Nishant Jindal

DPP - 1

FRICTION

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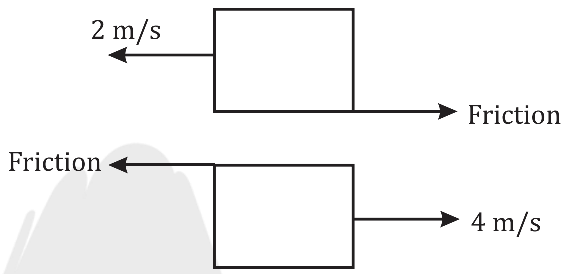
1. (A) left direction

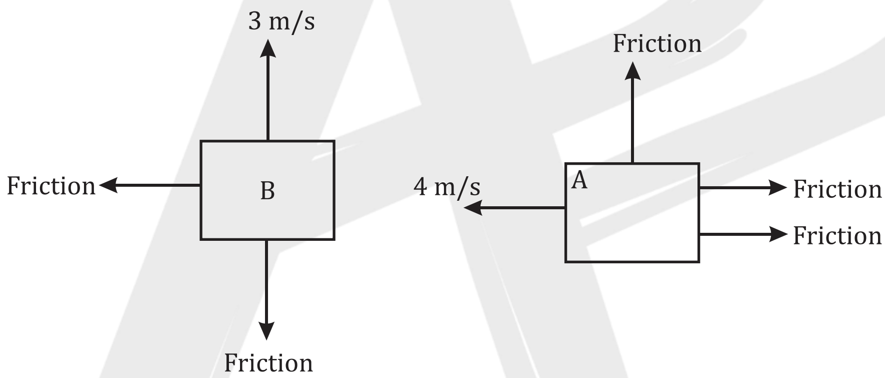
(B) Right direction

(c) on 1 →



(D) Right direction

(E)



2. (A) left direction

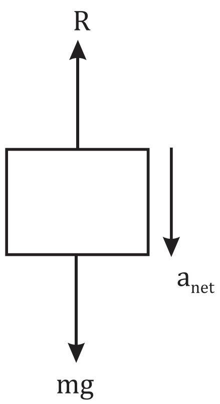
(B) left direction

(c) Right direction along inclined plane.

(D) In right direction

(E) In Right direction because Pseudo on 2 kg will be 6 N so resultant of 5 N and 6 N will work in left direction so friction will act in right direction.

3.



force eq^n $\Rightarrow W - R = ma_{net}$

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$R = W - ma_{net}$

$= (10 + 20 \times 3) \times 10 - (10 + 20 \times 3) \times 0.2$

$= 700 - 14$

$R = 686$ N

4. $a = \mu g = 0.4 \times 10 = 4$ m/sec^2.

initialy sliping ie $u = 0$

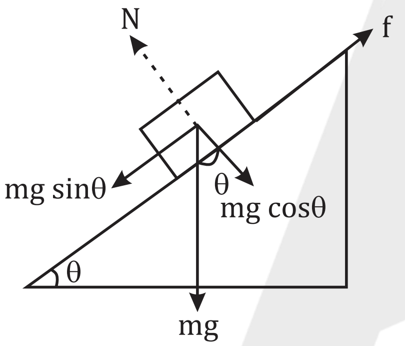
final satuation $v = 2$ m/sec

$\therefore v^2 = u^2 + 2ad$

$(2)^2 = 0 + 2 \times 4d$

$d = 0.5$ meter

5.



$\because N = Mg\cos\theta$

$f = Mg\sin\theta$

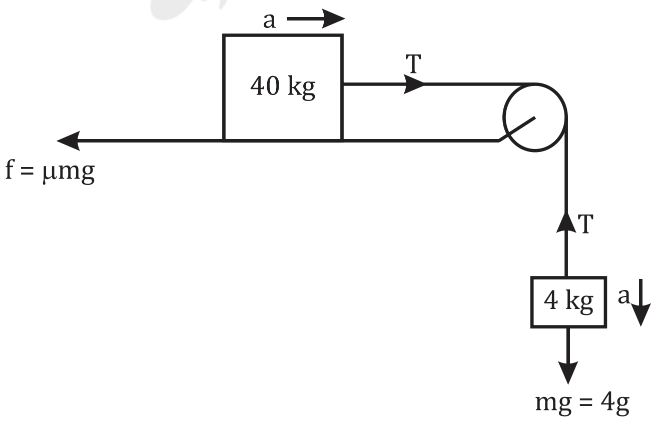
because there is no acceleration (speed is constant)

contact force $= \sqrt{N^2 + f^2}$

$= \sqrt{(Mg\cos\theta)^2 + (Mg\sin\theta)^2}$

$= Mg$

6.



