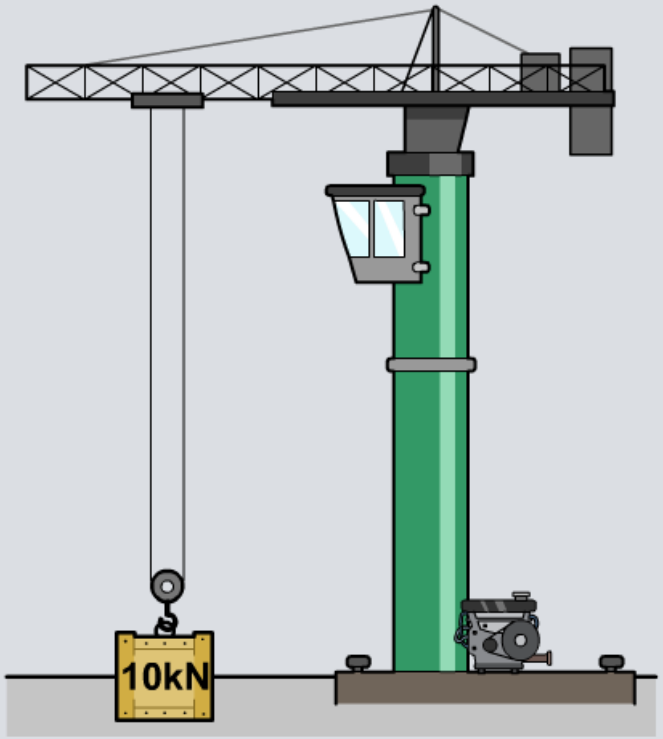
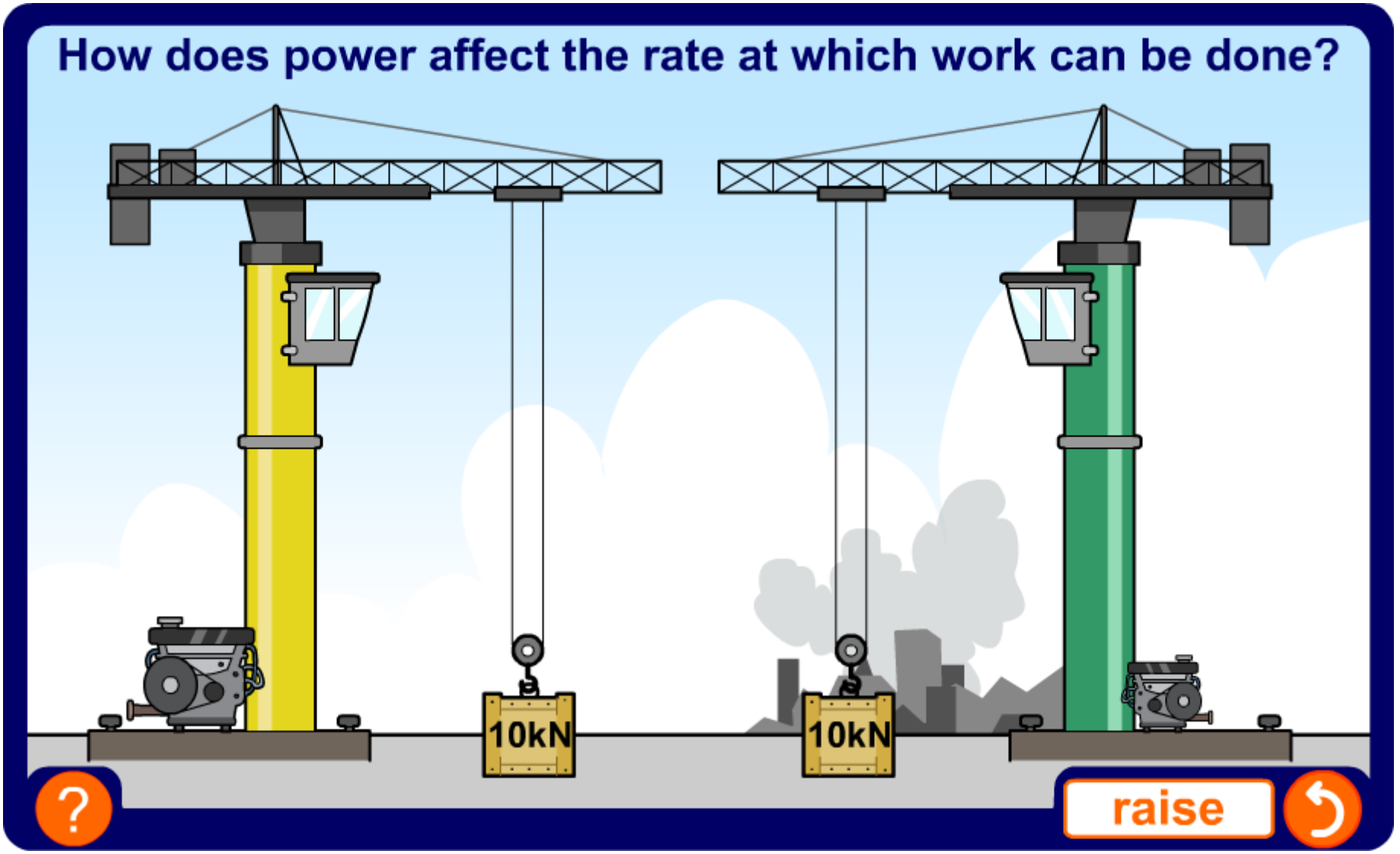
Power



