

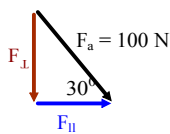
You push a 10. kg car 5.0 m across the floor with a force of 100. N directed downward at an angle of $30.^{\circ}$. How much work is done if $\mu = 0$?



oldphotos.blogspot.com/2009_04_01_archive.html

Feb 9-6:34 AM

You push a 10. kg car 5.0 m across the floor with a force of 100. N directed downward at an angle of $30.^{\circ}$. How much work is done if $\mu = 0$? What velocity will the work give the car?



$$\begin{aligned} m &= 10. \text{ kg} \\ d &= 5.0 \text{ m} \\ F_a &= 100 \text{ N} \\ \theta &= 30.^{\circ} \end{aligned}$$

$$W = Fd \cos\theta$$

$$W = 100.\text{N}(5.0 \text{ m})\cos 30^{\circ}$$

$$W = 433 \text{ J}$$

$$W = \Delta KE$$

$$W = \frac{1}{2}m\Delta v^2$$

$$v = \sqrt{2W/m}$$

$$v = \sqrt{[2(433\text{J})]/10\text{kg}}$$

$$v = 9.31 \text{ m/s}$$

$$\therefore a = v^2/2d = (9.3 \text{ m/s}^2)/[2(5.0 \text{ m})]$$

$$a = 8.64 \text{ m/s}^2$$

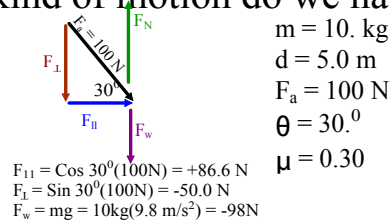
Feb 14-9:38 AM

You push a 10. kg car 5.0 m across the floor with a force of 100. N directed downward at an angle of 30.°. OH NO! Now $\mu = 0.30$, How much work is done now?



Feb 9-6:35 AM

You push a 10. kg car 5.0 m across the floor with a force of 100. N directed downward at an angle of 30.°. OH NO! Now $\mu = 0.30$, How much work is done now? What kind of motion do we have?



$W = Fd\cos\theta = 100 \text{ N}(5.0 \text{ m})\cos 30^\circ = 433 \text{ J} \dots \text{no change in work!}$

x	y
Type motion???	Type motion? <i>rest</i>
	$\therefore \Sigma F = 0$
accel because $F_{ } > F_f$	$0 = F_w + F_{\perp} + F_N$
$\therefore \Sigma F = ma$	$F_N = -F_w - F_{\perp}$
$a = F_{ } + F_f/m$	$F_N = -(-98 \text{ N}) -(-50\text{N}) = +148 \text{ N}$
$a = [+86.6\text{N} + (-44.4 \text{ N})]/10\text{kg}$	$F_f = \mu F_N = 0.30(148\text{N}) = -44.4 \text{ N}$
$a = 4.22 \text{ m/s}^2 \dots v = \sqrt{2(4.22\text{m/s}^2)5.0\text{m}}$	
$v = 6.50 \text{ m/s}$	

Feb 9-11:01 AM

Another cat!... let's look at the same problem from a different vantage point.



$$W = \Delta KE$$

$$W_a + W_f = \frac{1}{2}m\Delta v^2$$

$$433 \text{ J} + (-44.4\text{N} \times 5.0 \text{ m}) = \frac{1}{2}m\Delta v^2$$

$$211 \text{ J} = \frac{1}{2}m\Delta v^2$$

$$v = \sqrt{2W/m}$$

$$v = \sqrt{[2(211\text{J})]/10\text{kg}}$$

$$v = 6.50 \text{ m/s}$$

Feb 9-1:26 PM

Yet another cat!... let's look at the same problem from a different vantage point.



$$\Sigma F = ma$$

$$F_{||} + F_f = ma$$

$$a = F_{||} + F_f / m$$

$$a = [+86.6 \text{ N} + (-44.4 \text{ N})]/10 \text{ kg}$$

$$a = 4.22 \text{ m/s}^2$$

$$v = \sqrt{2(4.22\text{m/s}^2)5.0\text{m}}$$

$$v = 6.50 \text{ m/}$$

Feb 9-1:30 PM

$F_f = \mu F_N$ oh NO !!!
 $\mu = .30$
 what now?
 $F_x = \cos 30(100N)$
 $F_x = 87N$
 $F_y = \sin 30(100N)$
 $F_y = 50N$
 $F_f = \mu F_N$
 $F_f = .30(148N)$
 $F_f = -47N$

X
 accel
 $\sum F = ma$
 $F_x + f_f = ma$
 $a = \frac{F_x + f_f}{m}$
 $a = \frac{87N + (-47N)}{10kg}$
 $a = 4.3 m/s^2$

Y
 rest
 $\sum F = 0$
 $F_N + F_w + F_y = 0$
 $F_N = -F_y - F_w$
 $F_N = -(-50N) - (-50N)$
 $F_N = 148N$

$v_2^2 = v_1^2 + 2ad$
 $v_2 = \sqrt{2(4.3 m/s^2)5m}$
 $v_2 = 6.6 m/s$

$W_T = KE + W_f$
 $433 J = 1/2mv^2 + F_f d$
 $F_f = \mu F_N = .30[-(F_w + F_y)] = .30[-(-98N) + (-50N)] = 44 N$
 $W_f = F_f d = 44N(5m) = 220J$
 $W_i - W_f = KE$
 $445 J - 220 J = KE$ $225 J = 1/2(10kg)v^2$
 $v = 6.7 m/s$

