

# (FRICTION)

## EXERCISE

6

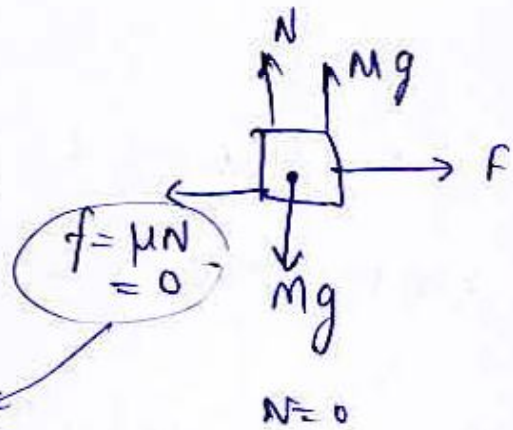
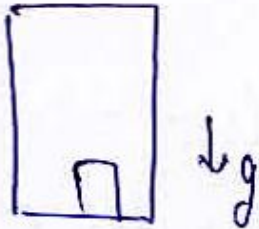
1) ~~1.5~~  
~~0.75~~

$$\mu = \tan \theta = 0.75 = \frac{3}{4}$$

$$\theta = 37^\circ$$

Ans (2)

2)



f = \mu N = 0

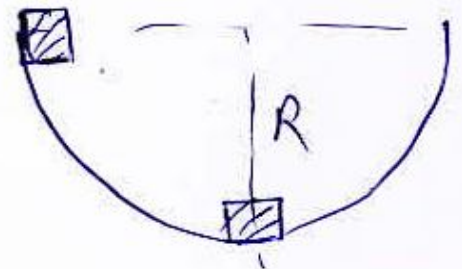
Ans (3)

3)

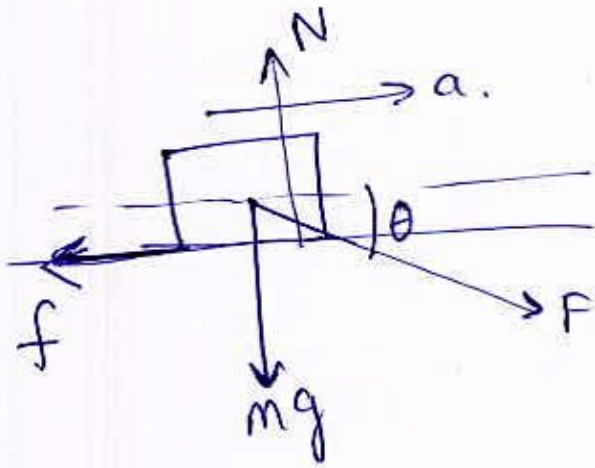
$$\rightarrow mg(R) = \frac{1}{2}mv^2 + W$$

$$\rightarrow 1.5 \times 10 \times R = \frac{1}{2} \times 1.5 \times 8^2 + 12$$

$$R = \frac{60}{15} = \boxed{4m}$$



Ans (1)



$$N = Mg + F \sin \theta$$

$$F \cos \theta = (f) (\mu N) = Ma$$

$$F \cos \theta = \mu (Mg + F \sin \theta) = Ma$$

$$F (\cos \theta - \mu \sin \theta) - \mu Mg = Ma$$

$$\mu = \frac{F \cos \theta - Ma}{(Mg + F \sin \theta)}$$

$$M = \frac{100 - 10}{10}$$

$$F (\cos \theta - \mu \sin \theta) - \mu (100) = 10 \times 1 = 10$$

$$2 \times F (\cos \theta - \mu \sin \theta) - \mu \times 100 = 10 \times 10 = 100$$

