

## 1. Energy Stores

Gravitational potential energy	Energy stored in an object that is raised above the ground
Kinetic energy	Energy stored in an object that is moving
Thermal energy	Energy stored or transferred as heat
Chemical energy	Energy stored in the bonds in molecules and compounds
Elastic potential energy	Energy stored in an object that is stretched or compressed

## 2. Calculating energy

Gravitational potential	$GPE = \text{mass} \times \text{gravitational field strength} \times \text{height}$ (J) (kg) (N/kg) (m)
Kinetic	$KE = \frac{1}{2} \times \text{mass} \times \text{velocity}^2$ *(velocity = speed) (J) (kg) (m/s)
Work done	Work done = force x distance (J) (N) (m)
Power	Power = Energy ÷ time OR Power = work done ÷ time (W) (J) (s) (W) (J) (s)

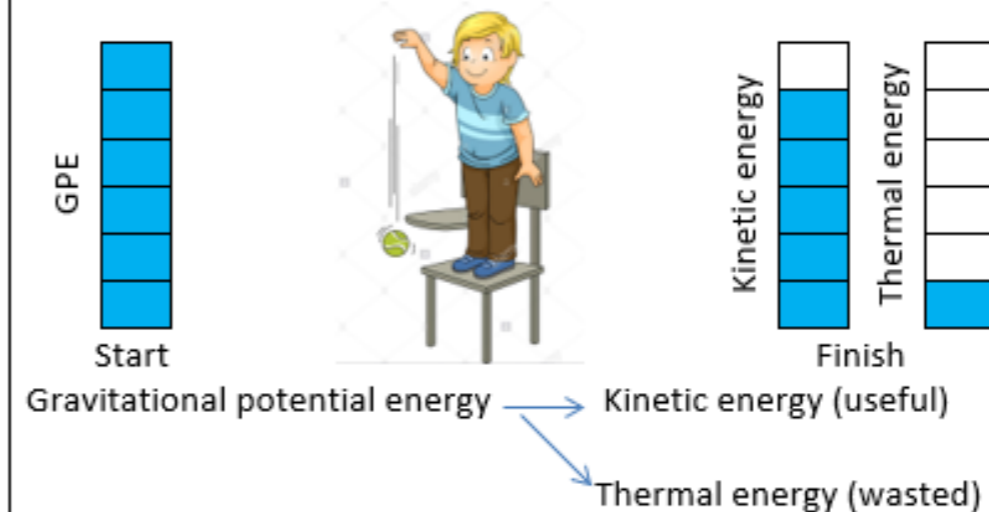
## 3. Units

Force	Newtons (N)
Power	Watts (W) OR kilowatts (kW)
Mass	Kilograms (kg)
Height	Metres (m)
Energy	Joules (J) OR kilojoules (kJ)
time	Seconds (s)

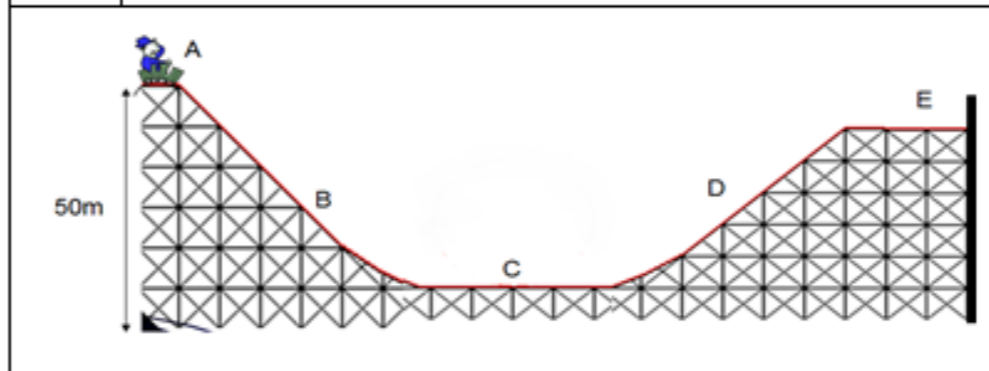
## 4. Conservation of energy and Energy transfers

The Law of Conservation of Energy states that energy can neither be created nor destroyed only transferred between stores.

Energy transfers in a ball falling



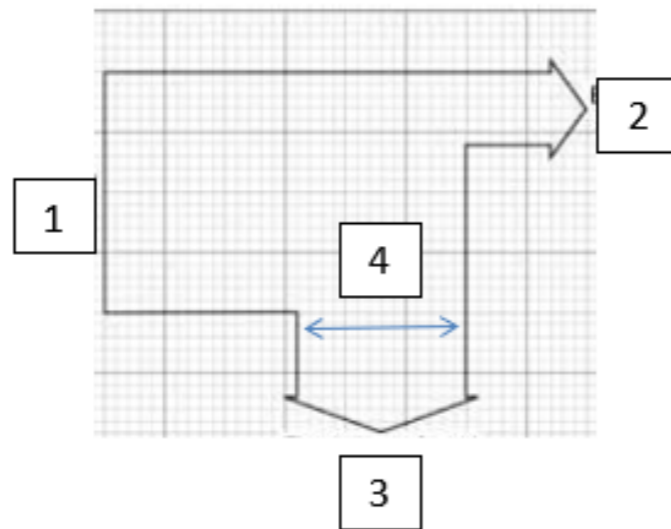
A	Has the most GPE
B	GPE is transferred to kinetic energy and thermal energy is dissipated to the environment. The carriage speeds up.
D	Kinetic energy is transferred to GPE and thermal energy is dissipated to the environment. The carriage slows down.
E	There is no kinetic energy as the carriage has stopped.



