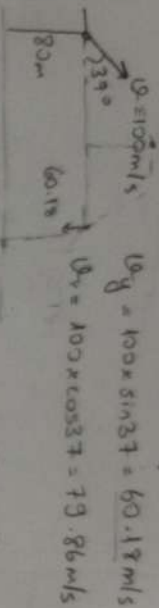


$$v_{yf} = v_{yi} - gt; \quad v_{yf}^2 = v_{yi}^2 + v_{yi}^2 - \frac{1}{2}gt^2$$

Questions 1 and 2: $v_{yf}^2 = v_{yi}^2 + 2g(\Delta y)$

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$$1) 0 = 60.18 - (9.8)t \quad 3) v_{yf}^2 = 60.18^2 - 2(9.8)(-80)$$

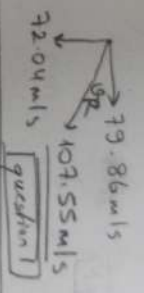
$$t = 6.14s$$

$$t_{up} = 12.28s$$

$$2) 0 = 80 - 60.18t - \frac{1}{2}(9.8)t^2$$

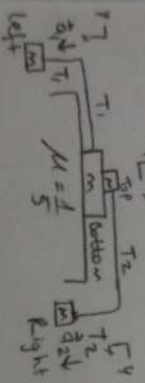
$$t = 1.25 \text{ or } t = -13.55$$

$$12.28 + 1.2 = 13.48s = 13.55s$$



$$\vec{F} = m \cdot \vec{a}; \quad F_f = \mu \cdot N$$

Questions 3 to 8:



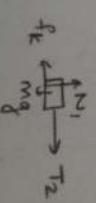
FBD right

$$\sum F_y = 0$$

$$\sum F_x = m \cdot \vec{a}_x$$

$$m_g - T_2 = m \cdot \vec{a}_x$$

FBD Top



$$F_f = \mu \cdot N$$

$$= \frac{1}{5} \cdot m \cdot g$$

$$\sum F_y = 0$$

$$N_1 - m \cdot g = 0$$

$$N_1 = m \cdot g$$

$$\sum F_x = m \cdot \vec{a}_x$$

$$T_2 - F_f = m \cdot \vec{a}_x$$

$$T_2 - \frac{1}{5}m \cdot g = m \cdot \vec{a}_x$$

$$T_2 = \frac{1}{5}m \cdot g + m \cdot \frac{2}{5}g$$

$$T_2 = \frac{3}{5}m \cdot g$$

$$T_2 - \frac{1}{5}m \cdot g = m \cdot \vec{a}_x$$

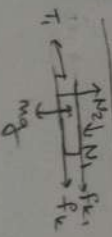
$$m \cdot g - \frac{1}{5}m \cdot g = m \cdot \vec{a}_x$$

$$\frac{4}{5}m \cdot g = m \cdot \vec{a}_x$$

$$a_x = \frac{4}{5}g$$

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FBD Bottom



$$\sum F_y = 0$$

$$N_2 - N_1 + mg = 0$$

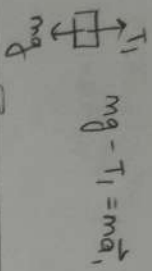
$$N_2 = N_1 + mg$$

f_k and N_1 are action-reaction pairs-

$$f_k = \mu N_2$$

$$f_k = \frac{1}{5} \cdot 2mg$$

FBD Left



$$T_2 - T_1 = ma_1$$

$$T_2 - \frac{3}{5}mg = ma_1$$

$$T_2 - \frac{3}{5}mg = 2\mu a_1$$

$f_k + f_{k1} = f_{total}$ on bottom;

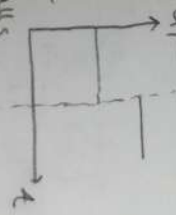
$$\frac{2}{5}mg + \frac{1}{5}mg = \frac{3}{5}mg$$

question 4

question 5

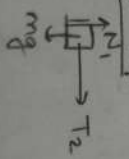
When top box falls

f_k and f_{k1} decrease so a_1 increase but constant



Questions 9 and 10:

FBD Top



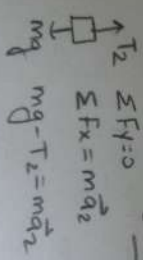
$$\sum F_y = 0$$

$$N_1 = mg$$

$$\sum F_x = ma_2$$

$$T_2 = ma_2$$

FBD right



$$\sum F_y = 0$$

$$\sum F_x = ma_2$$

$$T_2 = m \cdot \frac{g}{2}$$

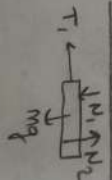
$$T_2 = ma_2$$

$$mg - T_2 = ma_2$$

$$mg = 2\mu a_2 \Rightarrow a_2 = \frac{g}{2}$$

question 9

FBD Bottom



$$\sum F_y = 0$$

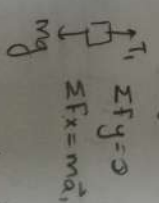
$$N_2 - N_1 - mg = 0$$

$$N_2 = N_1 + mg$$

$$\sum F_x = ma_1$$

$$T_1 = ma_1$$

FBD right



$$\sum F_y = 0$$

$$\sum F_x = ma_1$$

$$T_1 = \frac{mg}{2}$$

$$mg - T_1 = ma_1$$

$$T_1 = ma_1$$

$$mg - T_1 = ma_1$$

$$mg = 2ma_1 \Rightarrow a_1 = \frac{g}{2}$$