$$\rightarrow F (\cos \theta - \mu \sin \theta) + 10 = 100$$

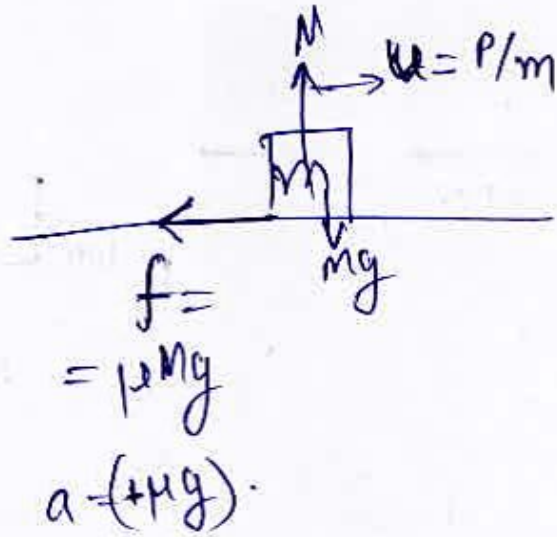
$$F (\cos \theta - \mu \sin \theta) = 90$$

$$\rightarrow 90 - \mu (100) = 10$$

$$\frac{80}{100} = \mu = 0.8$$

Ans (4)

5)



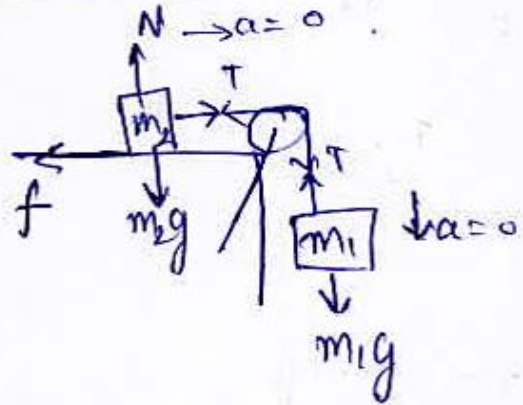
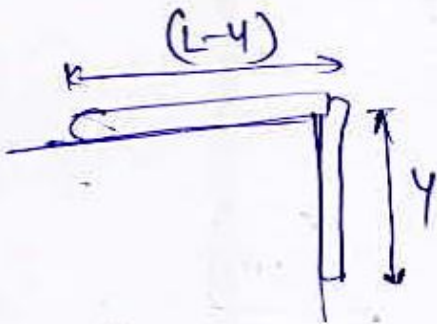
$$v^2 = u^2 - 2as$$

$$0 = u^2 - 2as$$

$$s = \frac{u^2}{2a} = \frac{P^2}{m^2 \times 2(\mu g)}$$

Ans (5)

6)



$$m_1 = \left(\frac{y}{L}\right) M$$

$$m_2 = \left(\frac{L-y}{L}\right) M$$

$$T = f = \mu(m_2 g) = T = m_1 g$$

$$m_1 = \mu m_2$$

$$\frac{y}{L} = \mu \left(1 - \frac{y}{L}\right)$$

$$y = \left(\frac{\mu}{1+\mu}\right) L$$

$$\left(\frac{1+\mu}{\mu}\right) \frac{y}{L} = 1$$

$$y = \left(\frac{1}{1.25}\right) L$$

0.25

$y = L/5 \rightarrow 20\% \rightarrow$  Ans (1)

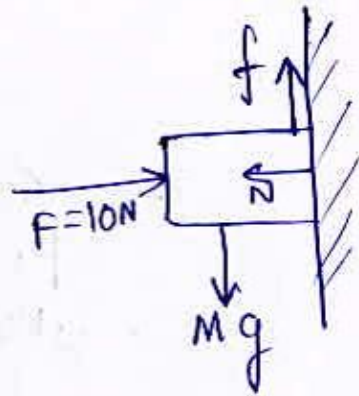
7)

$$Mg = f = \mu N$$

$$W = M \times 10 = 0.2 \times 10$$

$$W = 2 \text{ N}$$

$$\text{Ans (4)}$$

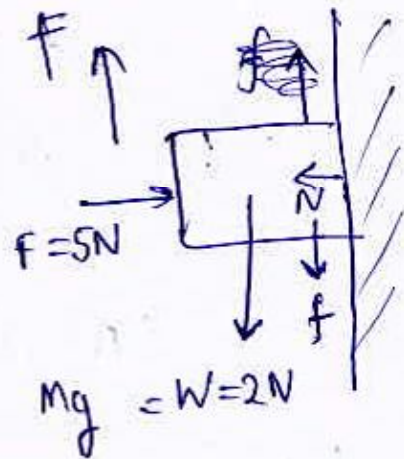


8)

