Trilogy C7 – Energy Changes

1: Law of the conservation of energy

Energy is conserved. This means that the amount of energy in the universe is the same at the start of a reaction and at the end of a reaction.
If the energy within the chemical bonds changes from the reactants to the products (which happens a lot), then the surroundings must either heat up or cool down to keep the total energy the same.

2: Exothermic

- A reaction that gives out energy. (Exothermic = Exit)
- The temperature of the surroundings increases
- The air around the reaction will feel hot
- The energy in the bonds of the reactants will be higher than the energy of the products

Examples:
- all combustion (burning) reactions
- neutralisation (acid + base) reactions

Uses:
- self-heating hand warmers
- self heating coffee cups.

3: Endothermic

- A reaction that takes in energy (Endothermic = Enter)
- The temperature of the surroundings decreases
- The air around the reaction will feel cold
- The energy in the bonds of the reactants will be lower than the energy of the products

Examples:
- thermal decomposition reactions (when you add lots of heat to make the chemicals react)
- the reaction between citric acid and sodium hydrogencarbonate

Uses:
- sports injury cool packs
- burns cooling pack

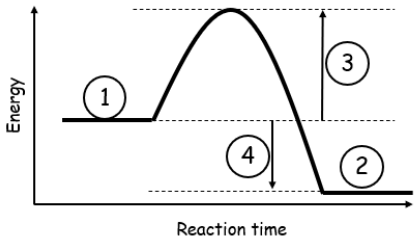
4. Activation Energy (E_A)

The minimum amount of energy particles must have to react is called the **activation energy**.
All reactions require particles to collide.

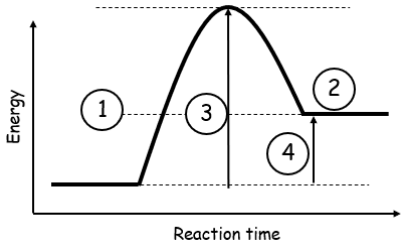
5: Reaction profile diagram

A diagram that shows:
- the amount of energy in the reactants and the products
- how much energy is required to start the reaction (the activation energy)
- the overall energy change

Exothermic energy profile
Product energy is lower than reactant



Endothermic energy profile
Product energy is higher than reactant



Key:
1 = reactants
2 = products
3 = activation energy (arrow must go from the reactants to the top of the curve)
4 = overall energy change (arrow must go from the reactants to the products)

6: (higher only) Calculating bond energy

In all chemical reactions breaking the bonds of the reactants needs energy added to the chemicals and making bonds in the new products releases energy.

You will be given a table of the bond energies (you will not need to learn them)

You will need to:
- count the number of each type of bond
- multiply it by the energy for that type of bond.

Then you will need to calculate:
- the total energy needed to break all the bonds in the reactants
- the total energy released when making all the bonds in the products
- the difference between the two totals

If the reaction is endothermic: energy from breaking bonds is biggest
If the reaction is exothermic: energy from making bonds is biggest