Work

February-22-16 9:57 AM

Energy: the ability to do work

Work and Energy are SCALAR values

Units: "J" joules

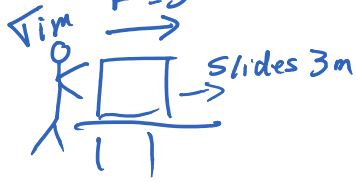
$J = \frac{kg \cdot m^2}{s^2}$

Work: the change in an objects energy

the product of Force and distance

$W = \Delta E$

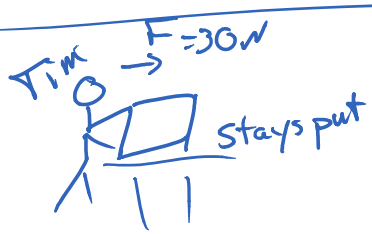
$W = F \cdot d$



How much work did Tim do?

$W = F \cdot d$

$W = 30 \cdot 3 = 90 J$



$W = F \cdot d$

$W = 30 \cdot 0 = 0 J$

No movement means No work!

Theo lifts a 32kg grapefruit up onto a 0.7m tall table. How much work did Theo do on the grapefruit?

$m = 32 kg$

$W = F \cdot d$

$F = F_g = mg = 32(9.8) = 313.6\ N$

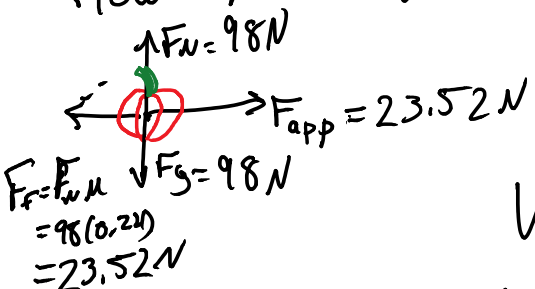
$d = 0.7m$

$W = 313.6 \cdot 0.7m$

$W = 219.52\ Nm$

$W = 220\ J$

A 10.0 kg pumpkin is moved horizontally 5.00m at a constant velocity across a level floor with a coefficient of friction of $\mu = 0.24$. How much work is done moving the pumpkin?



$W = F_{app} \cdot d$ ← Work is done by the applied force, not the net force!

$W = 23.52N \cdot 5m$

$W = 117.6\ J$

$W = 120\ J$

A 3.0kg pineapple is held 1.2m above the floor for 15s. How much work was done on the pineapple?

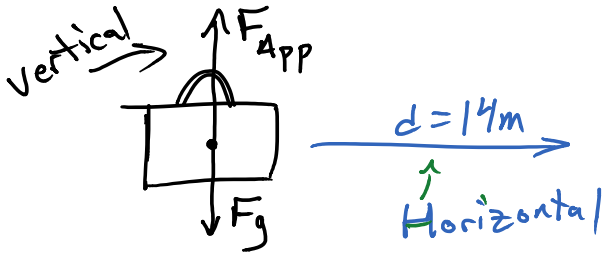
← "the object"

No distance = No work.

What did the work to keep the pineapple in place?

Work was done on the muscles used to hold the pineapple

Johannes is carrying his luggage. He uses 45 N to keep it off of the ground. He walks 14 m horizontally. How much work does he do on the luggage?



The Force and the distance must go in the same direction to perform work.

Vertical

$F_{App} = 45N$

$d = 0m$

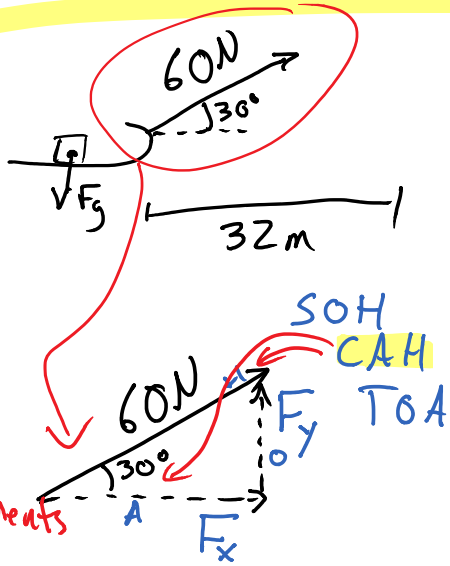
$W = 0J$

Horizontal

$F_{APP} = 0N$

$d = 14m$

$W = 0J$



This sled is pulled with a 60 N Force at an angle of 30° above the horizontal. The sled is pulled 32 m horizontally. How much work is done on the sled?

The movement was horizontal we should use F_x

$$60 \cos 30° = \frac{F_x}{60} \times 60$$

$$F_x = 60\cos 30 = 52N$$

$$W = 52N \times 32m = 1664J$$

$$W = 1700J$$

- W is positive if you put energy into moving

an object. (push/pull, engine)

- W is negative if you get energy out of a moving object. (Friction, generators)
  ↓
  Heat