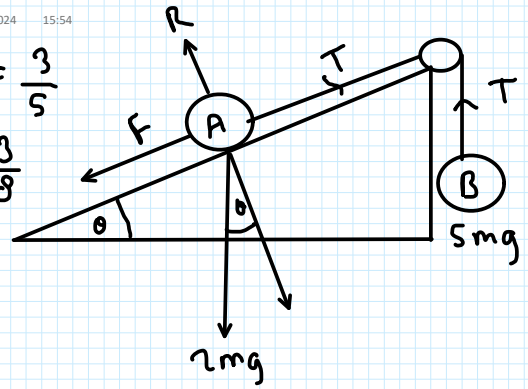
10 December 2024 15:54

$\sin\theta = \frac{3}{5}$

$\mu = \frac{3}{8}$



Resolve forces:

$R = 2mg\left(\frac{4}{5}\right)$

$F = R\mu = 2mg\left(\frac{4}{5}\right)\left(\frac{3}{8}\right) = \frac{24}{40}mg$

$W = 2mg\left(\frac{3}{5}\right) = \frac{6}{5}mg$

$T = 5mg$

After 1m of motion the string snaps. How far does A travel?

Calculate acceleration: $F = ma$

$$\left(5mg - \frac{24}{40}mg - \frac{6}{5}mg\right) = 7mg\,a$$

$$\frac{16}{5}mg = 7m\,a$$

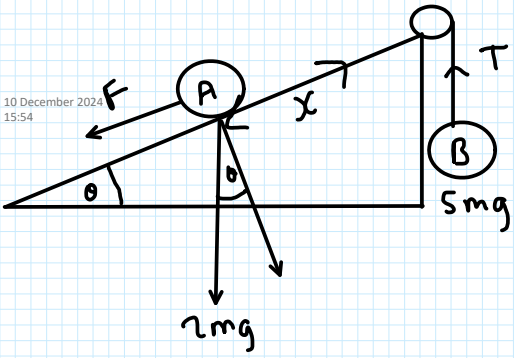
$$a = \frac{16}{5}mg \times \frac{1}{7m} = 4.48\ ms^{-2}$$

Calculate velocity:

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

$$v^2 = 0 + 2(4.48)(1)$$

$$v^2 = 8.96$$



kinetic energy

$$KE = \frac{1}{2}(2m)(8.96) = 8.96m$$

Potential energy after string snaps:

$$PE = 2mg\left(\frac{3}{5}\right)x$$

$$= \frac{6}{5}mg\,x$$

Work done = Change in energy

$$\left(\frac{6}{5}mg + \frac{24}{40}mg\right)x = 8.96m + \frac{6}{5}mg\,x$$

$$\frac{9}{5}mg\,x = 8.96m + \frac{6}{5}mg\,x$$

$$\frac{3}{5}gx = 8.96$$

$$x = \frac{8.96(5)}{3(9.8)} = 1.52\ m$$

A travels 1.52 m