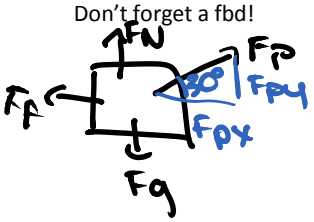
Work calculations

Thursday, October 31, 2013 9:54 AM

A 10 kg mass moves 5 m along a surface with a coefficient of friction of .2. What is the net work if the object is pulled with a force of 40 n at 30 degrees?

Don't forget a fbd!



$F_g = mg = 10 \cdot 9.8 = 98N$

$F_p = 40N$

$F_{py} = F_p \sin\theta = 40 \sin 30 = 20N$

$F_{px} = F_p \cos\theta = 40 \cos 30 = 34.6N$

$F_N = F_g - F_{py} = 98 - 20 = 78N$

$F_f = \mu F_N = .2 \cdot 78 = 15.6N$

W_{push}

$W_{push} = F_{push} \cdot x \cdot \cos\theta$

$= 40 \cdot 5 \cdot \cos 30$

$= F_{px} \cdot x$

$= 34.6 \cdot 5$

$= 173\ J$

$W_{friction}$

$W_{fric} = F_{fric} \cdot x \cdot \cos\theta$

$= 15.6 \cdot 5 \cdot -1$

$= -78\ J$

$W_{net} = W_{push} + W_{fric}$

$= 173 - 78 = 95J$

Work kinetic energy theorem

$W_{net} = F_{net} \cdot x \cdot \cos\theta$

$F_{net}x = F_{px} - F_f$

$= 34.6 - 15.6$

$= 19N$

$= 19 \cdot 5 \cdot \cos 0$

$= 19.5$

$= 95J$

Example

A car with a mass of 1000 kg starts at 10 m/s and accelerates to 20 m/s in 50m. How much work is done?

What is the force required?

$W = \Delta KE$

$W = KE_f - KE_i$

$= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$= \frac{1}{2}m(v_f^2 - v_i^2)$

$= \frac{1}{2} \cdot 1000 \cdot (20^2 - 10^2)$

$= 500(400 - 100)$

$= 500 \cdot 300$

$= 150,000J$

$KE = \frac{1}{2}mv^2$

$W = F \cdot x$

$F = W/x$

$= 150,000/50$

$= 3,000N$