## 5. Efficiency

Efficiency = useful energy ÷ wasted energy  
 Or  
 Efficiency = (useful energy ÷ wasted energy) x 100

1	Energy input to the system
2	Useful energy output
3	Wasted energy output
4	Width of the bar indicates the amount of energy. On graph paper, each square would have a value of energy.



### Challenge Questions

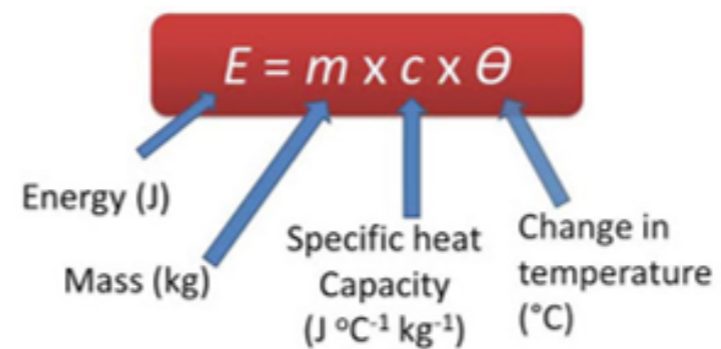
1	What is the GPE of a 60kg carriage on the roller coaster at 50m?
2	What would the maximum kinetic energy of the carriage be and why?
3	What would the maximum speed of the carriage be?
4	The actual speed of the carriage is 29m/s. Calculate the efficiency.

## 6. Generating electricity

Energy source	Advantages	Disadvantages
Fossil fuels	<ul style="list-style-type: none"> <li>Low cost</li> <li>Easily transportable</li> <li>Reliable</li> </ul>	<ul style="list-style-type: none"> <li>Non-renewable</li> <li>Produced CO<sub>2</sub></li> <li>Produced SO<sub>2</sub> and NO<sub>x</sub></li> </ul>
Wind	<ul style="list-style-type: none"> <li>Renewable</li> <li>No fuel cost</li> <li>Produces no pollutants</li> </ul>	<ul style="list-style-type: none"> <li>Cannot be used in high or no winds</li> <li>Visual pollution</li> </ul>
Hydroelectric	<ul style="list-style-type: none"> <li>Renewable</li> <li>Reliable</li> <li>Output easily controlled</li> </ul>	<ul style="list-style-type: none"> <li>Destroys habitats to build reservoir when flooding land</li> </ul>
Solar	<ul style="list-style-type: none"> <li>Renewable</li> <li>No fuel cost</li> <li>Produces no pollutants</li> </ul>	<ul style="list-style-type: none"> <li>Does not work at night</li> <li>Expensive to set up</li> </ul>
Nuclear	<ul style="list-style-type: none"> <li>High energy output for small mass of fuel</li> <li>Reliable</li> </ul>	<ul style="list-style-type: none"> <li>Non-renewable</li> <li>Produces radioactive waste</li> </ul>

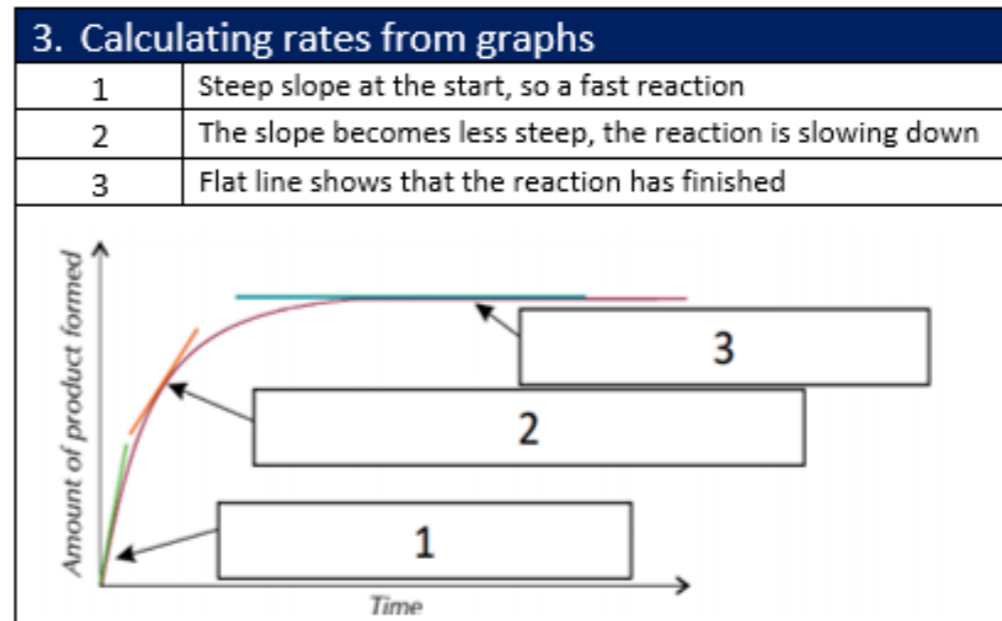
## 7. Specific Heat Capacity

The specific heat capacity is the amount of energy needed to increase the temperature of a 1kg mass by 1°C



