

A 50 kg box is pushed across the floor ( $\mu = 0.20$ ) at 2.5 m/s for 5.0s and then up a ramp which is 1.5 m high and 5.0 m long ( $\mu = 0.30$ ) The box accelerates at 1.5 m/s<sup>2</sup> on the ramp. What is the total work done?

$v_f = 0$   
 $d = \frac{1}{2} a t^2 = \frac{1}{2} (1.5) (5)^2 = 18.75 \text{ m}$   
 $v_f = 490.5 \text{ m/s}$   
 $a = 2.5 \text{ m/s}^2$   
 $F = \mu N = (0.2)(490.5) = 98.1 \text{ N}$   
 $F_n = (50)(2.5) = 125 \text{ N}$   
 $F = F_n - F = 125 - 98.1 = 26.9 \text{ N}$   
 $W_A = (26.9)(31.25) = 843.44 \text{ J}$

Ramp section:  
 $\sin \theta = \frac{1.5}{5} = 0.3$   
 $F_g = 490.5 \text{ N}$   
 $F_{gx} = 490.5 \sin \theta = 147.15 \text{ N}$   
 $F_{gx} = 490.5 \cos \theta = 467.8 \text{ N}$   
 $F = (0.3)(467.8) = 140.34 \text{ N}$   
 $F_n = F - F_{gx} = 26.9 - 140.34 = -113.44 \text{ N}$   
 $F = F_n + F + F_{gx} = 26.9 + 140.34 + 147.15 = 314.39 \text{ N}$   
 $W_B = (314.39)(5) = 1571.95 \text{ J}$

Total work:  
 $W_{\text{total}} = 843.44 + 1571.95 = 2415.39 \text{ J}$

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