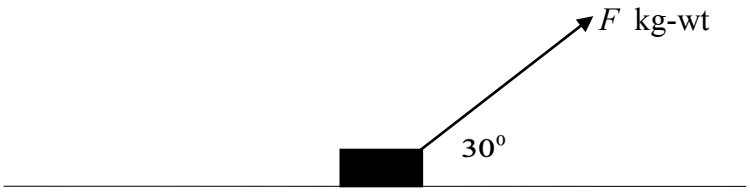
Question 37



A box of mass 3 kg is on a horizontal plane. A force of magnitude *F* kg-wt acting at an angle of 30^0 to the horizontal is applied to the box. The coefficient of friction between the box and the plane is $\frac{\sqrt{3}}{2}$. Which of the following is true?

A. If $F < 2g$ the box is not on the point of moving.

B. If $F < 2g$ the box moves with constant velocity.

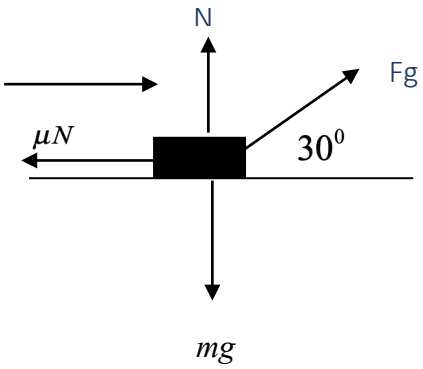
C. If $F = 2$ the box moves with constant acceleration.

D. If $F > 2$ the box moves with constant velocity.

E. If $F > 2$ the box moves with constant acceleration.

ANSWER E

All forces must be in newtons, $m = 3\,\text{kg}$ $\mu = \frac{\sqrt{3}}{2}$



resolving perpendicular to the plane

(1) $N + Fg\sin(30^0) - mg = 0$

$\Rightarrow N = 3g - \frac{Fg}{2}$

resolving parallel to the plane

(2) $Fg\cos(30^0) - \mu N = ma$

$\frac{Fg\sqrt{3}}{2} - \frac{\sqrt{3}}{2}\left(3g - \frac{Fg}{2}\right) = 3a$

$\Rightarrow \frac{3g\sqrt{3}}{4}(F-2) = 3a$ so if $F > 2$ $\Rightarrow$ $a > 0$

