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 efficency.	10/20 = 0.5 (0.5 x 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