P1 Energy

Lessons TBAT	Key Knowledge	Practical	Assessment
Identify how energy is stored around us Calculate the amount of kinetic energy an object has using an equation Calculate the amount of elastic potential energy an object has using an equation Calculate the amount of gravitational potential energy an object has using an equation	A system is an object or group of objects. There are changes in the way energy is stored when a system changes. Students should be able to describe all the changes involved in the way energy is stored when a system changes, for common situations. For example: • an object projected upwards • a moving object hitting an obstacle • an object accelerated by a constant force • a vehicle slowing down • bringing water to a boil in an electric kettle. Throughout this section on Energy students should be able to calculate the changes in energy involved when a system is changed by: • heating • work done by forces • work done when a current flows The link between work done (energy transfer) and current flow in a circuit is covered in Work done and energy transfer.	Investigate the transfer of energy from a gravitational potential energy store to a kinetic energy store. Investigate thermal conductivity using rods of different materials.	End of topic test With a focus of calculations Maths focus Students should be able to recall and apply this equation.

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Describe the power and the different ways we calculate it Describe the unwanted transfer of energy and how this can be reduced Describe and calculate efficiency	Students should be able to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level. The kinetic energy of a moving object can be calculated using the equation: kinetic energy = 0.5 × mass × s peed 2 Ek = 1 2 m v2 kinetic energy, Ek , in joules, J mass, m, in kilograms, kg speed, v, in metres per second, m/s The amount of elastic potential energy stored in a stretched spring can be calculated using the equation: elastic potential energy = 0.5 × spring constant × extension^2 Ee = 1/2 k e^2 (assuming the limit of proportionality has not been exceeded) elastic potential energy, Ee, in joules, J spring constant, k, in newtons per metre, N/m extension, e, in metres, m The amount of gravitational potential energy gained by an object raised above ground level can be calculated using the equation: g . p . e . = mass × gravitational field strength × height Ep = m g h gravitational potential energy, Ep, in joules, J mass, m, in kilograms, kg gravitational field strength, g, in newtons per kilogram, N/kg (In any calculation the value of the gravitational field strength (g) will be given). height, h, in metres, m	Key stage 3 Calculation of fuel uses and costs in the domestic context • comparing energy values of different foods (from labels) (kJ) • comparing power ratings of appliances in watts (W, kW) • comparing amounts of energy transferred (J, kJ, kW hour) • domestic fuel bills, fuel use and costs • fuels and energy resources Energy changes and transfers • simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged • heating and thermal equilibrium: temperature difference between 2 objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference; use of insulators • other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels Changes in systems • energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change • comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy

	Power is defined as the rate at which energy is transferred or the rate at which work is done. power = energy trans f erred time P = E t power = work done time P = W t power, P, in watts, W energy transferred, E, in joules, J time, t, in seconds, s work done, W, in joules, J An energy transfer of 1 joule per second is equal to a power of 1 watt. Students should be able to give examples that illustrate the definition of power eg comparing two electric motors that both lift the same weight through the same height but one does it faster than the other. Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed. Students should be able to describe with examples where there are energy transfers in a closed system, that there is no net change to the total energy. Students should be able to describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. This energy is often described as being 'wasted'. Students should be able to explain ways of reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation. The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material. Students should be able to describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls. Students do not need to know the definition of thermal conductivity. The energy efficiency for any energy transfer can be calculated using the equation: efficiency = useful output energy trans f er total in put	associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions • using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes

	energy transfer Efficiency may also be calculated using the equation: efficiency = useful power output total power in put (HT only) Students should be able to describe ways to increase the efficiency of an intended energy transfer.	

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