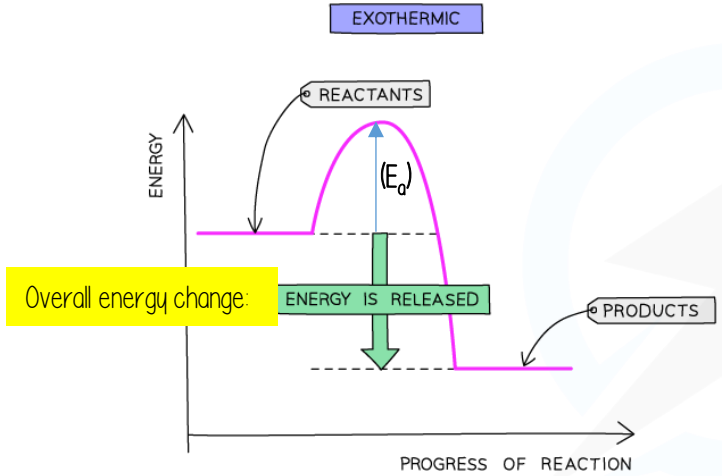
Energy changes:

Energy is **conserved** in chemical reactions. The amount of energy in the universe at the end of a chemical reaction is the same as before the reaction takes place. **If a reaction transfers energy to the surroundings the product molecules must have less energy than the reactants, by the amount transferred.**

Chemical reactions can occur only when **reacting particles collide with each other and with sufficient energy**. The **minimum** amount of energy that particles must have to react is called the **activation energy** (E_a).
Reaction profiles can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction.

EXOTHERMIC



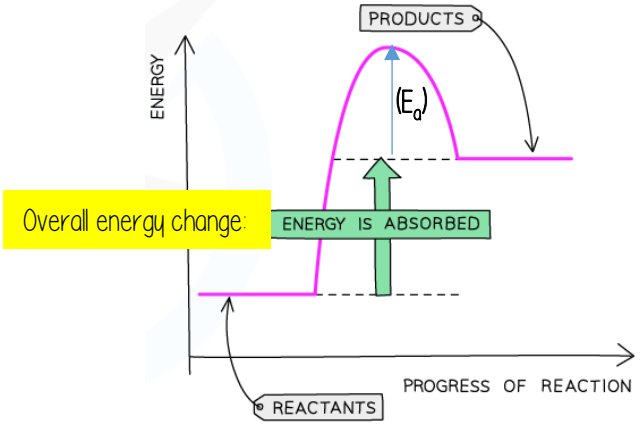
An **exothermic reaction** is one that transfers energy to the surroundings so the temperature of the surroundings increases. **It feels hot.**

Exothermic reactions **include combustion, many oxidation reactions, neutralisations AND RESPIRATION.**

Everyday uses of exothermic reactions include self-heating cans and hand warmers.

HT: In an exothermic reaction, the energy released from forming new bonds is greater than the energy needed to break existing bonds.

ENDOTHERMIC



An **endothermic reaction** is one that takes in energy from the surroundings so the temperature of the surroundings decreases. **It feels cold.**

Endothermic reactions include **thermal decompositions** and the **reaction of citric acid and sodium hydrogencarbonate AND PHOTOSYNTHESIS.**

Some sports injury packs are based on endothermic reactions.

HT: In an endothermic reaction, the energy needed to break existing bonds is greater than the energy released from forming new bonds.

During a chemical reaction: The energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies
- energy must be supplied to break bonds in the reactants
- energy is released when bonds in the products are formed.

Overall energy change of the reaction. =

$\sum$ the **energy needed to break bonds** in the **reactants** $-$ $\sum$ the **energy released when bonds formed** in the **products** are formed

Diagrams adapted from savemyexams.com