$T - \mu mg = 40a$

$T - 0.02 \times 40 \times 10 = 40a$

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$T - 40a = 8$ ...(i)

$4g - T = 4a$

$40 - T = 4a$

$T + 4a = 40$ ...(ii)

from eq^n (i) & (ii)

$T - 40a = 8$

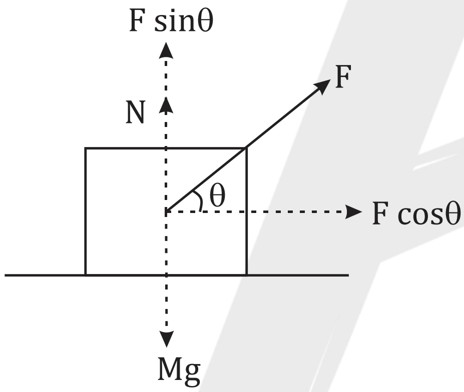
$-T \pm 4a = -40$

$-44a = -32$

$a = \frac{32}{44} = \frac{8}{11}$

$a = \frac{8}{11}\ m/sec^2$

7.



$N = Mg - F\sin\theta$

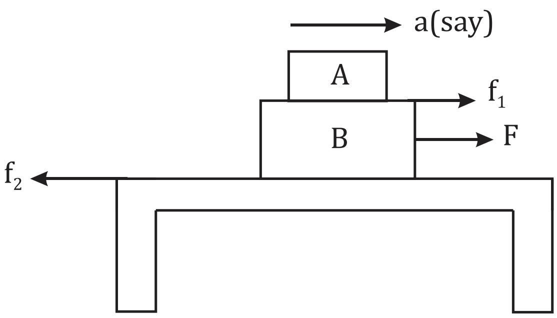
$N = Mg - F\sin\theta$

$F\cos\theta - \mu_K R = Ma$

$a = \frac{F\cos\theta}{M} - \frac{\mu_K}{M}(Mg - F\sin\theta).$

$a = \frac{F}{M}\cos\theta - \mu_K\left(g - \frac{F}{M}\sin\theta\right)$

8.



Pseudo on $A = m_1 a = 1 \times a = a$

Pseudo of $A = f_1$

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$a = \mu M_1 g = 0.2 \times 1 \times 10$

