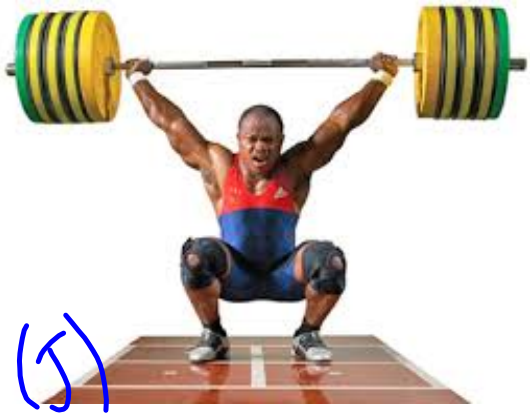
Work It!

Work: the quantity of **energy** transferred by a **force** when it is applied to a body and causes that body to move in the direction of force

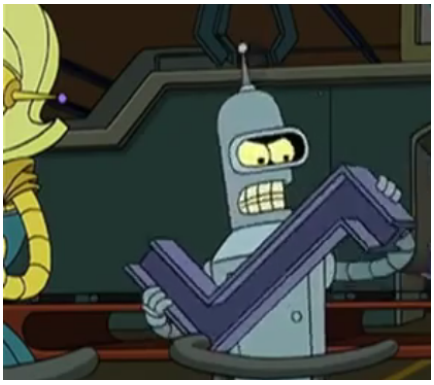
Work = Force · distance
W = F · d
SI Units: Joules (J)

↳ 1 N · m = 1 Joule (J)



Example 1: Basic...

Bender the robot uses an average force of 5,200 N to lift a girder 5 m. How much work does the Bender do on the girder?



$W = F \cdot d$

$(5{,}200\,N)(5\,m)$

$= 26{,}000\,J$

Example 2: A little trickier...

A mechanic uses a hydraulic lift to raise a 1,200 kg car 1.5 m off the ground. How much work does the lift do on the car?

$W = F \cdot d$

$(11{,}760\ N)(1.5\ m)$

$17{,}640\ J$

$F = m \cdot a$

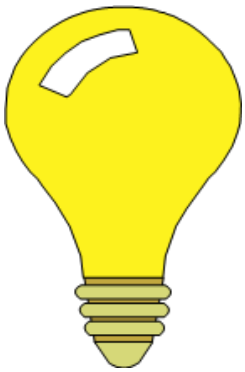
$(1200\ kg)(9.8\ m/s^2) = 11{,}760\ N$

Power

Power: a quantity that measures the rate at which work is done

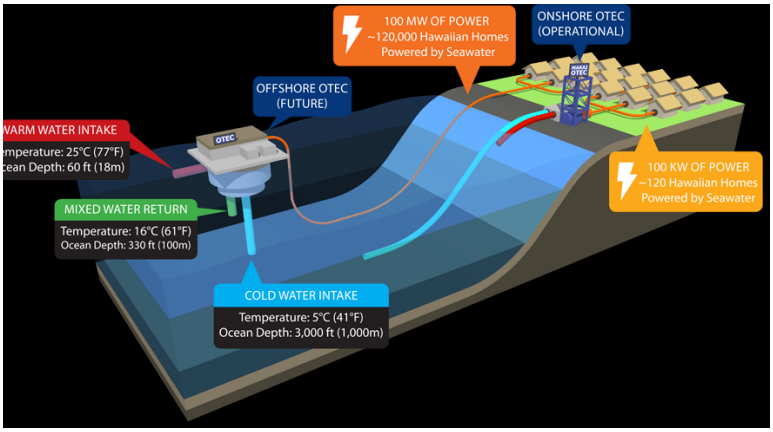
Power = Work / time
P = W / t
SI Units: Watts (W)

→ units: J/s = W



Example 1: Basic...

Every 2 seconds, the Seal Life Center's OTEC (Ocean Thermal Energy Conversion) system produces enough electricity to do 9,000 J of work by pumping large quantities of deep cold seawater and warm surface seawater to run a power cycle and produce electricity. What is the Sea Life Center's power output?



$$P = \frac{W}{t} = \frac{9000\,J}{2\,s}$$

$$= 4500\,W$$

~~4500 W~~

Example 2: A little trickier...

Anna walks up the stairs on her way to class. She weighs 70 kg and the stairs go up 20 stairs that are 10 cm high each.

$= .10m$

a. How much work does she do?

$W = F \cdot d$

$(686\,N)(2m)$

$= 1372\,J$

$F = ma$

$(70kg)(9.8m/s^2)$

$= 686\,N$

b. What is her power output if it takes her 10.5 seconds to climb stairs?

$P = \frac{W}{t} = \frac{1372\,J}{10.5s} = \boxed{130.6W}$