# Reaction rates and equilibrium

| Specification reference | Checklist questions | |
|---|---|---|
| **3.2.2 a** | Can you describe the effect of concentration, including the pressure of gases, on the rate of a reaction, in terms of frequency of collisions? | ☐ |
| **3.2.2 b** | Can you calculate reaction rate from the gradients of graphs measuring how a physical quantity changes with time? | ☐ |
| **3.2.2 c i** | Can you explain the role of a catalyst in increasing reaction rate without being used up by the overall reaction? | ☐ |
| **3.2.2 c ii** | Can you explain the role of a catalyst in allowing a reaction to proceed via a different route with lower activation energy, as shown by enthalpy profile diagrams? | ☐ |
| **3.2.2 d i** | Can you explain the terms *homogeneous* and *heterogeneous* catalysts? | ☐ |
| **3.2.2 d ii** | Can you explain that catalysts have great economic importance and benefits for increased sustainability by lowering temperatures and reducing energy demand from combustion of fossil fuels with resulting reduction in $CO_2$ emissions? | ☐ |
| **3.2.2 e** | Can you list and describe the techniques an procedures used to investigate reaction rates including the measurement of mass, gas volumes and time? | ☐ |
| **3.2.2 f** | Can you explain the Boltzmann distribution and its relationship with activation energy? | ☐ |
| **3.2.2 g i** | Can you explain, using Boltzmann distributions, of the qualitative effect on the proportion of molecules exceeding the activation energy and hence the reaction rate, for temperature changes? | ☐ |
| **3.2.2 g ii** | Can you explain, using Boltzmann distributions, of the qualitative effect on the proportion of molecules exceeding the activation energy and hence the reaction rate, for catalytic behaviour? | ☐ |

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|---|---|---|
| **3.2.3 a** | Can you explain that a dynamic equilibrium exists in a closed system when the rate of the forward reaction is equal to the rate of the reverse reaction and the concentrations of reactants and products do not change? | ☐ |
| **3.2.3 b** | Can you explain le Chatelier's principle and its application for homogeneous equilibria to deduce qualitatively the effect of a change in temperature, pressure or concentration on the position of equilibrium? | ☐ |
| **3.2.3 c** | Can you explain that a catalyst increases the rate of both forward and reverse reactions in an equilibrium by the same amount resulting in an unchanged position of equilibrium? | ☐ |
| **3.2.3 d** | Can you list and describe the techniques and procedures used to investigate changes to the position of equilibrium for changes in concentration and temperature? | ☐ |
| **3.2.3 e** | Can you explain the importance to the chemical industry of a compromise between chemical equilibrium and reaction rate in deciding the operational conditions? | ☐ |
| **3.2.3 f** | Can you give expressions for the equilibrium constant, $K_c$ for homogeneous reactions and calculations of the equilibrium constant, $K_c$ from provided equilibrium concentrations? | ☐ |
| **3.2.3 g** | Can you estimate the position of equilibrium from the magnitude of $K_c$? | ☐ |