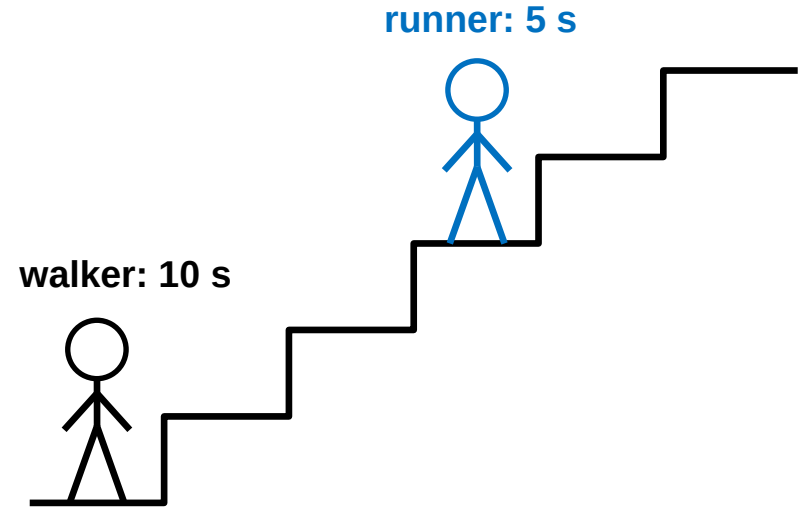


Essential Question

What makes one machine more powerful than another?

What Is Power?

- How fast work is done
- How fast energy is transferred
- Same work, faster: more power



same stairs, same work: the runner has more power

The Power Equation

$$P = W / t = \Delta E / t$$

 P

power (W)

 W or ΔE

work or energy (J)

 t

time (s)

The Watt

- $1 \text{ W} = 1 \text{ J/s}$
- $1 \text{ kilowatt (kW)} = 1,000 \text{ W}$
- $1 \text{ horsepower} \approx 746 \text{ W}$

