

The Story thus far ...

$$\text{2nd Law ... } \Sigma F = ma = \text{kg m/s}^2 = \text{N}$$

A Net force (ΣF) causes an object (m) to accelerate (a)

$$Ft = m\Delta v = \text{kg m/s}$$

An impulse (Ft) changes an objects momentum ($m\Delta v$)

and now ...

Feb 23-7:04 AM

$$F =$$

$$Ft =$$

$$Fd =$$

Feb 23-7:14 AM

Work

$$W = Fd_{\parallel}$$

$$W = N \times m = \text{Joules} \quad J = Nm = \text{kg m/s}^2 \text{ m} = \text{kg m}^2/\text{s}^2 = J$$

$$W = Fd_{\parallel}$$

$$v_2^2 = v_1^2 + 2ad$$

$$v_2^2 - v_1^2 = 2ad \quad F = ma \text{ and } a = F/m$$

$$v_2^2 - v_1^2 = 2Fd/m \quad \text{mult by "m" div by 2}$$

$$\frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 = Fd$$

$$W = \Delta \frac{1}{2}mv^2$$

$KE = \Delta \frac{1}{2}mv^2$ *Kinetic Energy is the energy of a moving object ... When work is done on an object it changes the KE of it. This is called the **Work-Energy Theorem**: $\Delta KE = W$*

Feb 6 - 10:13 AM

Calculating Work:



- A 140 g baseball is thrown at 40.0 m/s by a force of 93 N acting over a distance of 1.2 m.
- What work does the pitcher do on the ball?
 - What is the change in the ball's energy?
 - Using the Work-Energy Theorem find the speed of the ball as it left the pitchers hand.

Feb 8-11:00 AM

Calculating Work:



A 140 g baseball is thrown at 40.0 m/s by a force of 93 N acting over a distance of 1.2 m. a) What work does the pitcher do on the ball?
b) What is the change in the ball's energy?
c) Using the Work-Energy Theorem find the speed of the ball as it left the pitchers hand.

a) $W = Fd$
 $W = 93 \text{ N} (1.2 \text{ m}) = 112 \text{ J}$

$$W = Nm = J$$

b) $KE = \frac{1}{2}mv^2$
 $KE = \frac{1}{2} (.140 \text{ kg}) (40.0 \text{ m/s})^2$

$$KE = 112 \text{ J}$$

$$KE = \text{kg} \times \text{m}^2/\text{s}^2$$

$$KE = (\text{kg} \times \text{m}/\text{s}^2) \times \text{m} = \text{Nm} = \text{J}$$

c) $W = \Delta KE$
 $Fd = \frac{1}{2}mv^2$

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

$$v = \sqrt{[2(93 \text{ N} \times 1.2 \text{ m})]/.140 \text{ kg}}$$

$$v = 39.9 \text{ m/s}$$

$$v = \sqrt{[N \times m]/\text{kg}}$$

$$v = \sqrt{[(\text{kg} \times \text{m}/\text{s}^2) \times \text{m}]/\text{kg}}$$

$$v = \sqrt{\text{m}^2/\text{s}^2}$$

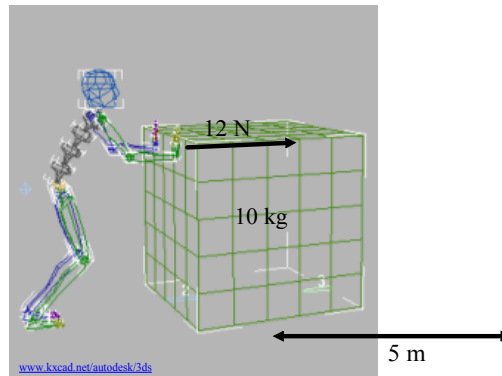
$$v = \text{m/s}$$

Feb 8-10:07 AM

You apply an average force of 12 N to a 10 kg box to move it 5 m.

a) How much work do you do?

b) If $v_1 = 0$ and $\mu = 0$, What velocity would this work give the box?



Feb 8-11:00 AM

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a) $W = Fd$

$$W = 12 \text{ N} \times 5 \text{ m} = 60 \text{ Nm} = 60 \text{ J}$$

b) $W = \Delta KE$

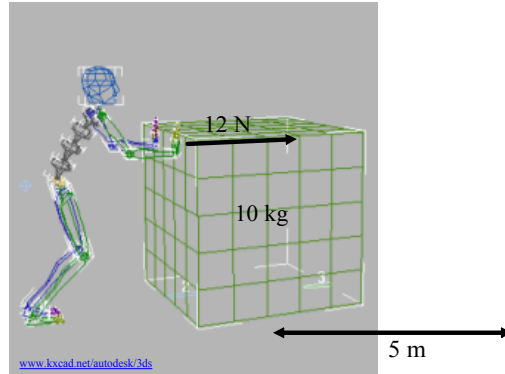
$$W = \frac{1}{2}mv^2$$

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

$$v = \sqrt{[(2(60 \text{ J}))]/10 \text{ kg}}$$

$$v = 3.5 \text{ m/s}$$

$$v = \sqrt{J/kg} = \sqrt{Nm/kg} = \sqrt{[(\text{kg} \times \text{m/s}^2) \times \text{m}]/\text{kg}} = \sqrt{\text{m}^2/\text{s}^2} = \text{m/s}$$



Feb 6 - 10:37 AM

A woman applies a 140 N force to a lawnmower handle. What work does she do if the handle makes an angle of 55° with the horizontal and she pushes it 15 m?



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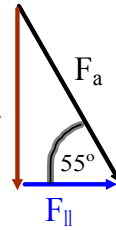
$$F_{\parallel} = \cos 55^\circ (140 \text{ N}) = 80. \text{ N}$$

$$W = F_{\parallel} d = 80. \text{ N} \times 15 \text{ m} = 1200 \text{ J}$$

$$\text{or } W = F_{\parallel} d = (\cos \theta F_a) d$$

$$W = Fd \cos \theta = 140 \text{ N} (15 \text{ m}) \cos 55^\circ = 1200 \text{ J}$$

When the force is along the plane of motion then theta is 0° , and the Cos of 0° is "1"



Feb 8-11:03 AM