SCIENCE

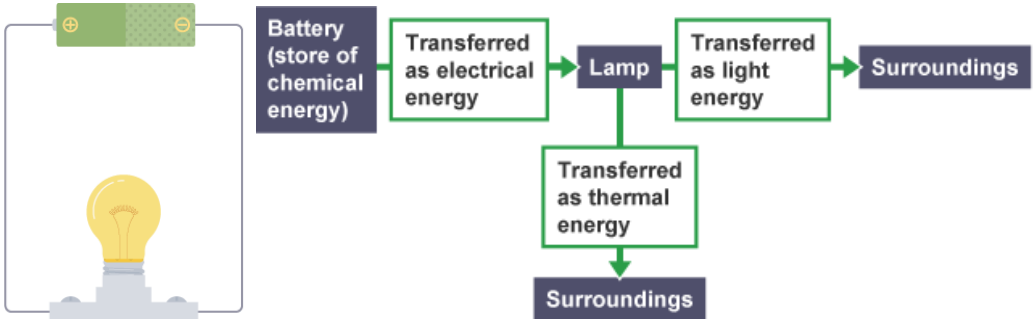
Year 8: Energy

1) Energy Stores

Chemical store	Energy stored as chemicals waiting to **react.**
Kinetic store	Energy stored in objects that are **moving.**
Gravitational Potential store	Energy stored in objects raised up against the force of **gravity**
Elastic Potential store	Energy stored in an object that have been **stretched.**
Internal store	Energy stored in the movement of particles. Can be changed by **heating** or **cooling**.
Nuclear store	Energy stored in the **nuclei** of atoms that can fuse (nuclear fusion) or split (nuclear fission).
Magnetic store	Energy stored by **magnets** that are **attracting** or **repelling.**
Electrostatic store	Energy stored in **electric charges** that are **attracting** or **repelling**.

2) Energy Transfers

Mechanical transfer	Energy transferred when a **force moves through a distance** (when **work is done**)
Electrical transfer	Energy transferred when a **charge moves**.
Radiation transfer	Energy transferred by **electromagnetic radiation**.
Heat transfer	Energy transferred when an object is **heated.**



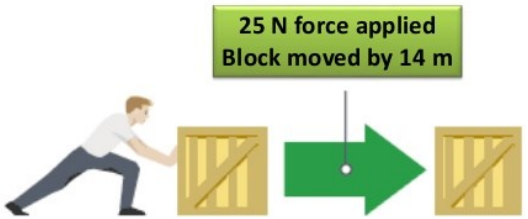
3) Quantities and Units

Quantity	Symbol	SI Unit	Symbol
Force	F	Newtons	N
Distance	d	metres	m
Energy	E	Joules	J
Work Done	W	Joules	J
Velocity	v	Metres per second	m/s
mass	m	kilograms	Kg
Gravitational field strength	g	Newtons per kilogram	N/kg

4) Work Done

Work is done when a force moves by a distance

$$Work\ Done = Force \times Distance\ Moved\ In\ Direction\ Of\ Force$$



In the example above Work Done = 25 N × 14 m = 350 J

$$Work\ Done = Energy\ Transferred$$

Work done is also equal to energy transferred , so the man pushing has transferred 350 J of energy to other forms. Some of this will be in the kinetic store of the block but most will have gone to the thermal store because friction acts between the block and the floor.

SCIENCE

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5) Efficiency

Energy efficiency measures the proportion of energy which is converted to the useful store.

$$Efficiency = \frac{Useful\ Output\ Energy}{Total\ Input\ Energy}$$

Forces such as friction and drag can cause energy to be transferred to stores that are not useful in that situation such as thermal stores.

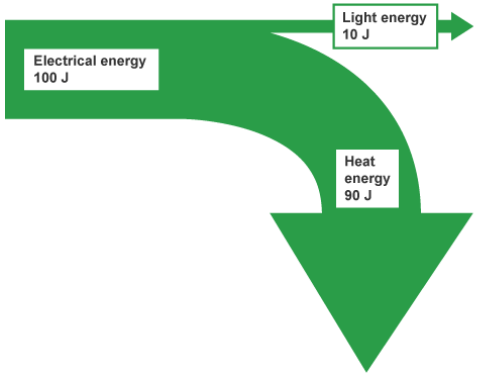
Example

The energy supplied to a LED bulb is 100 J. Out of this total energy supplied, 10 J is usefully transferred. How efficient is the light bulb? - Efficiency = 10 J ÷ 100 J = 0.1

6) Conservation of Energy

"Energy can be stored or transferred, but it cannot be created or destroyed. "

You can show energy transfers in a Sankey diagram. In these diagrams, the thicker the line or arrow, the greater the amount of energy stored in that form.



The total widths of the two arrows must be the same as the width of the initial arrow because none of the energy can be created or destroyed and so must have

7) Calculating Gravitational Potential Energy

Gravitational Potential Energy is the energy stored by an object as you lift it up. You can calculate it using the following equation.

$$Gravitational\ Potential\ Energy = Mass \times g \times Height$$

You must convert all masses into kilograms and heights into metres before you can use the equation. The gravitational field strength of the Earth g =9.8 N/kg (this can often be approximated to 10 N/kg)

Example

A students bag weighs 5 kg and she lifts it to her shoulder which is 150 cm above the ground. How much gravitational potential energy is stored by the bag?

GPE = 5 kg × 9.8 N/kg × 1.5 m = 73.5 J

8) Calculating Kinetic Energy

Kinetic Energy is the energy stored by an object when its is moving. You can calculate it using the following equation.

$$Kinetic\ Energy = \frac{1}{2} \times mass \times velocity^2$$

You must convert all masses into kilograms and velocities into metres per second before you can use the equation.

Example

A student has a mass of 39.9 kg and his bike has a mass of 9.2 kg. He is riding his bike at 5.6 m/s. How much kinetic energy is stored by the boy and his bike?

Total mass = 39.9 kg + 9.2 kg = 49.1 kg

KE = 0.5 × 49.1 kg × $(5.6\ m/s)^2$ = 756.14 J