



Energy



What is energy?

- Energy exists as different 'stores'.
- Energy **cannot be created or destroyed**.
- Energy can only be transferred from one store to another.
- **Energy** is measured in **joules, J**

Transferring Energy

Energy can be transferred in four different ways.

- **Mechanically** – a force being applied to move an object
- **Electrically** – when charged particles move (electricity)
- **Heating** – when energy is transferred between hotter and colder regions
- **Radiation** – when energy is transferred as a wave (e.g. light wave or sound wave)

Losing Energy to the Surroundings

When **energy** is transferred from one store to another, it **can sometimes be lost to the surroundings**.

For example, when a light bulb shines, it heats up. The heat is lost to the air surrounding it.



Energy Stores

| Store | Description | Example |
|--------------------------------|--|---|
| Thermal | Energy stored in hot objects | Hot Tea Hot Coffee |
| Kinetic | Energy in moving objects | Runners Moving bus |
| Nuclear | Energy stored in the nucleus of the atom. | Hydrogen fusing in the sun Any atoms nucleus |
| Chemical | Energy stored in chemical bonds | Batteries Food Fuel |
| Gravitational potential | Energy stored in objects above the ground | Plane in flight, cup on the table, flying kite |
| Magnetic | Energy stored in a magnetic field | Magnets Earths magnetic field |
| Elastic potential | Energy stored in objects which stretch or squash | Elastic bands, hair bobbles, springs |
| Electrostatic | Energy stored in charged objects | Electrons Complete circuits |

Energy Changes

Energy can transfer from one store to another. You need to identify which store increases, and which store decreases.

Energy Changes Example 1

Burning coal:

- **Chemical** store **decreases**
- **Thermal** store **increases**



Energy Changes Example 2

Skydiving:

- **Gravitational** store **decreases**
- **Kinetic** store **increases**



Efficiency

When a device, appliance or machine is switched on, some of the energy being transferred is wasted and lost to the surroundings.

- An efficient device transfers more energy into the useful and wastes as little energy as possible.
- For example: LED lights are more efficient because less energy is wasted as heat.

Calculating Efficiency

You can use this equation to calculate the efficiency of a device. The higher the number, the more efficient it is and the less energy the device wastes.

$$\text{Efficiency} = \frac{\text{Useful energy output}}{\text{Total energy input}}$$

Power

Power is the rate at which **energy is transferred per second**.

- Power is measured in **watts, W**
- The higher the power, the more energy is being transferred per second.
- For example: a powerful car will transfer more energy into it's kinetic store in a shorter amount of time.

Calculating Power

You can use this equation to calculate the power of a device. You need to know how much energy is being transferred and how long it takes **in seconds**.

$$\text{Power (W)} = \frac{\text{Energy Transferred (J)}}{\text{Time Taken (s)}}$$



CORE Questions



The following are core questions for this topic. Cover the answer section with a sheet of paper and try and quiz yourself. Only try learning 5 at a time, once you know them move on.

| | | |
|----|---|--|
| 1 | State the law of conservation of energy | No energy can be created or destroyed. It can only be transferred from one store to another. |
| 2 | What energy store increases if an object moves faster? | Kinetic energy |
| 3 | What energy store increases as the objects height increases? | Gravitational Potential energy |
| 4 | What is the energy stored in food, fuel and batteries? | Chemical energy |
| 5 | What is the energy stored in an object which can be stretched or squashed? | Elastic potential energy |
| 6 | What is a system? | An object or group of objects |
| 7 | State four ways energy can be transfereed. | Electric currents, heating, sound and light |
| 8 | When coal burns identify the energy store which decreases and increases. | Decreases: chemical Increases: Thermal (light) |
| 9 | When a torch is switched on identify the energy stores which decrease and increase. | Decreases: chemical Increases: Thermal and light |
| 10 | When an rubber falls off a bench identify the energy stores which initially decrease and increase. | Decreases: GPE Increases Kinetic |
| 11 | Which a torch is switched on, identify the useful energy transfer and wasted energy transfer. | Useful: Light Wasted: Thermal |
| 12 | Which an engine starts moving, identify the useful energy transfer and wasted energy transfer. | Useful: Kinetic Wasted: Thermal |
| 13 | A light bulb give out 10J of light energy from a total of 20J in its battery. Calculate the efficiency. | $10/20 = 0.5$ $(0.5 \times 100 = 50\%)$ |
| 14 | Why are no systems 100% efficient? | Wasted energy is always lost to the surroundings |
| 15 | Identify the factors that affect gravitational potential energy. | mass, height and gravitational field strength |
| 16 | Identify the factors that affect kinetic energy. | mass and speed |
| 17 | Identify the factors that affect elastic potential energy. | extension and spring constant |
| 18 | State the defintion of power | The rate at which energy is transferred. |
| 19 | Put into an equation: power, energy transferred and time | Power = Energy transferred / time |
| 20 | 10,000J is transferred in 100 seconds. Calculate the power. | $P = E / t$ $P = 10,000 / 100$ $P = 100W$ |