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Physics 11

Section 7.6: Efficiency

If power is how impressive you are...

Then efficiency is how smart you are.

When a machine (or a human) does work, the efficiency depends on...

how much energy it uses up

and

how much useful work it does

goal/purpose/intention

$$E_{ff} = \frac{W_{out}}{W_{in}} \times 100\% \text{ or } \frac{P_{out}}{P_{in}} \times 100\%$$

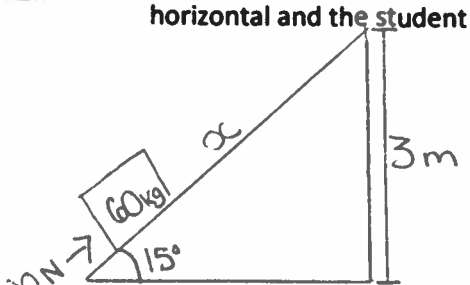
input

ft over from
wer notes.

Anyone can do a certain amount of work if you give them enough time, but

power is actually worth bragging about.

Example: A student raises a 60 kg box 3 m by pushing it up a ramp. The ramp makes a 15° angle with the horizontal and the student pushes with a force of 500 N. What is the efficiency of the ramp?



$\sin 15° = \frac{3}{x}$

$x = \frac{3}{\sin(15)}$

$x = 11.59\text{m}$

Crate moves at constant velocity.

$$E_{ff} = \frac{W_{out}}{W_{in}} = \frac{mgh}{F_{\parallel} d}$$

$$= \frac{(60)(9.8)(3)}{(500)(11.59)}$$

$$= 0.304 \times 100\%$$

$$= 30.4\%$$

Example: A 500 W motor lifts a 20 kg object 5 m in 3.5 s. What is the efficiency of the motor?

power in

power out

$$E_{ff} = \frac{P_{out}}{P_{in}} = \frac{\frac{W_{out}}{t}}{500} = \frac{\frac{mgh}{t}}{500}$$

$$= \frac{\frac{(20)(9.8)(5)}{3.5}}{500}$$

$$= 0.56 \times 100\%$$

$$= 56\%$$