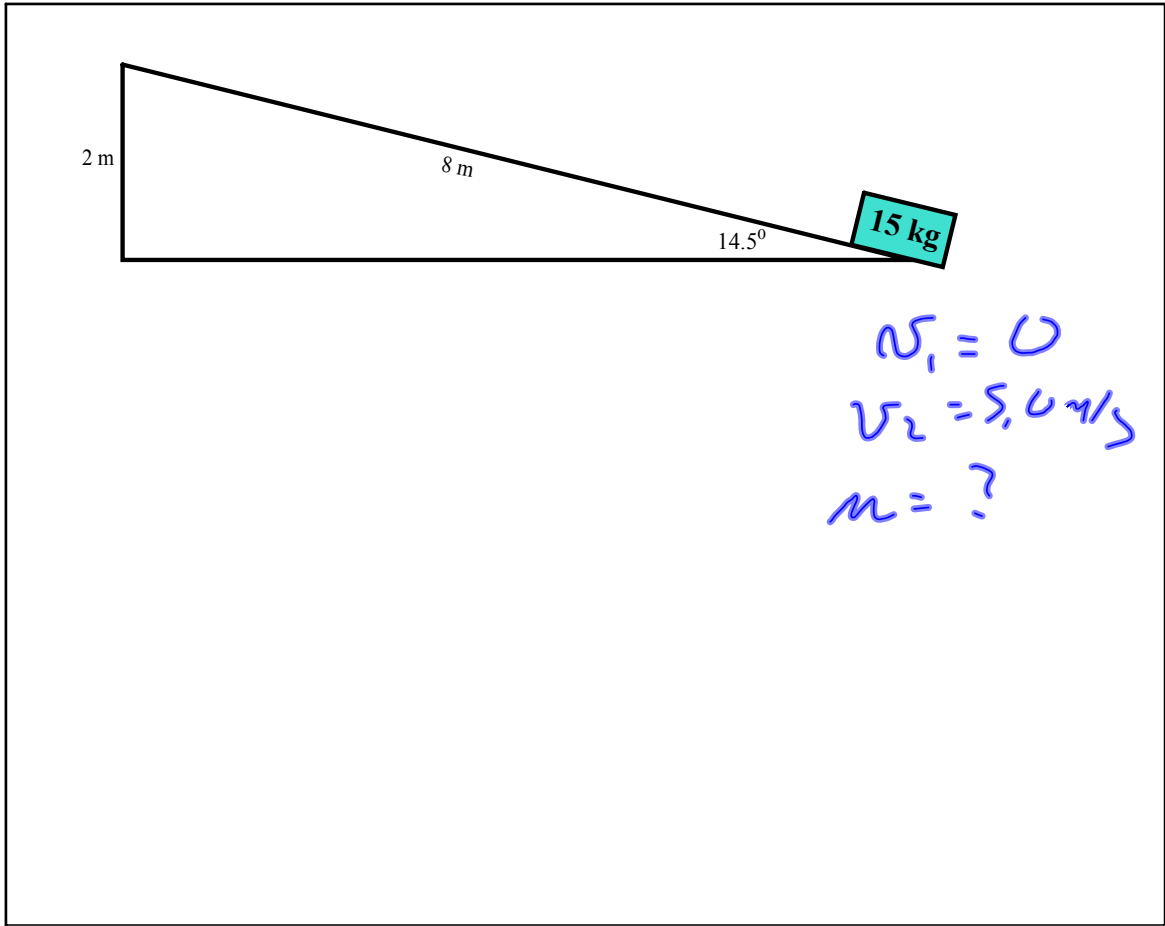
Feb 7 - 12:34 PM

$\mu = .30$

$W = \Delta KE$
 $W_a + W_f = \Delta KE$
 $F_x d + F_f d = \frac{1}{2} m v^2$
 $(F_x + F_f) d = \frac{1}{2} m v^2$
 $v = \sqrt{\frac{2d(F_x + F_f)}{m}}$
 $v = \sqrt{\frac{2(5m)[87N + (-47N)]}{10kg}}$
 $v = 6.6 m/s$

$F_f = \mu F_N$
 $= .30(148N)$

Feb 7 - 12:46 PM



Feb 11-7:25 AM

$v_1 = 0$
 $v_2 = 5.0 \text{ m/s}$
 $\mu = ?$

$$PE = KE + W_f$$

$$mgh = \frac{1}{2}mv^2 + W_f$$

$$W_f = mgh - \frac{1}{2}mv^2$$

$$W_f = m\left(gh - \frac{1}{2}v^2\right)$$

$$W_f = 15 \text{ kg} (9.8 \text{ m/s}^2) 2 \text{ m} - \frac{1}{2} (5.0 \text{ m/s})^2$$

$$W_f = 106 \text{ J}$$

$$W_f = f_f d$$

$$f_f = \frac{W_f}{d} = \frac{106 \text{ J}}{8} = 13 \text{ N}$$

$$f_f = \mu F_N$$

$$\mu = \frac{f_f}{F_N} = \frac{13 \text{ N}}{142 \text{ N}}$$

$$\mu = .092$$

$F_w = mg = 15 \text{ kg} (9.8 \text{ m/s}^2)$
 $F_N = \cos 14.5 (147 \text{ N})$
 $F_N = 142 \text{ N}$

Feb 11-7:31 AM