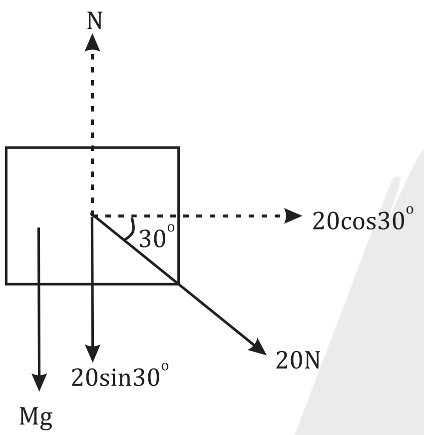
$a = 2\ m/sec^2$

$F = (m_1 + M_2)a + \mu(M_1 + M_2)g$

$= (1+3) \times 2 + 0.2(1+3) \times 10 = 8 + 8$

$F = 16\ N$

9. Case I



$N = 20\sin 30° + Mg$

$= 10 + 50$

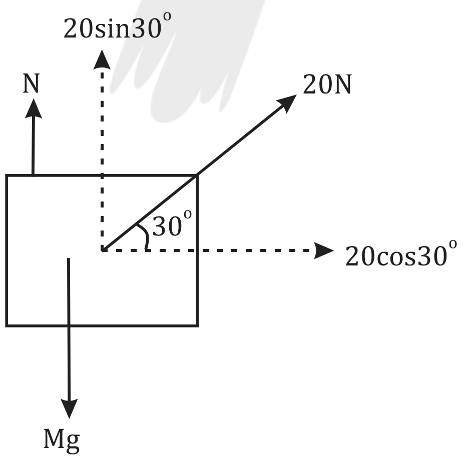
$N = 60$ Newton

$Ma_1 = 20\cos 30° - \mu N$

$Ma_1 = 5.3$

$a_1 = 1.06\ m/sec^2$

Case II



$N + 20\sin\ 30° = Mg$

$N = 40$ Newton

$Ma_2 = 20\cos 30° - \mu N$

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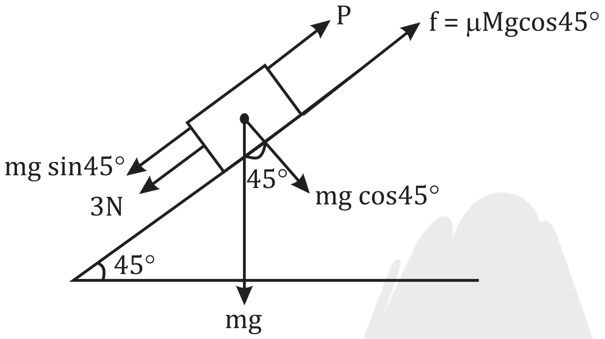
$= 20\frac{\sqrt{3}}{2} - 0.2 \times 40$

$Ma_2 = 9.3$

$a_2 = 1.86\ \text{m/sec}^2$

$a_2 \sim a_1 = 0.8\ \text{m/sec}^2$

10.



In balanced condition

$3 + \text{Mg}\sin 45^\circ = P + \mu\ \text{Mg}\cos\ 45^\circ$

$$3 + \frac{10 \times 10}{\sqrt{2}} = P + \frac{0.6 \times 10 \times 10}{\sqrt{2}}$$

$$P = 3 + \frac{40}{\sqrt{2}}$$

$= 3 + 28.29$

$P \simeq 32$ Newton

11. In rest mode

$T = M_1 g$ ...(i)

$T = (m + m_2)\mu g$ ...(ii)

for no motion

$(m + m_2)\mu g > M_1 g$

$$m + m_2 > \frac{M_1}{\mu}$$

$$m > \frac{M_1}{\mu} - M_2$$

$$m > \frac{5}{0.15} - 10$$

$m > 23.3$ kg

ie option (B) is suitable.

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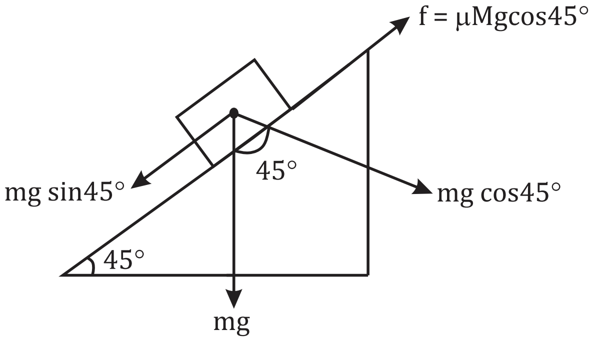
12.



Case I

With Rough inclined plane

$ma_1 = Mg\sin\ 45^\circ - \mu\ Mg\cos 45^\circ$

$a_1 = \frac{g}{\sqrt{2}}(1-\mu)$

Case II smooth inclined surface

$Ma_2 = Mg\sin\ 45^\circ\ (\because\ f = 0 \text{ for smooth surface })$

$a_2 = g/\sqrt{2}$

$$\because\ d = \frac{1}{2}at^2 \Rightarrow t = \sqrt{\frac{2d}{a}}$$

ie $t_1 = \sqrt{\frac{2d}{a_1}}$ and $t_2 = \sqrt{\frac{2d}{a_2}}$.

$\because\ nt_2 = t_1$

$\frac{t_1}{t_2} = n \Rightarrow \left(\frac{t_1}{t_2}\right)^2 = n^2$

$$\Rightarrow \frac{a_2}{a_1} = n^2 \Rightarrow \frac{1}{1-\mu} = n^2 \Rightarrow \frac{1}{n^2} = 1-\mu$$

$\mu = 1 - \frac{1}{n^2}$