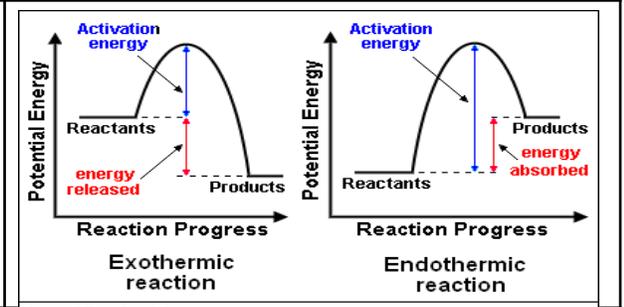


KPI:1 (p61 - 62)

Describe energy changes in reactions as exothermic or endothermic and illustrate these as energy profile diagrams

Exothermic reactions transfer energy to the surroundings. Endothermic reactions take in energy from the surroundings. Reversible reactions are where the products can react to remake the original reactants. If the forward reaction is exothermic, the reverse reaction is endothermic.



KPI:2 (p63)
Explain energy changes in reactions in terms of activation energy, bond breaking and bond forming

Making and breaking chemical bonds

Most chemicals will break up (decompose) if they are heated strongly enough. This means that energy is needed to break chemical bonds – an **endothermic** process.

Because bond-breaking is endothermic, bond-making must therefore be **exothermic**. This means that energy is released when chemical bonds are made.

KPI:3 (p63)
Calculate energy changes from bond energies



From the table of the values of bond enthalpy, the values we need are:

Bond	Enthalpy (kJ/mol)
H-H	432
Cl-Cl	239
H-Cl	427

KPI:4 (p64)
Describe simple cells and the difference between rechargeable and non-rechargeable batteries

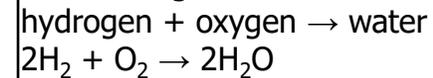
Non-rechargeable batteries
Ordinary 'dry-cell' batteries are non-rechargeable. As the reactants inside them become used up in chemical reactions, the output from these batteries gradually falls. Once all the reactants have been used up, these batteries go 'flat' and cannot supply electrical energy anymore.

Rechargeable batteries
Rechargeable batteries usually maintain a constant output until just before they go flat. They contain reactants that can be made again just by passing electricity through the products. Once the battery has gone flat, it can be connected to a recharger. This uses electrical energy to reverse the chemical reactions that happened in the battery while it was in use. Car batteries are rechargeable batteries - they are constantly recharged while the car is moving, so the lights and horn will always work. Mobile phones, many MP3 players and other portable devices use rechargeable batteries. They must be recharged at regular intervals. It is usually recommended that such batteries should almost be flat before recharging. This allows the battery to be fully charged again.

KPI:5 (p65)
Describe fuels and evaluate their use

Fuel cells produce electricity through the reaction of a fuel with oxygen. Hydrogen-oxygen fuel cells use hydrogen as their fuel, and are useful in cars and spacecraft. Water is the only waste product from a hydrogen-oxygen fuel cell, so they cause less pollution when in use.

Hydrogen-oxygen fuel cell
The reaction between hydrogen and oxygen is **exothermic**- it releases energy to the surroundings:



Fuel cells use the reaction between a fuel and oxygen to produce electrical energy. They are efficient and convert a large proportion of the chemical energy in the fuel into electrical energy. Hydrogen-oxygen fuel cells use hydrogen as their fuel.