LED bulb: about 10 W

laptop: about 50 W

microwave: about 1,000 W

car engine: about 100,000 W

Same Work, Different Power

- Same work: 1,500 J
- Half the time
- Twice the power

walker

1,500 J
in 10. s

150 W

runner

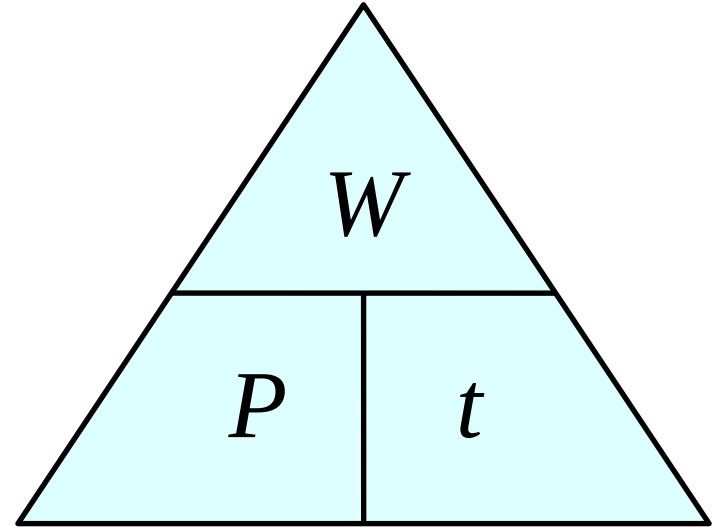
1,500 J
in 5.0 s

300 W

half the time means twice the power

Solving for Any Variable

- Find power: $P = W / t$
- Find work: $W = Pt$
- Find time: $t = W / P$

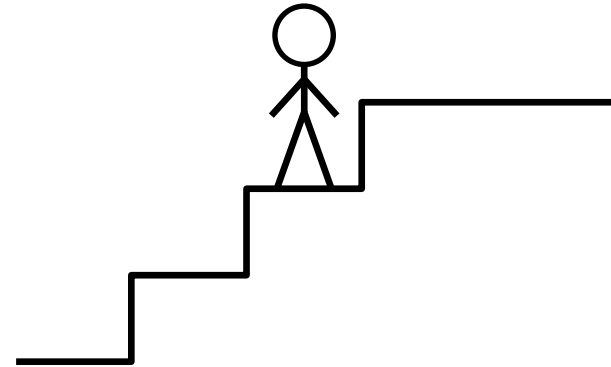


cover the one you want

Example: Climbing Stairs

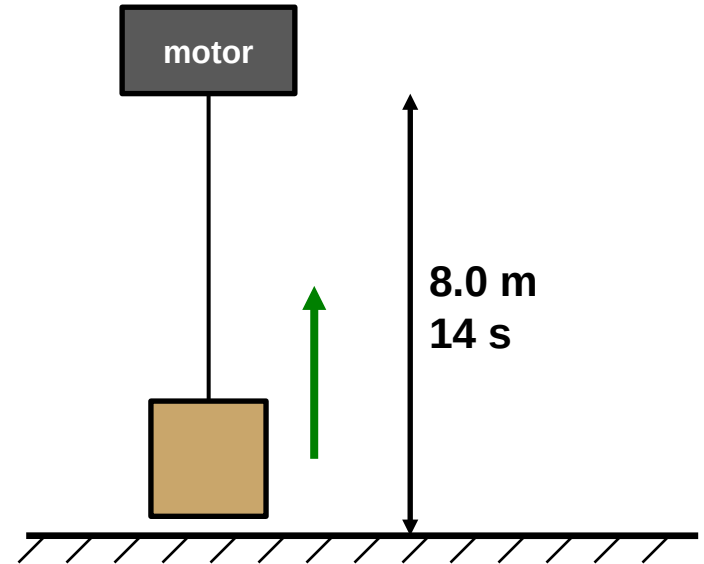
A student does 1,800 J of work climbing a flight of stairs in 4.0 s. What is her power?

$$W = 1,800 \text{ J}$$
$$t = 4.0 \text{ s}$$



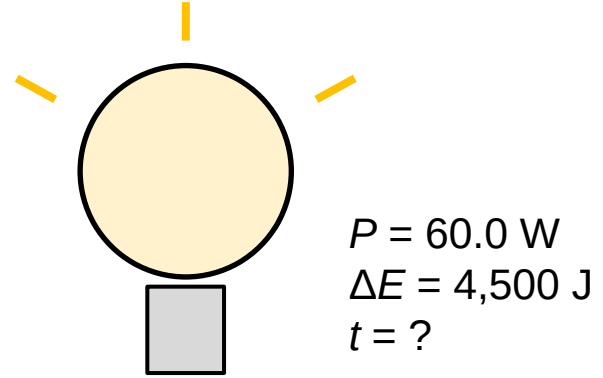
Example: Motor Lifting a Crate

A motor lifts a 25 kg crate straight up 8.0 m at a constant speed in 14 s. What is the motor's power?



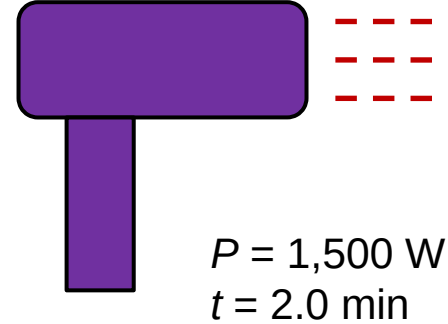
Example: Light Bulb

A 60.0 W light bulb transfers 4,500 J of energy. How long is it on?



Example: Hair Dryer

A 1,500 W hair dryer runs for 2.0 minutes. How much energy does it transfer?



Big Ideas

- Power: how fast energy is transferred
- $P = W/t = \Delta E/t$
- Watt: $1 \text{ W} = 1 \text{ J/s}$
- Same work, less time: more power