.78\ \text{m/s}^2}$$

$\sum \mathbf{F} = \mathbf{n} + \mathbf{f} + m\mathbf{g} = m\mathbf{a}$:

Along x: $0 - f + mg\sin 30.0° = ma$

$f = m(g\sin 30.0° - a)$

Along y: $n + 0 - mg\cos 30.0° = 0$

$n = mg\cos 30.0°$

(b) $\mu_k = \frac{f}{n} = \frac{m(g\sin 30.0° - a)}{mg\cos 30.0°}$, $\mu_k = \tan 30.0° - \frac{a}{g\cos 30.0°} = \boxed{0.368}$

(c) $f = m(g\sin 30.0° - a)$, $f = 3.00(9.80\sin 30.0° - 1.78) = \boxed{9.37\ \text{N}}$

Q(3): Newton's third law gives the relation between two forces acting between two masses:

a) They are equal and opposite b) They are not equal and opposite c) They are equal and perpendicular d) They are not equal and perpendicular

---

Q(4): Two forces $F_1 = (2i + j)$ N and $F_2 = (i + 4j)$ N acting on a mass of 2 kg. The magnitude of the resultant acceleration and its direction are respectively:

a) 5.83 and 59° b) 34 and 45° c) 17 and 76° d) 2.92 and 59°

Q(5): The acceleration of the mass (m = 4 kg) down the incline ($\mu_k = 0.15$) is:

a) 4.9 b) 3.63 c) 8.5 d) 1.3

Q(6): The tension (two masses m and 2m each on a triangular incline with equal base angles)in the string is:

a) $T = \frac{4}{3} mg \sin\theta$ b) $T = \frac{3}{4} mg \sin\theta$ c) $T = \frac{4}{3} mg \cos\theta$ d) $T = \frac{3}{4} mg \cos\theta$

Q(7):The force of a train engine is 45000 N. If this force starts to pull three carriages of equal mass then the tension in the rope pulling the second carriage is:

a) 22500 b) 45000 c) 30000 d) 15000

Q(8): A bullet (m = 50 gm, v = 100 m/s) is fired and stopped after moving 5 cm into a tree trunk. The magnitude of the average reaction force is:

a) 10^3 b) 10^5 c) $5x10^3$ d) 10^2

Q(9): If a horizontal force (29.4 N) is used to pull a crate (m = 20 kg) on a rough surface ($\mu_k = 0.15$) then:

a) $W_{net} = 0$ b) a = 0 c) v = constant d) All of these

5- A rope whose working strength is 2000 N is used to tow a 1000 kg car up a 10° frictionless incline. Find the maximum acceleration that can be given to the car?

a) 3.4 m/s² b) 5.3 m/s² c) 0.3 m/s² d) 0.8 m/s² e) 1.6 m/s²

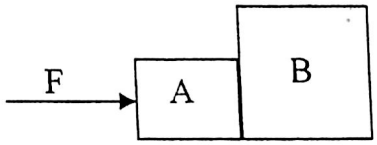
15- An object, of mass m, is suspended by a string from the ceiling inside an elevator. The elevator is traveling upward with a constant speed. The tension in the string:

a) is equal to mg b) is less than mg c) is greater than mg d) varies with the speed of the elevator e) is equal to zero

16- Two objects are travelling in circular orbits. Object A is travelling at twice the velocity of object B in a circle with a diameter of twice that of B. The centripetal acceleration

a) of A and B are the same b) of A is twice that of B c) of A is four times that of B d) of A is half that of B e) of A is three times that of B

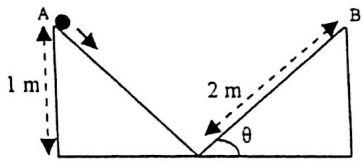
17- Two boxes are in contact with each other on a frictionless ground. Box B has twice the mass of box A. If you push on box A with a horizontal force F, then box B will experience a contact force of:



a) 2/3 F b) F c) 4/5 F d) 3/4 F e) 1/2 F

5

8- A small ball of mass 0.2 kg is released from rest at point A and is sliding without a friction as shown in the figure. In order for it to reach point *B* and momentarily stay at rest there, what should be the angle (θ) of the inclined plane?



a) 60° **b)** 50° **c)** 45° **d)** 30° **e)** 20°

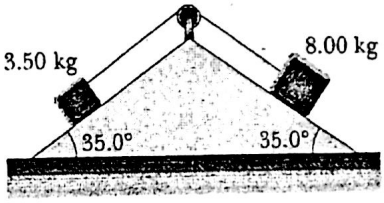
5

Give a detailed answer for the following question

9- Two blocks of mass 3.50 kg and 8.00 kg are connected by a massless string that passes over a frictionless pulley. The inclines are frictionless.

a) Find the magnitude of the acceleration of of the system

b) Find the tension in the string.