Powerful cranes



Which is most powerful?

Power is the rate at which work is done. A more powerful engine, therefore, does work (i.e. transfers energy) faster than a less powerful engine.

Both these planes are about the same mass, but the jet has more powerful engines.

This means that chemical energy in the fuel can be transferred to kinetic energy faster, so it will have greater acceleration and a higher top speed.

How is power calculated?

The power exerted by an object can be calculated using one of two equations:

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

- Work done is measured in **joules** (**J**).
- Time is measured in **seconds** (**s**).
- Power is measured in **watts** (**W**).

Remember that work done = energy transferred.

Calculating power question 1

A lawnmower engine does 10 kJ of work in 10 seconds. What is the power of the engine?

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$= 10{,}000 / 10$$

$$= \mathbf{1{,}000\,W} = \mathbf{1\,kW}$$

Calculating power question 2

A car transfers 12 mJ of energy in 2 minutes. What is the power of the car?

$$\text{power} = \frac{\text{work done}}{\text{time}} = \frac{\text{energy transfer}}{\text{time}}$$

$$= 12{,}000{,}000 / 120$$

$$= \mathbf{100{,}000\,W} = \mathbf{100\,kW}$$

Power, work and time calculations

How is power related to fuel consumption?

Which plane will consume fuel the fastest?

The jet plane will have a higher fuel consumption than the propeller plane because its engines are more powerful.

A higher-powered engine will consume fuel more quickly than a lower-powered engine because it transfers energy at a faster rate. However, more work will be done in the same time.

Why is fuel consumption important?

In what situations might fuel consumption be an important consideration?

When buying a car, its fuel consumption (measured in miles per gallon – mpg) is an important factor to think about. This is because cars with a higher fuel consumption are:

- more expensive to run due to increased need to refuel, and may be subject to the Gas Guzzler Tax
- more polluting due to higher carbon dioxide emissions.

What factors might affect the fuel consumption of a car?

Factors affecting fuel consumption

All car manufacturers publish data on the fuel consumption on their cars, usually for two different speeds (e.g. urban and highway).

These figures are, however, based on ideal driving conditions and are unlikely to be achieved in real-world driving.

The fuel consumption of a specific car will vary with factors including:

- its speed, and the amount of harsh acceleration and braking
- the number of passengers and amount of luggage it is carrying
- the quality of the road surface.