



# OCR A GCSE Chemistry

## Topic 5: Monitoring and controlling chemical reactions

### Equilibria

### Notes





*C5.3a recall that some reactions may be reversed by altering the reaction conditions*

- In some chemical reactions, the products of the reaction can react to produce the original reactants
  - These are called reversible reactions
  - The direction of the reaction can be changed by changing the conditions

E.g. The Haber Process: nitrogen + hydrogen  $\rightleftharpoons$  ammonia

*C5.3b recall that dynamic equilibrium occurs in a closed system when the rates of forward and reverse reactions are equal*

- When a reversible reaction occurs in a closed system, equilibrium is reached when the reactions occur at exactly the same rate in each direction.

*C5.3c (HT only) predict the effect of changing reaction conditions on equilibrium position and suggest appropriate conditions to produce as much of a particular product as possible*

- The relative amounts of all the reacting substances at equilibrium depend on the conditions of the reaction.
- If a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change.
  - Effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle.
- Effect of changing concentration:
  - If the concentration of one of the reactants or products is changed, the system is no longer at equilibrium and the concentrations of all the substances will change until equilibrium is reached again.
  - If **concentration of reactants is increased**: position of equilibrium shifts towards products (right) so **more product is produced** until equilibrium is reached again
  - if **concentration of products is increased**: position of equilibrium shifts towards reactants (left) so **more reactant is produced** until equilibrium is reached again





- Effect of changing pressure:
  - In gaseous reactions, an increase in pressure will favour the reaction that produces the least number of molecules as shown by the symbol equation for that reaction.

if reaction produces a...	larger volume of gas (more moles on product side)	smaller volume of gas (fewer moles on product side)
an increase in pressure...	decreases yield of reaction- equilibrium shifts left	increases yield of reaction- equilibrium shifts right
a decrease in pressure...	increases yield of reaction- equilibrium shifts right	decreases yield of reaction- equilibrium shifts left

- Effect of changing temperature:
  - If **temperature is increased**: equilibrium moves in the **direction of the endothermic reaction** (e.g. if forwards reaction is endothermic and temperature is increased, equilibrium shifts right to produce more product)
  - If **temperature is decreased**: equilibrium moves in the **direction of the exothermic reaction**
  - For the forwards being exo/endothermic and yield meaning the amount of product from the forwards reaction:

	Exothermic	Endothermic
An increase in temperature...	Decreases yield of reaction- equilibrium moves left	Increases yield of reaction- equilibrium moves right
A decrease in temperature...	Increases yield of reaction- equilibrium moves right	Decreases yield of reaction- equilibrium moves left