9)

$$\sum F_1 = m_1 a_1 : \quad -m_1 g \sin 35.0^\circ + T = m_1 a$$
$$\sum F_2 = m_2 a_2 : \quad m_2 g \sin 35.0^\circ - T = m_2 a$$

$$-(3.50)(9.80)\sin 35.0^\circ + T = 3.50\,a$$
$$(8.00)(9.80)\sin 35.0^\circ - T = 8.00\,a.$$

Adding, we obtain

$$+45.0\ \text{N} - 19.7\ \text{N} = (11.5\ \text{kg})\,a.$$

(b) Thus the acceleration is

$$\boxed{a = 2.20\ \text{m/s}^2}.$$

By substitution,

$$-19.7\ \text{N} + T = (3.50\ \text{kg})(2.20\ \text{m/s}^2) = 7.70\ \text{N}.$$

(a) The tension is

$$\boxed{T = 27.4\ \text{N}}.$$

Q(3): Newton's third law gives the relation between two forces acting between two masses:

a) They are equal and opposite b) They are not equal and opposite c) They are equal and perpendicular d) They are not equal and perpendicular

---

Q(4): Two forces $F_1 = (2i + j)$ N and $F_2 = (i + 4j)$ N acting on a mass of 2 kg. The magnitude of the resultant acceleration and its direction are respectively:

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Q(5): The acceleration of the mass (m = 4 kg) down the incline ($\mu_k = 0.15$) is:

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a) 10^3 b) 10^5 c) 5×10^3 d) 10^2

Q(9): If a horizontal force (29.4 N) is used to pull a crate (m = 20 kg) on a rough surface ($\mu_k = 0.15$) then:

a) $W_{net} = 0$ b) a = 0 c) v = constant d) All of these

14- Three forces, given by $\mathbf{F}_1 = (-2\,\mathbf{i} + 2\,\mathbf{j})$ N, $\mathbf{F}_2 = (5\,\mathbf{i} + 18\,\mathbf{j})$ N, and $\mathbf{F}_3 = (17\,\mathbf{i})$ N, act on an object to give it an acceleration of magnitude 3.75 m/s^2.

a) What is the direction of the acceleration?

b) What is the mass of the object?

c) If the object is initially at rest, what is its speed after 10.0 s?

d) What are the velocity components of the object after 10.0 s?

14) $\Sigma F = ma$

$\vec{\Sigma F} = (-2i + 5i + 17j) + (2j + 18j) = m(3.75)$

$\vec{\Sigma F} = (20i + 20j) = (3.75)m$

$\vec{\Sigma F} = 28.28\ N$ at $\tan^{-1}\left(\frac{20}{20}\right) \Rightarrow 45^\circ$

a) a at 45° from +ve x-axis

b) $m = \frac{F}{a} = \frac{28.28}{3.75} = 7.54\ kg$

c) $\vec{V_f} = \vec{V_i} + at = 0 + (3.75 \text{ at } 45^\circ)10 \Rightarrow \vec{V_f} = 37.5\ m/s \text{ at } 45^\circ$

$\vec{V_f} = 37.5 \cos 45\, i + 37.5 \sin 45\, j = 26.5i + 26.5j$

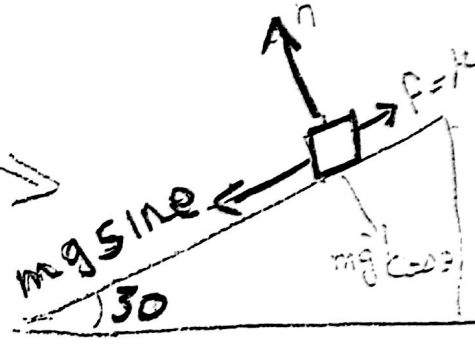
$|V_f| = \sqrt{(26.5)^2 + (26.5)^2} = 37.5\ m/s$

d) from c) $\vec{V_f} = 26.5i + 26.5j\ m/s$

(8) A 3.0 kg block starts from rest at the top of a 30° rough incline. If it slides 3.0 m with constant acceleration down the incline in 2 s, find the following:

1) Show all forces acting on the block.
2) The acceleration of the block.
3) The coefficient of kinetic friction between the block and the incline.

