QUES 01

A block of mass m slides on the wooden wedge, which in turn slides backward on the horizontal surface. The acceleration of the block with respect to the wedge is: Given m = 8 kg, M = 16 kg.

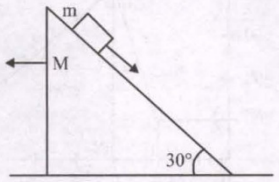
Assume all the surfaces shown in the figure to be frictionless. **[Sep. 1, 2021 (II)]**

(a) $\frac{4}{3}g$

(b) $\frac{6}{5}g$

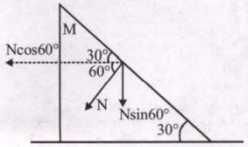
(c) $\frac{3}{5}g$

(d) $\frac{2}{3}g$



(d) Let a_w be the acceleration of wedge and a_b be the acceleration of block w.r.t wedge

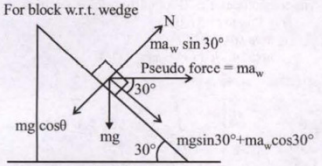
For the wedge w.r.t. ground



$N\cos60° = Ma_w \Rightarrow N \times \frac{1}{2} = 16\, a_w$

$\Rightarrow N = 32a_w$ ...(i)

For block w.r.t. wedge



Balancing vertical forces

$N + ma_w\sin30° = mg\cos30°$

$\Rightarrow N = 8g\cos30° - 8a_w\sin30°$

$\Rightarrow 32a_w = 4\sqrt{3g} - 4a_w$ (Using (i))

$\Rightarrow a_w = \frac{\sqrt{3}}{9}g$

Along incline plane

$\Rightarrow m\,g\sin30° + ma_w\cos30° = ma_b = 8a_b$

$\Rightarrow a_b = \frac{8 \times g \times \frac{1}{2} + 8 \times \frac{\sqrt{3}}{9} \times g \cdot \frac{\sqrt{3}}{2}}{8}$

$\Rightarrow a_b = g \times \frac{1}{2} + \frac{\sqrt{3}}{9}g \cdot \frac{\sqrt{3}}{2} = \frac{2g}{3}$