$$\begin{aligned} F &= f + W \\ &= \mu N + W \\ &= 0.4 \times 5 + 2 \end{aligned}$$

$$f = 4 \text{ N}$$

$$\text{Ans (3)}$$



9)

$$a = \frac{2mg}{4m}$$

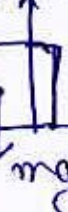
$$a = g/2$$

$$\frac{mg}{2} = ma$$

$$= ma$$

$$a'$$

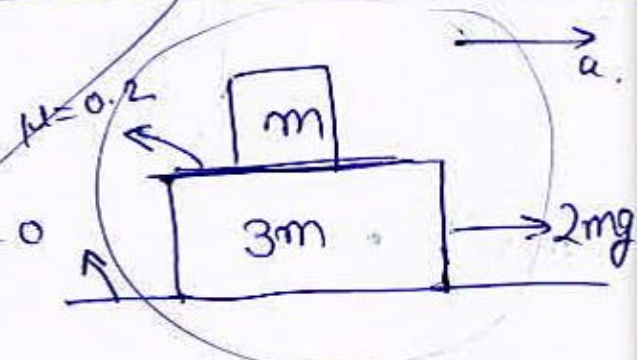
$$N$$



$$f = \mu N = 0.2 mg$$



$$\begin{aligned} \Rightarrow ma - f &= ma' \\ \frac{mg}{2} (0.5 - 0.2) &= a' \\ a' &= 0.3g \end{aligned}$$



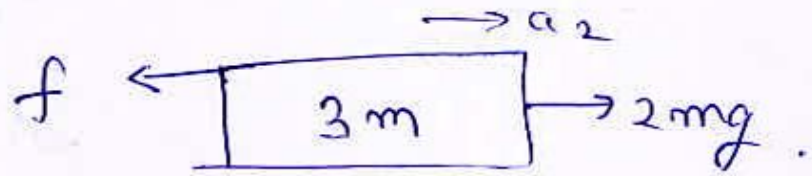
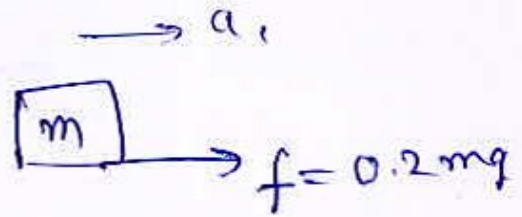
9)

(3)

$$f = m a_1$$

$$0.2 mg = m a_1$$

$$a_1 = 0.2g$$



$$2mg - 0.2mg = (3m)a_2$$

$$\frac{1.8mg}{3m} = a_2 = 0.6g$$

$$(a_A)_{\text{plank}} = a_2 - a_1 = 0.4g = \frac{2g}{5}$$

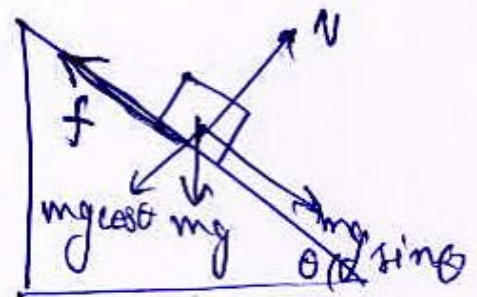
$$(a_A)_{\text{ground}} = a_1 = 0.2g = \frac{g}{5}$$

