Energy and power

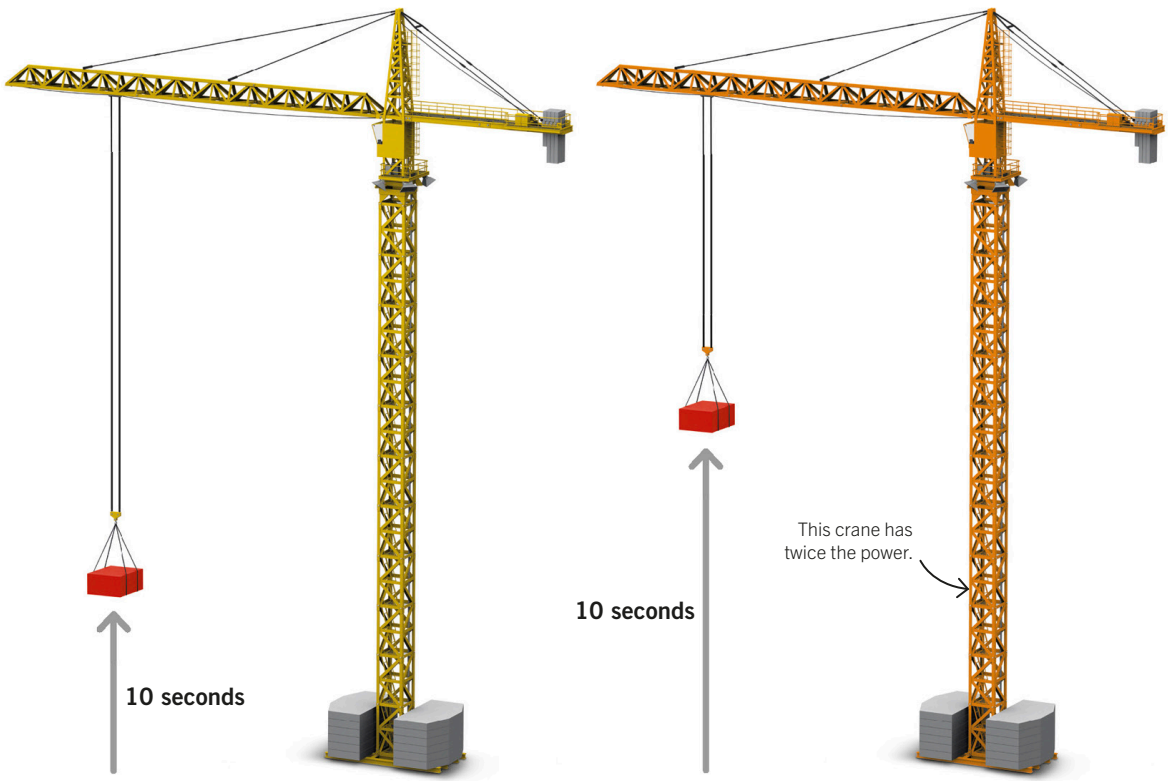
Power is a measure of how quickly energy is transferred (how quickly work is done). The more energy transferred per second, the greater the power.

Key facts

- ✓ **Power is a measure of how quickly energy is transferred (how quickly work is done).**
- ✓ **Power = energy transferred ÷ time taken.**
- ✓ **We measure power in watts (W). 1 W = 1 J/s.**

Lifting power

Two cranes use motorized pulleys to lift heavy loads from a ship. Both loads have the same mass, so the same energy is needed to lift them a certain distance. However, the orange crane lifts the cargo to twice the height of the yellow crane in the same time. Its motor has twice the power.



Power equation

The equation here shows how to calculate power. We measure power in units called watts (W). A power of 1 watt means 1 joule of energy is transferred in 1 second.

$$\text{power (W)} = \frac{\text{energy transferred (J)}}{\text{time (s)}}$$

$$P = \frac{E}{t}$$

Calculating power

Question

A boy weighing 400 newtons climbs 2.6 m up a ladder in 4 seconds. Use the formula work = force × distance to calculate how much energy was transferred. What was the boy's power?

Answer

First, calculate energy transferred (work done).

$E = f \times d$

$= 400\ \text{N} \times 2.6\ \text{m}$

$= 1040\ \text{J}$

Then use the power formula to calculate his power.

$P = \frac{E}{t}$

$= \frac{1040\ \text{J}}{4\ \text{s}}$

$= 260\ \text{W}$

Calculating energy

Question

A microwave oven with a power rating of 800 W heats a bowl of soup for 3 minutes. How much energy does it use?

Answer

First, rearrange the power equation to make energy the subject, then put in the numbers. Don't forget to convert minutes to seconds (3 minutes = 180 s).

$P = \frac{E}{t}$

$E = P \times t$

$= 800\ \text{W} \times 180\ \text{s}$

$= 144\,000\ \text{J}$

Rocket power

To escape the pull of gravity and reach orbit, massive rockets require engines with up to 60 gigawatts (60 billion watts) of power.