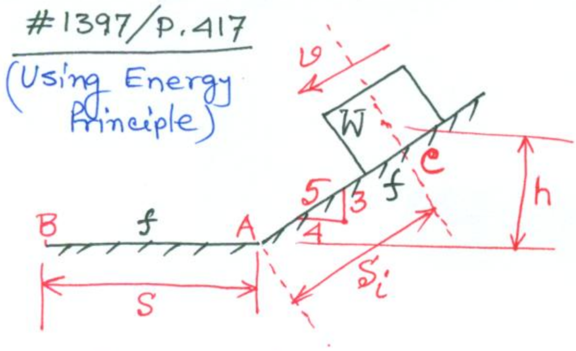
#1397/P.417

(Using Energy Principle)



Given

$f = \frac{1}{3}$

$h = 10$ ft

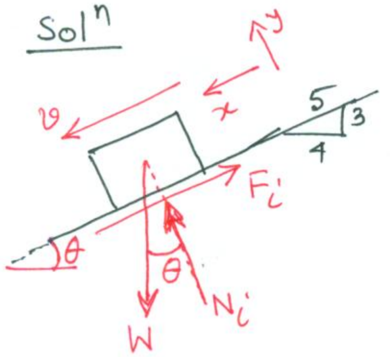
$S = 18$ ft

$v_B = 0$

Determine

v_C

Sol^n



$\Sigma F_y = 0$, +ve y as +ve (box on slope)

$\Rightarrow N_i - W\cos\theta = 0$

$\therefore N_i = W \times \frac{4}{5} = \frac{4}{5} W$

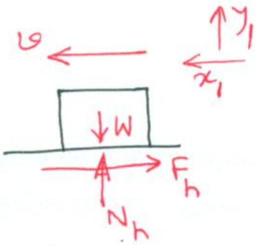
$\therefore F_i = N_i \cdot f = \frac{4}{5} W \times \frac{1}{3} = \frac{4}{15} W$

$\frac{S_i}{h} = \frac{5}{3} \quad \therefore S_i = \frac{5}{3} \times 10 = \frac{50}{3}$ ft

$\therefore$ Work done from C to A $= (W.\sin\theta - F_i) \times S_i$

$= \left(W \times \frac{3}{5} - \frac{4}{15} W\right) \times \frac{50}{3}$

$= \frac{50}{9} W$



When the box is on horizontal plane

$\Sigma F_{y_1} = 0$ gives, $N_h = W$

$\therefore F_h = N_h \cdot f = W \times \frac{1}{3} = \frac{W}{3}$

Work done from A to B $= -F.S = -\frac{W}{3} \times 18 = -6W$

[Here work done is −ve, because force and displacement are opposite]

$U_{net} = \frac{50}{9} W - 6W = -\frac{4}{9} W$

$\Delta KE = \frac{1}{2} \cdot \frac{W}{g} \left(v_B^2 - v_C^2\right) = \frac{1}{2} \times \frac{W}{32.2} \times \left(0 - v_C^2\right) = -\frac{W v_C^2}{64.4}$

Now $U_{net} = \Delta KE$

$\Rightarrow -\frac{4}{9} W = -\frac{W v_C^2}{64.4}$

$\therefore v_C = \boxed{5.35 \text{ fps}}$ Ans.