Ans (4)

$$\mu mg \cos \theta = f = mg \sin \theta$$

$$\mu = \tan \theta = \frac{3}{4}$$

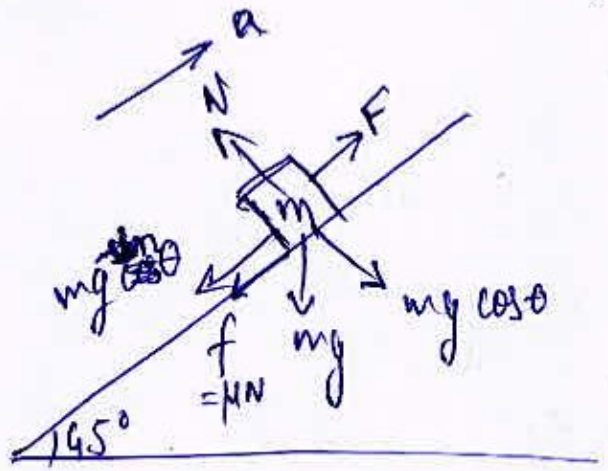
$$\theta = 37^\circ$$



Ans (2)

11)

$$t_d = 2 \times t_a$$



$$\underline{\mu = 0.6}$$

Ans (1)

12)

$$N = mg \cos \theta$$

$$= 2 (mg \sin \theta - \mu mg \cos \theta)$$

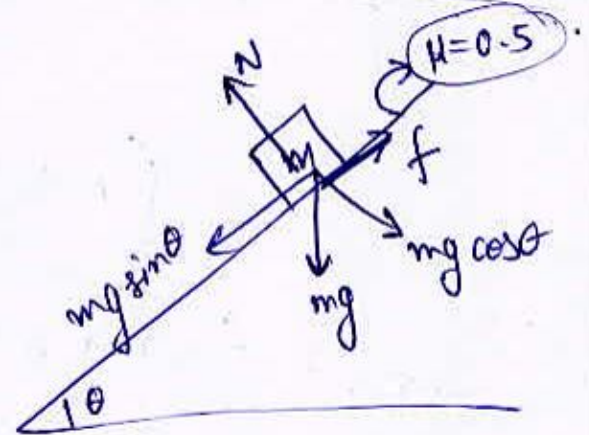
$$\cos \theta = 2 (-\sin \theta - \mu \cos \theta)$$

$$1 = 2 (\tan \theta - \mu)$$

$$1 = \tan \theta$$

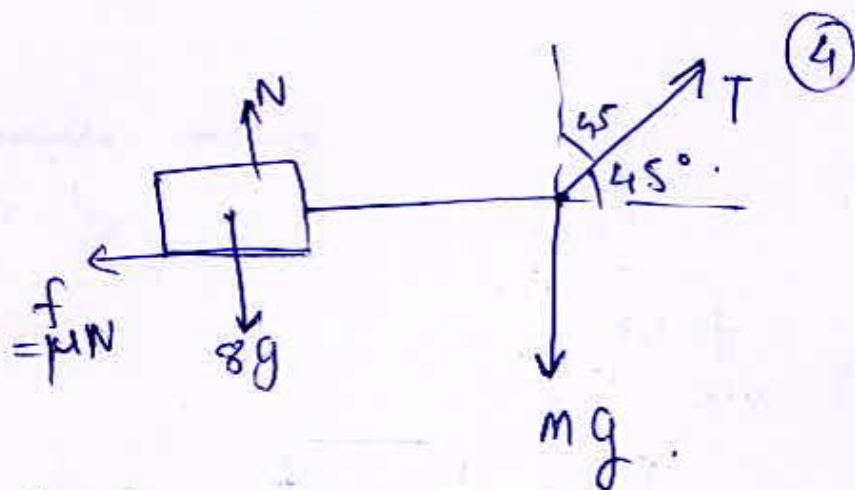
$$\boxed{\theta = 45^\circ}$$

Ans (4)



$$\mu = 0.5$$

1.3)