1. Key Words	
Rate of reaction	Amount of reactant <u>used</u> or product formed $\div$ time
Collision theory	Idea that for a reaction to occur the particles <u>have to hit</u> each other with enough energy
Activation energy	The minimum energy needed for a collision to cause a reaction
Catalyst	A substance which speeds up a chemical reaction by lowering the activation energy
Reversible reaction	A chemical reaction that can go in either direction
Equilibrium	When the forwards and backwards reactions happen at the same rate

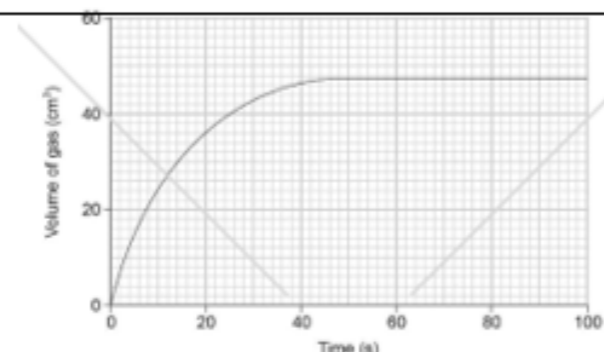
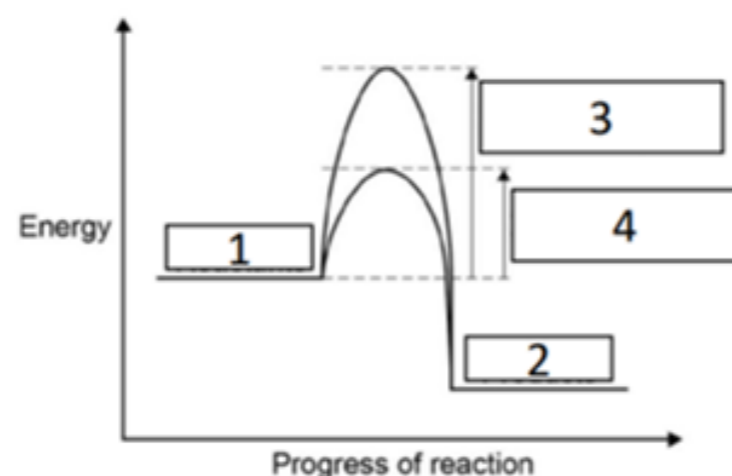
2. Ways to measure a rate of reaction	
Volume of gas released	
Formation of a solid product (become opaque)	
Change in mass	



4. Factors affecting the rate of reaction			
Factor	Change	Effect on rate	Reason
Temperature	Increase	Increase	The particles are moving faster so collide more often and with a greater proportion of successful collisions
Concentration	Increase	Increase	There are more particles so there are more frequent collisions
Surface area	Increase	Increase	There are more particles available so there are more collisions
Catalyst	Add	Increase	The lower activation energy means that more particles can successfully collide

## 5. Catalysts

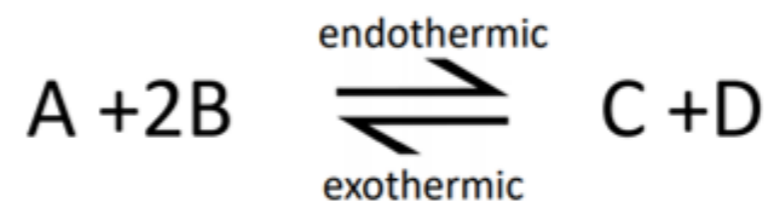
1	Reactants
2	Products
3	Activation energy without catalyst
4	Activation energy with catalyst



### Challenge Questions

1	How long did it take for the reaction to finish?
2	Calculate the rate of reaction after 20 seconds.
3	Explain why the graph is a curve at the beginning.
4	Calculate, using the tangent method, the rate of reaction at 30 seconds.

## 6. The effect of changing the conditions of equilibrium (H)



Le Chatelier's principal: a reaction at equilibrium will act to oppose any changes to it

Condition	Change	Effect
Concentration	Increase A or B	Shifts to the right to increase the concentration of C + D
	Decrease A or B	Shifts to the left to increase the concentration of A + B
Temperature	Increase	Shifts right to favour the endothermic reactions, making more C + D
	Decrease	Shifts left to favour the exothermic reactions, making more A + B
Pressure	Increase	Shifts to the right side with the fewest moles so makes more C + D
	Decrease	Shifts to the left side with the most moles so <u>makes</u> more A+B