

Physics Knowledge Organiser

P1 – Energy stores and Systems

Energy Stores

There are 7 main stores of energy in a system. These can be remembered using MICKEE G

Energy store	Description	Examples
Magnetic	The energy stored when repelling poles have been pushed closer together or when attracting poles have been pulled further apart.	Fridge magnets, compasses, maglev trains which use magnetic levitation.
Internal (thermal)	The total kinetic and potential energy of the particles in an object, in most cases this is the vibrations - also known as the kinetic energy - of particles. In hotter objects, the particles have more internal energy and vibrate faster.	Human bodies, hot coffees, stoves or hobs. Ice particles vibrate slower, but still have energy.
Chemical	The energy stored in chemical bonds, such as those between molecules.	Foods, muscles, electrical cells.
Kinetic	The energy of a moving object.	Runners, buses, comets.
Electrostatic	The energy stored when repelling charges have been moved closer together or when attracting charges have been pulled further apart.	Thunderclouds, Van De Graaff generators.
Elastic potential	The energy stored when an object is stretched or squashed.	Drawn catapults, compressed springs, inflated balloons.
Gravitational potential	The energy of an object at height.	Aeroplanes, kites, mugs on a table.

Equation	Meanings of terms in equation
$E_e = 0.5ke^2$ *	E_e = Elastic Potential Energy (Joules, J) k = spring constant (Newtons per metre N/m) e = extension (metres, m)

Energy Systems and transfers

An energy system is an object or a group of objects in which energy may change.

Energy can be transferred in a system in for main ways:

- Mechanical work – A force moving an object a distance
- Electrical work – Charges moving due to a potential difference
- Heating – Due to temperature differences caused electrically or by a chemical reaction
- Radiation – energy transferred as a wave (Light, infrared, sound etc). Light and infrared radiation are emitted from the sun.

We can show how energy is transferred by using two diagrams. Energy transfer diagrams and Sankey diagrams.

Both diagrams are for a child at the top of a slide. The gravitational energy stored in the child at the top of the slide is transferred as mechanical work done to speed up and do work against friction. The result of this is energy shifts from gravitational potential energy to kinetic energy of the child and internal energy (raising the temperature of the slide and child). The Sankey diagram includes the amount of energy and the width of the arrows are drawn to scale.



Equation	Meanings of terms in equation
$E_k = 0.5mv^2$ *	E_k = Kinetic Energy (Joules, J) m = mass (kilograms, Kg) v = velocity (metres per second, m/s)
$E_p = mgh$ *	E_p = Gravitational potential energy (Joules, J) m = mass (kilograms, Kg) g = gravitational field strength (Newtons per Kilogram N/Kg) h = height (metres, m)

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Energy dissipation

When there is a change of energy in a system, energy is transferred and some of that energy is dissipated. Any energy that is not transferred to a useful store is said to be wasted as it is lost to the surroundings. For example electrical cables will warm up and then the energy is dissipated to the surrounding air.

In a mechanical system energy is dissipated when two surfaces rub together. Work is done against friction which causes the two surfaces to heat up, this leads to the increase in internal (thermal) energy. Adding a lubricant to the surface will reduce friction so less heat energy is wasted.

If an object is described as being more energy efficient then less energy is wasted.

Energy can sometimes be dissipated as sound waves. The ways energy is dissipated depends on the system.

Examples

A radio:

The electrical work is transferred to useful sound waves and infrared radiation is dissipated to the surrounding. (Wasted as heat energy)

A tumble dryer:

The electrical work is transferred into useful internal (thermal) energy which dries the clothes. Energy is dissipated as sound waves.

Key Terms	Definitions
Energy system	An object or group of objects
Work	A scientific way of saying that energy has been transferred.
Dissipation	A term used when energy is wasted
Internal energy	The total kinetic and potential energy of the particles in an object
Transferred	When something is moved from one place to another.

Conservation of energy

Energy can be transferred usefully, stored or dissipated. It can't be created or destroyed.

Examples:

When a skydiver jumps out of a plane he begins to lose gravitational potential energy as his height decreases, he gains kinetic energy as his speed increases. Not all of the gravitational potential energy transfers to kinetic energy. Work is done pushing against the air particles so some of the gravitational potential energy is transferred to the air particles and stored as internal energy.

A smartphone contains a battery that stored chemical energy. When the phone is used electrical work is done as the current flows. The chemical energy is also transferred to sound from the speaker and light from the screen. The phone also heats up so the chemical energy is transferred to internal energy, emitting infrared radiation (heat energy).