$$\rightarrow T \cos 45 = f = \mu (8g)$$

$$T = \sqrt{2} \times \frac{1}{4} \times 8 \times g$$

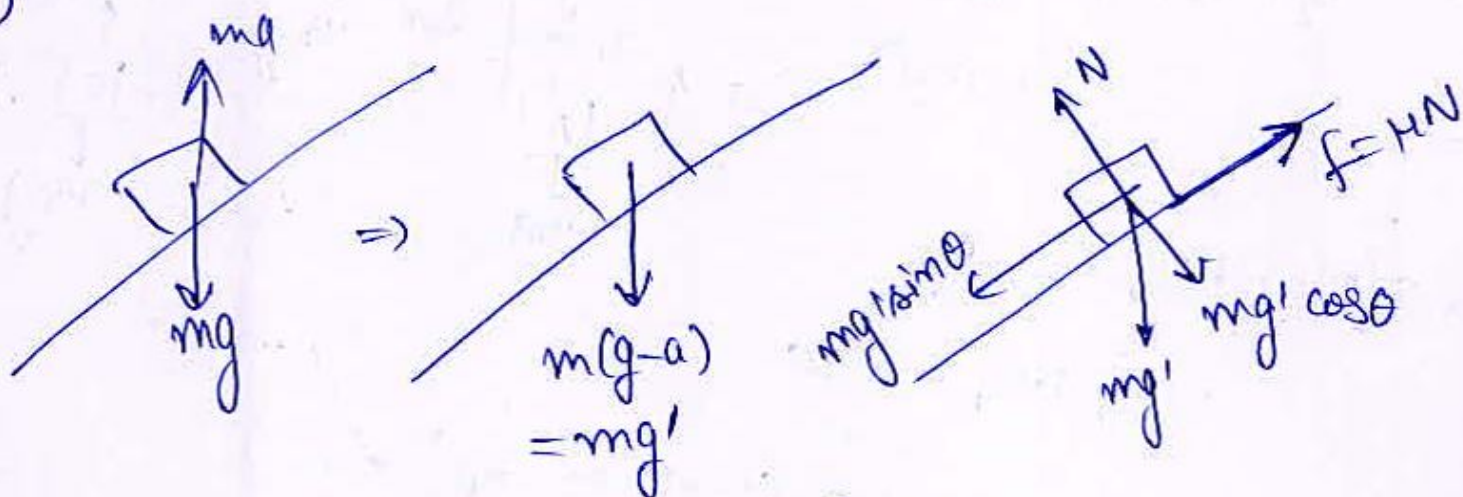
$$T = 2\sqrt{2}g$$

$$\rightarrow T \sin 45 = mg$$

$$(2\sqrt{2}g) \times \frac{1}{\sqrt{2}} = mg$$

Ans (1)

14)

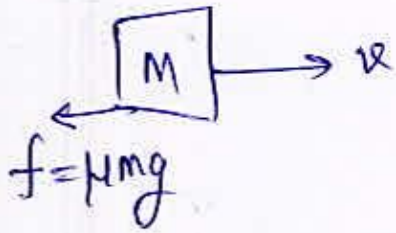


$$a = 0 \Rightarrow mg' (\sin 30) = \mu mg' (\cos 30)$$

$$\mu = \tan 30 = \frac{1}{\sqrt{3}}$$

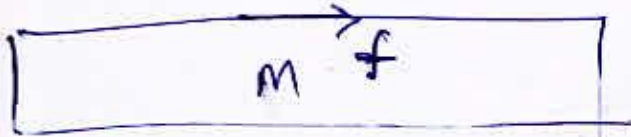
Ans (1)

15)



$$v = u + at$$

$$v' = v - (\mu g)t$$



$$v' = a(\mu g)t$$

$$v' = v'$$

$$v - (\mu g)t = (\mu g)t$$

$$\leftarrow v = (2\mu g)t$$

$$t = \frac{v}{2\mu g}$$

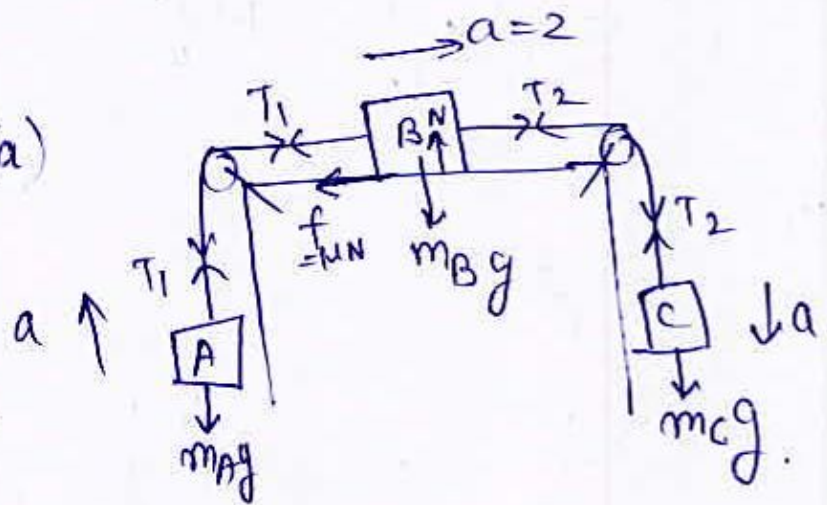
Ans (1)

