THE Ebbsfleet ACADEMY
Aspire, Excel

Subject: Science
Years: KS3 – Year 8
Topic: P4 Energy

Lesson Sequence
1. Introduction to Energy
2. Renewable and Non-Renewable Energy
3. Energy Transfers
4. Conservation of Energy
5. Energy in Food
6. Energy in Fuels
7. Conduction
8. Convection
9. Radiation
10. Evaporation
11. Work and Power
12. Energy Changes in Reactions
13. Calculating Energy Transferred

Key Assessments

EA Exam 1

Essay: Why are renewable energy resources important?

Core Texts

SMART Science text book

Key Words

Bonds	Attraction between two atoms holding them together as one.	**Elastic Potential Energy**	Energy stored in a material when it is stretched or squashed.
Calories	A measure of energy. The amount of energy needed to heat 1g of water by 1°C.	**Electrons**	Particles that surround an atom, with a negative charge, they also carry current in electric circuits.
Calorimeter	Apparatus for measuring the amount of heat involved in a chemical reaction.	**Endothermic**	Describes any reaction that takes in heat energy.
Conduction	Process by which heat or electrical energy passes through a solid materials.	**Energy**	The ability to do work, it exists in many forms and can be transferred between them.
Conductor	Solid materials that allow heat or electricity to pass through easily.	**Environmental Impact**	An issue affecting the environment, including water/air quality, landscape or animal habitats.
Conservation of Energy	Energy cannot be created or destroyed, only moved from one form to another.	**Evaporation**	A liquid changing to a gas due to an increase in temperature and/or pressure.
Convection Current	In liquids and gases. Hotter, less dense particles rise, colder, denser particles sink.	**Exothermic**	A chemical reaction that gives out energy (as heat or light).
Density	A measure of the concentration of mass in an object, calculated by mass ÷ volume = density. Units are g/cm^3.	**Force**	An interaction between two objects that results in each exerting a push or pull on the other.

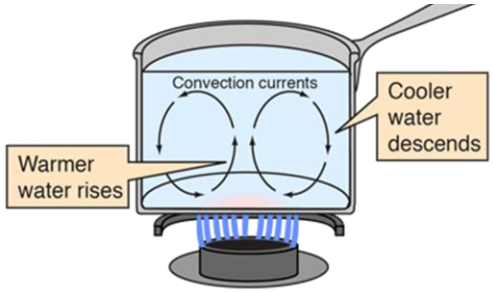
Energy in Food/Fuels

- The energy in food or a fuel can be calculated via calorimetry.
- Water is placed in a calorimeter and its temperature is measured.
- A known mass of fuel/food is burnt to heat the water.
- The temperature rise of the water is proportional to the amount of energy the food/fuel contains.

Calculating Work Done

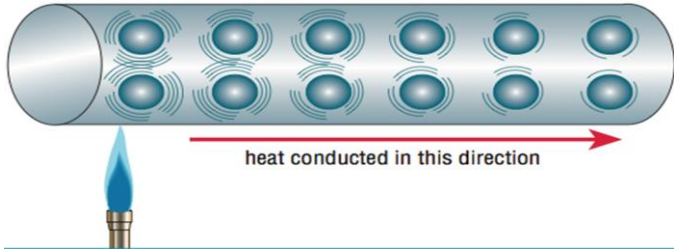
Work done (Nm) = Force (N) x Distance (m)
Force (N) = Work done (Nm) ÷ Distance (m)
Distance (m) = Work done (Nm) ÷ Force (N)

Convection: Warm, less dense particles rise. Cooler, denser particles sink – forming a convection current. It occurs in liquids and gases.



Radiation: Hot objects give out heat in the form of infrared radiation. It does not require particles to travel through.

Conduction



The hotter a particle is, the more kinetic energy it has. As particles gain thermal energy they begin to vibrate. These vibrations then spread to nearby particles.

Key Words

Gravitational Potential Energy (GPE)	Energy stored when an object is lifted upwards.	**Power**	The measure of how much energy something uses each second.
Insulator	Solid materials that do not allow heat or electricity to pass through easily.	**Radiation**	Energy that comes from a source and that can travel through space e.g. light energy or sound energy.
Joule (J)	The unit of energy.	**Renewable**	Anything that can be replaced naturally after it has been used.
Kilowatt	A measure of electrical power (1 kilowatt = 1000 watts).	**Sankey Diagram**	Diagram showing how much energy is changed to different forms in a process.
Kinetic Energy (KE)	Energy of a moving object.	**Social**	The effect of an activity on the social fabric of the community and well-being of the individuals and families.
Non Renewable	Anything that cannot be replaced naturally when it is used up.	**Thermal Energy**	Energy stored in a hot object.
Nuclear Energy	Energy stored in the nucleus of an atom, released in a nuclear reaction.	**Work**	The transfer of energy from one object to another caused by a force.
Particles	Small pieces such as molecules or atoms that make up a substance.		

Renewable Energy Resources

- Hydroelectric Power (HEP), Wind Turbines, Wave Turbines, Solar Cells, Geothermal Power, Tidal Power.
- Biofuels – Can be replaced quickly under normal circumstances.

Non-Renewable Energy Resources

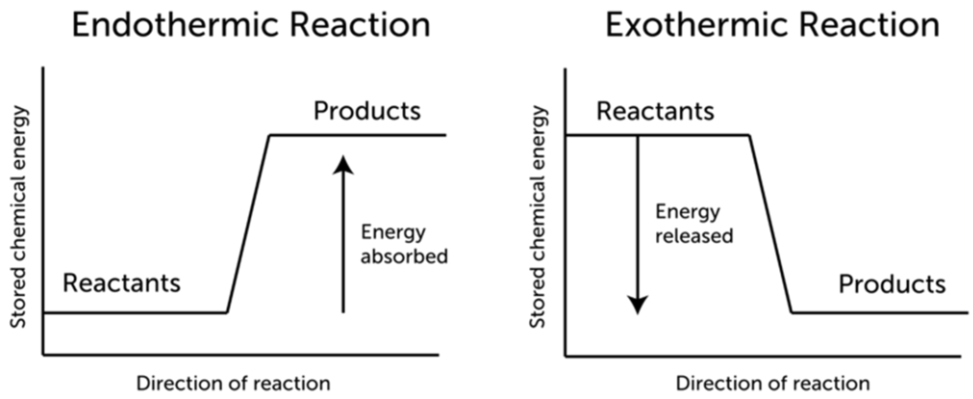
- Fossil fuels: Coal, Oil, Natural Gas.
- Nuclear (Will last a long time but will run out eventually).

Calculating Energy efficiency

- Useful and total output energy is measured in Joules (J)
- Energy efficiency does not have a unit. It is a number between 0 and 1. It can be converted to a percentage by multiplying by 100.

Energy efficiency (%) = (Useful energy output ÷ Total energy output) x 100

Endothermic and Exothermic Reactions



- Exothermic reactions release energy to the surroundings as heat (or light). As a result, the temperature of the surroundings increases.
- Endothermic reactions absorb energy from the surroundings. As a result the temperature of the surroundings drops.

Sankey Diagrams: A 'to scale' diagram representing energy transfers