4 Energy resources and energy transfers

The following sub-topics are covered in this section.

(a) Units

(b) Energy transfers

(c) Work and power

(d) Energy resources and electricity generation

(a)	**Units**
Students should:	
4.1	use the following units: kilogram (kg), joule (J), metre (m), metre/second (m/s), metre/second^2 (m/s^2), newton (N), second (s) and watt (W)

(b)	**Energy transfers**
Students should:	
4.2	describe energy transfers involving energy stores: • energy stores: chemical, kinetic, gravitational, elastic, thermal, magnetic, electrostatic, nuclear • energy transfers: mechanically, electrically, by heating, by radiation (light and sound)
4.3	use the principle of conservation of energy
4.4	know and use the relationship between efficiency, useful energy output and total energy output: $\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$
4.5	describe a variety of everyday and scientific devices and situations, explaining the transfer of the input energy in terms of the above relationship, including their representation by Sankey diagrams
4.6	describe how thermal energy transfer may take place by conduction, convection and radiation
4.7	explain the role of convection in everyday phenomena
4.8	explain how emission and absorption of radiation are related to surface and temperature
4.9	*practical: investigate thermal energy transfer by conduction, convection and radiation*
4.10	explain ways of reducing unwanted energy transfer, such as insulation

(c)	**Work and power**
Students should:	
4.11	know and use the relationship between work done, force and distance moved in the direction of the force: work done = force × distance moved $W = F \times d$
4.12	know that work done is equal to energy transferred
4.13	know and use the relationship between gravitational potential energy, mass, gravitational field strength and height: gravitational potential energy = mass × gravitational field strength × height $GPE = m \times g \times h$
4.14	know and use the relationship: kinetic energy = $\frac{1}{2}$ × mass × speed^2 $KE = \frac{1}{2} \times m \times v^2$
4.15	understand how conservation of energy produces a link between gravitational potential energy, kinetic energy and work
4.16	describe power as the rate of transfer of energy or the rate of doing work
4.17	use the relationship between power, work done (energy transferred) and time taken: $\text{power} = \frac{\text{work done}}{\text{time taken}}$ $P = \frac{W}{t}$

(d)	**Energy resources and electricity generation**
Students should:	
4.18P	**describe the energy transfers involved in generating electricity using:** • **wind** • **water** • **geothermal resources** • **solar heating systems** • **solar cells** • **fossil fuels** • **nuclear power**
4.19P	**describe the advantages and disadvantages of methods of large-scale electricity production from various renewable and non-renewable resources**