16)

$$\rightarrow T_1 - (m_A)g = (m_A)a$$

$$\rightarrow T_2 - T_1 = \mu(m_B g) = m_B(a)$$

$$\rightarrow m_C g - T_2 = m_C(a)$$



$$\rightarrow g(m_C - \mu m_B - m_A) = (m_A + m_B + m_C)a$$

$$\rightarrow g(m_C - 0.1 \times 20 - 2) = (2 + 20 + m_C) \times 2$$

$$\rightarrow m_C - 4 = 0.2 \times 22 + 0.2 m_C$$

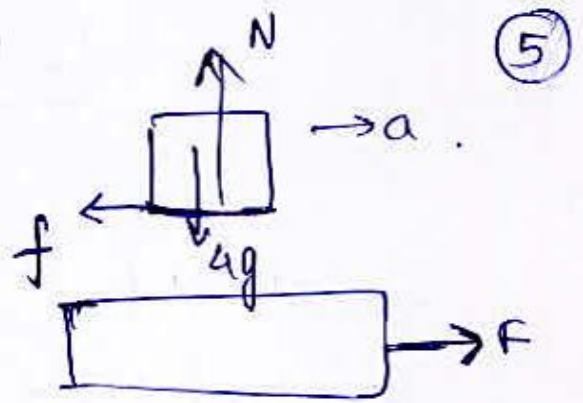
$$0.8 m_C = 4.4 + 4 = 8.4$$

$m_C = 10.5 \text{ kg}$       Ans (4)



17)

$$\begin{aligned}
 f &= \mu (4g) \\
 &= 0.8 \times 10 \\
 f &= 8 \text{ N} = m \times a \\
 8 &= 4 \times a \\
 \boxed{a} &= 2
 \end{aligned}$$



$$F = (4+2) a = 6 \times 2 = 12 \text{ N}$$

Ans (2)

18)

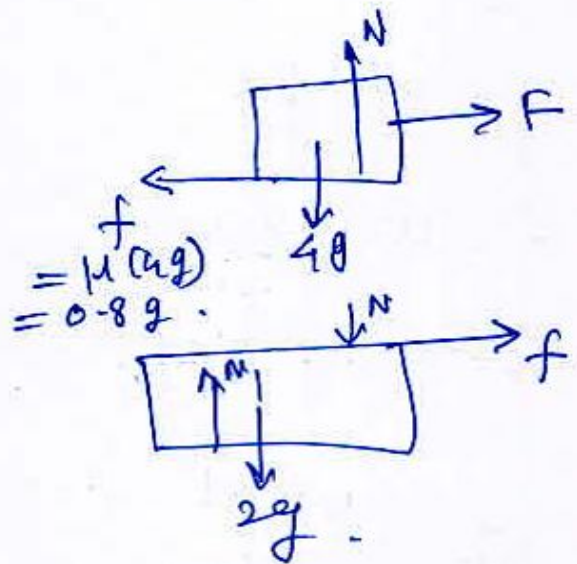
$$\begin{aligned}
 N_1 &= N + 2g \\
 &= 6g
 \end{aligned}$$

$$\begin{aligned}
 0.8g &= f = m \times a \\
 0.8g &= 2 \times a \\
 a &= 0.4g
 \end{aligned}$$

