AQA P1a Energy stores and transfers + P1b Heat Transfers Combined Foundation

The following required practicals are covered in this topic:
RP1 - Determining specific heat capacity of a material

Quantities are things that can be measured or calculated.

Quantity	Symbol used in equations	Unit
Work done	W	joules (J)
Force	F	newtons (N)
Distance	s	metres (m)
Gravitational potential energy (GPE)	E_p	joules (J)
Mass	m	kilograms (kg)
Gravitational field strength	g	newtons per kilogram (N/kg)
Height	h	metres (m)
Kinetic energy	E_k	joules (J)
Speed	v	metres per second (m/s)
Power	P	watts (W)
Energy transferred	E	joules (J)
Time	t	seconds (s)
Elastic potential energy	E_e	joules (J)
Spring Constant	k	newtons per metre (N/m)
Extension	e	metres (m)
Change in thermal energy	ΔE	joules (J)
Specific heat capacity	c	joules per degree Celsius (J/kg ^oC)
Temperature change	Δθ	degrees Celsius (^oC)

Equations are used to calculate an unknown quantity from known quantities (given in a question).

Here are the ones you need to <u>memorise</u>:

Word equation	Symbol equation
work done = force x distance	$W = F\ s$
gravitational potential energy = mass × gravitational field strength × height	$E_p = m\ g\ h$
kinetic energy = 0.5 × mass × speed^2	$E_k = \frac{1}{2} m\ v^2$
$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
$\text{power} = \frac{\text{energy transferred}}{\text{time}}$	$P = \frac{E}{t}$
$\text{power} = \frac{\text{work done}}{\text{time}}$	$P = \frac{W}{t}$

These equations are provided for you but you need to be able to select and apply them:

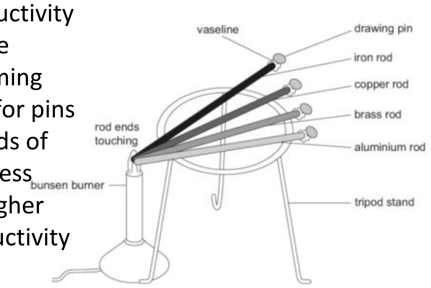
Word equation	Symbol equation
elastic potential energy = 0.5 x spring constant x (extension)^2	$E_e = \frac{1}{2} k\ e^2$
change in thermal energy = mass x specific heat capacity x temperature change	$\Delta E = m\ c\ \Delta\theta$

Conduction is a method of thermal energy transfer through the passing on of particle vibrations.

The higher the **thermal conductivity** of a material the higher the rate of energy transfer by **conduction** across the material.

How quickly houses cool down is known as the **rate of cooling**. Houses have a slower rate of cooling if they have thicker walls. The rate of cooling can also be reduced by decreasing the thermal conductivity of the walls by installing **cavity wall insulation**.

The thermal conductivity of materials can be investigated by timing how long it takes for pins to drop off the ends of heated rods. The less time taken, the higher the thermal conductivity of the material.



Key word	Definition	Examples / additional information
System	An object or a group of objects	A kettle of water, a room of air.
Energy store	If a system has a store of energy, it has the ability to do work. Energy stores can increase or decrease when transfers occur. Measured in joules (J).	Kinetic (moving), thermal, gravitational potential, elastic potential, magnetic, electrostatic, nuclear, chemical.
Energy transfer	When energy is moved from one energy store to another. Measured in joules (J).	**Mechanical** (a force moving an object), **work done by current** (due to a voltage/potential difference), **heating** (due to temperature difference), **radiation** (e.g. visible light, infra red).
Work	The amount of energy transferred when an object is moved over a distance by an external force.	Pushing a book along a table, lifting a weight directly upwards.
Energy efficiency	The ratio of **useful** output energy transfer to total input energy transfer**,** written either as a decimal or a percentage.	A petrol engine car can have an efficiency of 0.30 (30%). This means 30% of the chemical energy in the petrol is transferred to kinetic energy of the car.
Power	The rate at which energy is transferred OR the rate at which work is done, measured in watts (W).	A typical car has a power of 60,000 W – it transfers 600,000 J of energy every second.
Dissipated energy	Energy that has been transferred to a store that is not useful. Sometimes referred to as "wasted" energy. Can be reduced with lubrication or thermal insulation.	5% of transferred energy to a conveyor belt is dissipated to the surroundings (the air) in the form of thermal energy.
Law of conservation of energy	Energy cannot be transferred usefully, stored or dissipated, but cannot be created or destroyed.	The total amount of energy in the universe has always been the same.
Specific heat capacity	The amount of energy required to increase the temperature of 1 kg of a substance by 1 ^oC.	Water has a specific heat capacity of 4,200 J/kg ^oC. It takes 4,200 J to increase the temperature of 1 kg of water by 1^oC.