a)



b) $3 = \Delta X = \frac{1}{2} a t^2 = \frac{1}{2} a (2^2)$

$\rightarrow$ $a = 1.5\ m/s^2$

c) $mg \sin 30 - \mu mg \cos 30 = ma$

$(g \sin 30 - a) = \mu g \cos 30$

$\mu = \frac{g \sin 30 - 1.5}{g \cos 30} \simeq 0.4$

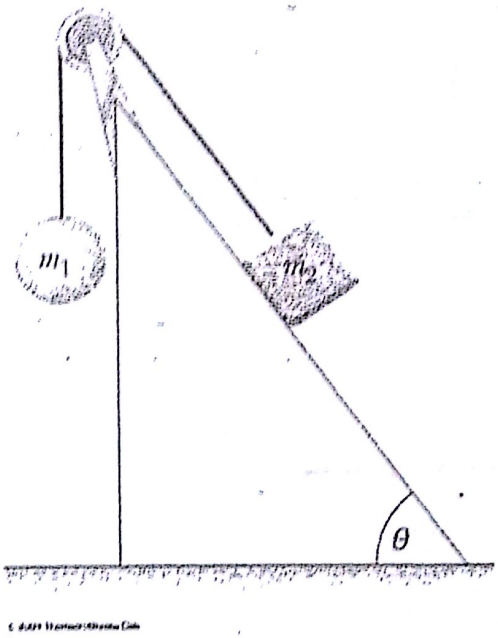
Give a detailed answer for the following question

8- Two blocks (of masses m_1&m_2) are connected by a light string that passes over a frictionless pulley, as shown in Figure. If the coefficient of kinetic friction between the block of mass m_2 and the incline is 0.10. $m_1 = 10$ kg, $m_2 = 5$ kg, and $\theta = 30°$, Find the following:-

a) The frictional force

b) The acceleration of the two blocks

c) The tension in the string



المطلوب في المسألة رقم (8) بدرجة واحدة فقط

a) $f = \mu n = \mu mg\cos\theta$

$= (0.1)(5)(9.8)\cos 30 = \underline{4.24\ N}$

b) $mg - T = ma \Rightarrow 98 - T = 10a \quad (1)$

$T - \mu mg\cos 30 - mg\sin 30 = 5a$

$T - 4.24 - 24.5 = 5a \Rightarrow T - 28.74 = 5a$

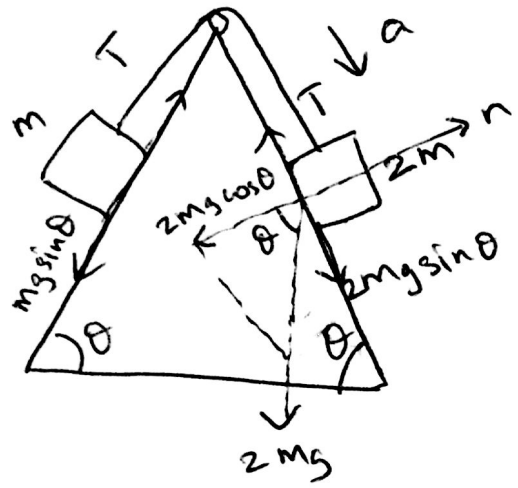
From (1) & (2)

$a = \underline{4.62\ m/s^2}$

c) From (1) or (2)

$T = \underline{51.8\ N}$

Pg-6 : Q-6



$2mg\sin\theta - T = 2ma$

$T - mg\sin\theta = ma$

$\therefore a = \frac{g\sin\theta}{3}$

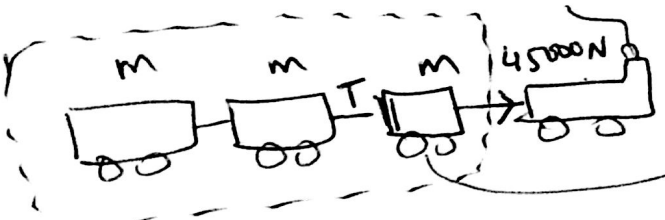
$T = mg\sin\theta + ma$

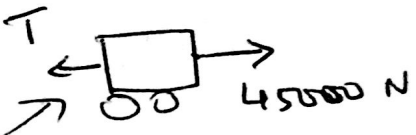
$= mg\sin\theta + \frac{mg\sin\theta}{3}$

$= mg\sin\theta\left(1 + \frac{1}{3}\right)$

$T = \frac{4}{3}mg\sin\theta$

P-6
Q-7





$\Sigma F_x = 45000 - T = ma$

$T = 45000 - ma$

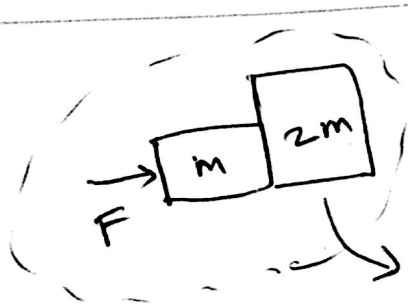
$\Sigma F_x = F = ma$

$45000 = 3ma$

$a = \frac{45000}{3m} = \frac{15000}{m}$

$T = 30000$

P-8
Q-17



$\Sigma F_x = F = (m+2m)a$

$a = \frac{F}{3m}$

$F_{contact} = 2ma$

$= 2m \frac{F}{3m} = \frac{2}{3}F$