$$F = (4+2) \times 0.4g$$

$$\boxed{F = 24 \text{ N}}$$

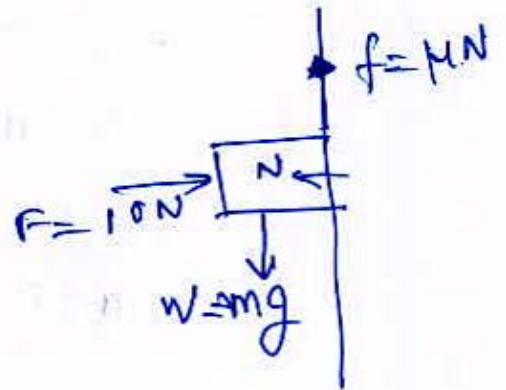
Ans (1)



**JEE MAIN**

$$f = \mu N = W$$

$$W = 0.2 \times 10 = 2$$



**Ans (3)**

2)

$$f = \mu (2g)$$

$$a = \mu g$$

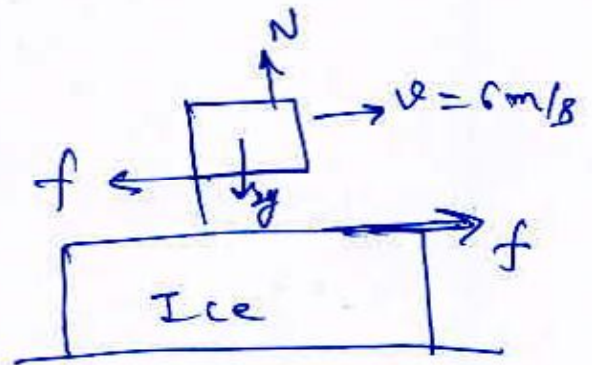
~~$$v^2 = u^2 + 2as$$~~

~~$$0 = 36 - 2(\mu g)$$~~

$$v = u + at$$

$$0 = 6 - (\mu g) \times 10$$

$$0.6 = \mu g \quad \boxed{\mu = 0.06}$$



3)

$$\mu = 0.8$$

~~$$f = \mu N = \mu mg \cos \theta \Rightarrow 10$$~~

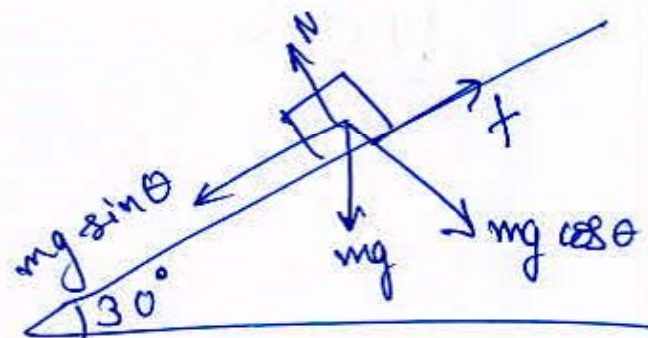
~~$$0.8 \times m \times 10 \times \frac{\sqrt{3}}{2} = 10$$~~

~~$$m = \frac{1}{0.4\sqrt{3}}$$~~

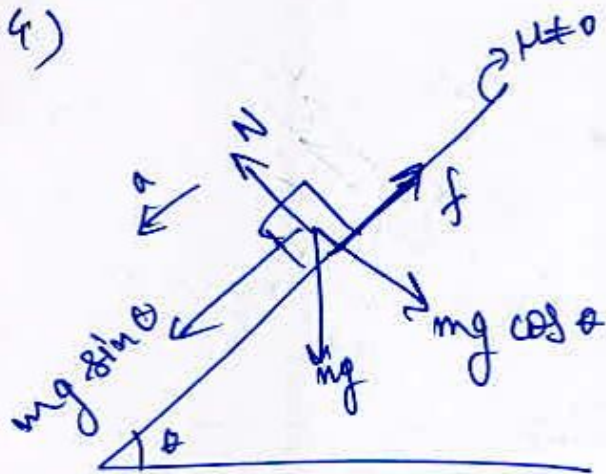
$$f = mg \sin \theta \Rightarrow 10 = m \times 10 \times \frac{1}{2}$$

$$\boxed{m = 2}$$

**Ans (1)**



4)

