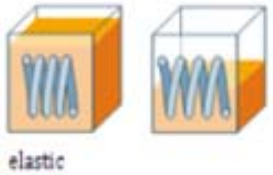
P1 Knowledge Organiser – 4.1.1 – Energy

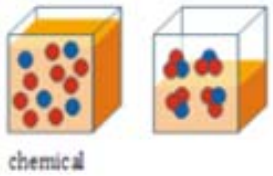
Energy Stores

- Gravitational potential
- Magnetic
- Internal thermal
- Chemical
- Kinetic
- Electrostatic
- Elastic potential
- Nuclear
- As one store empties, another store is filled by the same amount
- **Conservation of energy**
- **Energy usually wasted as thermal energy**

Energy pathways

- Mechanical
- Internal thermal
- Radiation
- Electrostatic





Energy Transfers in a System

- Energy can be **transferred usefully, stored or dissipated**, but cannot be created or destroyed
- **Dissipation is reduced by lubrication or Insulation**
- Rate of cooling of a building is affected by the thickness and thermal conductivity of the walls

Power

Power is the rate at which energy is transferred or the rate at which work is done

Power = Energy Transferred / Time

Power = Work Done / Time

Efficiency

Is a measure of useful energy output of a system

Efficiency = useful output energy / total input energy

Efficiency = useful power output / total power input

Kinetic Energy

Kinetic energy stores describe the energy that an object has because it is moving. It is calculated using the formula:

Kinetic Energy = 0.5 x mass x (speed)^2

Elastic Potential Energy

Elastic potential energy stores describe the energy that is stored in a spring when you squash or stretch it. **Elastic Potential Energy = 0.5 x spring constant x (extension)^2**

Assuming the limit of proportionality has not been exceeded.

Gravitational Potential Energy

Gravitational potential energy stores describe the energy that is stored in an object because of its position above the ground

g.p.e = Mass x Gravitational Field Strength x Height

Objects with mass have weight due to gravitational field strength.

Weight = Mass x Gravitational Field Strength

This means that: **g.p.e = Weight x Height**

Change in Thermal Energy

Thermal energy stores describe the energy a substance has because of its temperature

Change in Thermal Energy = Mass x Specific Heat Capacity x Temperature Change

The specific heat capacity of a substance is the amount of energy required to raise the temperature of 1kg of the substance by 1°C.

Quantity	Symbol	Unit
Kinetic Energy	E_k	J
Elastic Potential Energy	E_e	J
Gravitational Potential Energy	E_p	J
Change in Thermal Energy	ΔE	J
Energy Transferred	E	J
Work Done	W	J
Mass	m	Kg
Speed	v	m/s
Spring Constant	k	N/m
Extension	e	m
Height	h	m
Gravitational Field Strength	g	N/kg
Weight	w	N
Specific Heat Capacity	c	J/kg°C
Temperature Change	$\Delta\theta$	°C
Power	P	W
Time	t	s

Energy source	Renewable	Non-renewable
Advantages		
Disadvantages		

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Renewable Energy: Resources that are replenished at the same rate as they are used.

Non Renewable Energy: Resources that are replenished slower than the rate as which they are used.

Energy Resource	Description	Renewable/ Non Renewable	Way Used	Reliability	Environmental Impact
Fossil Fuel	Coal, oil and natural gas that are extracted from the Earth and burned.	**Non-Renewable**	Transport, electricity generation and heating.	Reliable	Produce greenhouse gases.
Nuclear Fuel	Energy from atoms. Uranium is a nuclear fuel and transfers energy when the nucleus splits in two.	**Non-Renewable**	Electricity generation.	Reliable	No greenhouse gases, but radioactive waste is made.
Biofuel	A fuel taken from living or recently living things. An example of a biofuel is animal waste.	**Renewable**	Transport, electricity generation and heating.	Reliable	It is carbon neutral.
Wind	The force of wind turns blades and a generator at the top of a narrow tower.	**Renewable**	Electricity generation.	Unreliable as when there is no wind they don't work.	Unsightly and make a noise. Don't produce greenhouse gases.
Hydroelectricity	Can be generated when rainwater collects behind a reservoir and flows downhill. This turns a turbine.	**Renewable**	Electricity generation.	Affected by droughts if the reservoirs dry up.	Large reservoirs of water needed and habitats can be flooded to do this. Don't produce greenhouse gases.
Geothermal	Water is pumped under the Earth and turns to steam. This turns a turbine to turn a generator.	**Renewable**	Electricity generation and heating.	Reliable	Doesn't produce greenhouse gases.
Tidal	Water is trapped from high tide behind a barrage and then released into the sea through turbines.	**Renewable**	Electricity generation.	Reliable	Affect river estuaries and the habitats of animals. Don't produce greenhouse gases.
Solar	Transfers energy from the Sun using solar panels. They can be used to generate electricity or heat water.	**Renewable**	Electricity generation and heating.	No energy produced at night and affected by windy weather.	Cover large areas to generate enough power. Don't produce greenhouse gases.
Water Waves	The waves make a floating generator move up and down to generate electricity.	Renewable	Electricity generation.	Affected by storms and don't make a constant supply of electricity.	Can spoil the coastline and affect habitats. Don't produce greenhouse gases.