Chp 5.1

Work and Power

Work

- Work is the force times distance moved in the direction of the force.

$$W = Fd$$

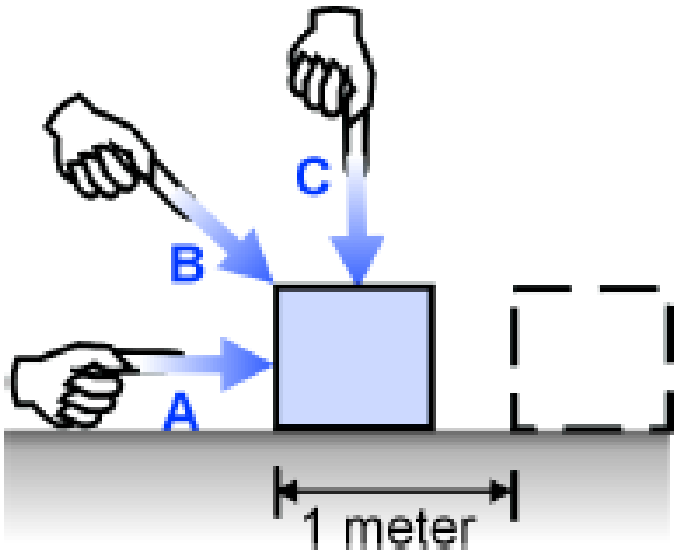
Work (Joules)

Force (Newtons)

Distance (meters)

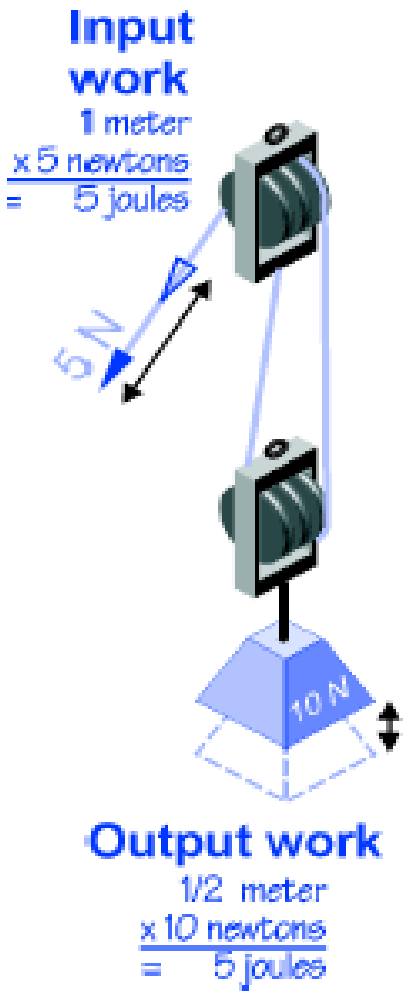
Unit is Joules (J)

- A force at an angle is not as effective at doing work
  - A does 1 J
  - B does less than 1 J
  - C does no work, since it does not help to move the box



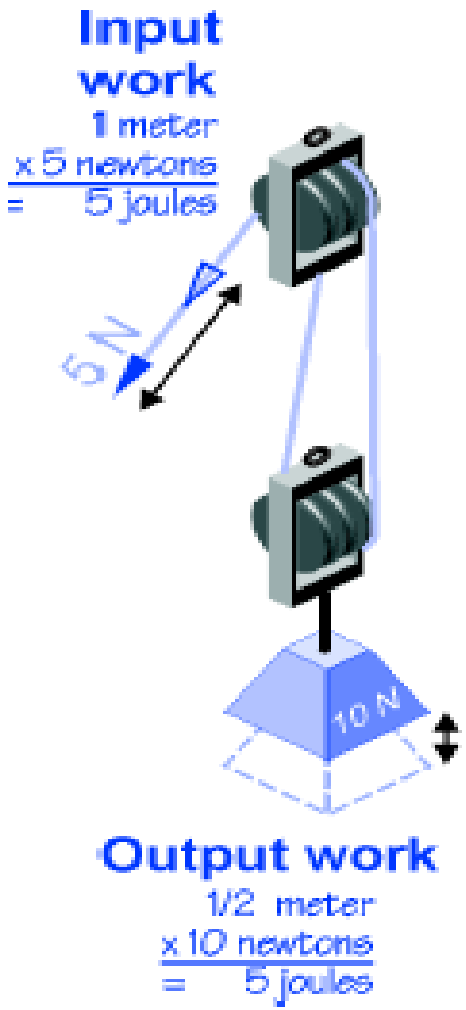
Work by a machine

- Machines can do work
  - For example, when a pulley lifts a 10 N weight, a force is applied. As a result of the force, the weight moves a distance of ½ meter. Work is done because the force as exerted over some distance



Work Input

- You do work as well
  - For example, you pulled on the string with a force of 5 N because the MA=2. But you had the pull twice as far. The weight moved up only ½ meter, but you had to pull 1 meter of string.

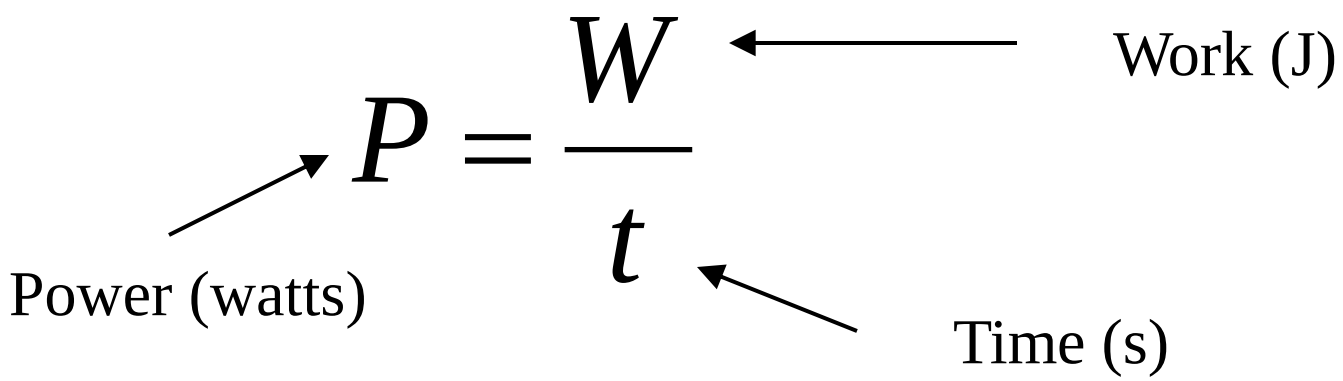


Efficiency

- You can never get more work out than you put in
- The efficiency of a machine is the ratio of the work output to the work input.
- An ideal machine would be 100 efficient.
- In real machines, the work output is always less than the work input, so it is always less than 100% efficient.

Power

- Power is the rate at which work is done.



- Units is a watt

Example

- Suppose you are your friend must each lift 10 5 N boxes from the floor to a 1 meter tall table. You do the task in 5 secs. It takes your (slacker) friend 20 sec to accomplish the same task. Who did more work?

Answer

- You both did the same. You both moved 10 5 N boxes 1 meter.

  W=Fd (10)(5)(1) = 50 J

  BUT, you had more power because it took you less time.

  P=W/t you 50/5 = 10 watt

  slacker 50/20 = 2.5 watt