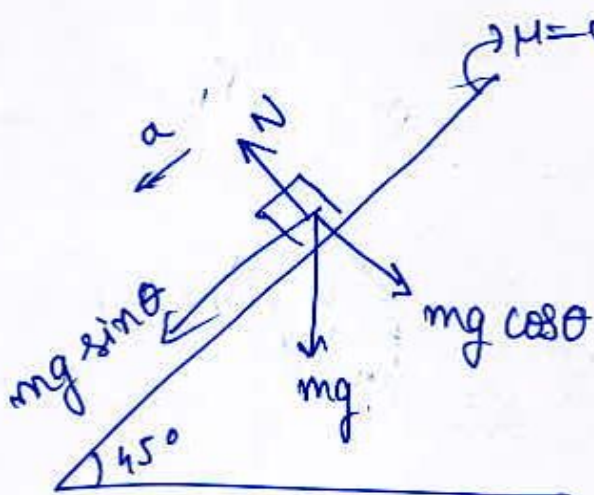


$$a_1 = \frac{(mg \sin \theta - \mu mg \cos \theta)}{m}$$

$$= (g \sin \theta - \mu \cos \theta)$$

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

6



$$a_2 = g \sin \theta$$

$$a_2 = \frac{g}{\sqrt{2}}$$

$$s = ut + \frac{1}{2} at^2$$

$$d = \frac{1}{2} \left( \frac{g - \mu}{\sqrt{2}} \right) (nt)^2 = \frac{1}{2} \left( \frac{g}{\sqrt{2}} \right) t^2$$

$$(g - \mu) n^2 = g$$

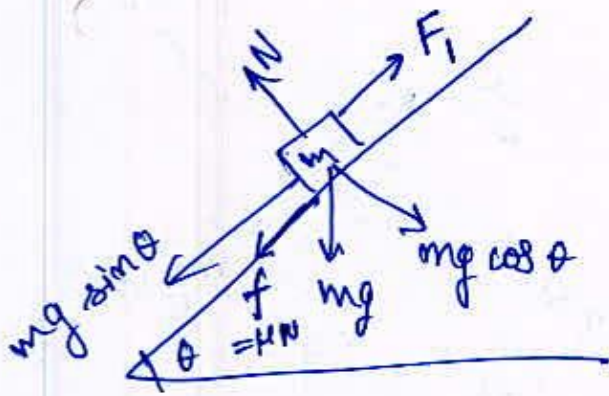
$$1 - \frac{\mu}{g} = \frac{1}{n^2}$$

$$\left( 1 - \frac{1}{n^2} \right) = \frac{\mu}{g} \Rightarrow \mu \propto \left( 1 - \frac{1}{n^2} \right)$$

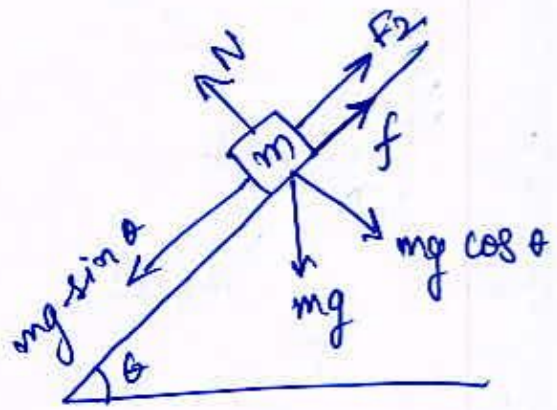
Ans (1)

5)

$$\tan \theta = 2\mu.$$



$$F_1 = mg \sin \theta + \mu mg \cos \theta$$



$$F_2 = mg \sin \theta - \mu mg \cos \theta$$

$$\frac{F_1}{F_2} = \frac{\sin \theta + \mu \cos \theta}{\sin \theta - \mu \cos \theta} = \frac{\tan \theta + \mu}{\tan \theta - \mu} = \frac{3\mu}{\mu} = 3.$$

Ans (3)