

**Mathematics Questions by Topic**

Motion and Force

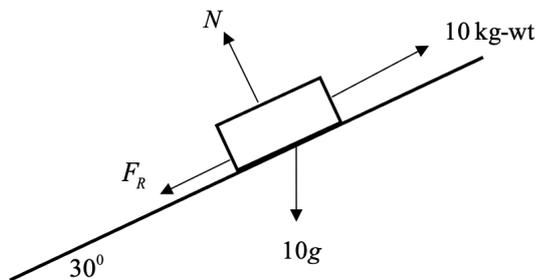
Answer 31

Source: K11SM2Q17

**Question 31**

A box of mass 10 kg is at rest on a plane inclined at angle of  $30^\circ$  to the horizontal. A force of magnitude 10 kg-wt acting up and parallel to the plane is applied to the box. For equilibrium to be maintained, the co-efficient of friction between the box and the plane must be

- A. at least  $\frac{\sqrt{3}}{3}$
- B. less than  $\frac{\sqrt{3}}{3}$
- C. at least  $\frac{g-2}{g\sqrt{3}}$
- D. less than  $\frac{g-2}{g\sqrt{3}}$
- E. at least  $5g\sqrt{3}$

**ANSWER A**

Note that all forces are in newtons.

$$\text{resolving perpendicular to the plane } N - 10g \cos(30^\circ) = 0 \Rightarrow N = 10g \cos(30^\circ) = 5\sqrt{3}g$$

resolving up and parallel to the plane

$$10g - 10g \sin(30^\circ) - F_R = 0 \Rightarrow F_R = 10g - 10g \sin(30^\circ) = 5g$$

$$F_R \leq \mu N$$

$$5g \leq \mu 5\sqrt{3}g \Rightarrow \mu \geq \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$