2024 Higher Chemistry Paper 2 – Q8

Section: Chemistry in Society
Topic: Getting the Most from Reactants (Reversible Reactions)

Question summary (Q8):
Reversible reactions can cause challenges for chemists trying to maximise yields. Using your knowledge of chemistry, suggest how yields can be maximised in reversible reactions.

Worked Solution:
• Reversible reactions reach an equilibrium where forward and reverse rates are equal.
• To maximise yield of desired product, apply Le Chatelier's principle: the equilibrium position shifts to oppose a change in conditions.
• Methods include:
  – Increasing pressure (if fewer moles of gas on product side).
  – Decreasing temperature (if forward reaction is exothermic).
  – Removing product as it forms (drives equilibrium forward).
  – Using a catalyst (speeds up rate of equilibrium being reached, though not the position).

Final Answer:
Maximise yield by adjusting conditions: high pressure (if product has fewer gas molecules), lower temperature (if exothermic), continuous product removal, and use of a catalyst.

Revision Tips:
• Le Chatelier's principle predicts how equilibrium shifts with changes.
• High pressure favours fewer moles of gas, low temperature favours exothermic reactions.
• Catalysts do not change equilibrium position, only speed up attainment.
• Industrial compromise: balance between yield, cost, and rate

(e.g. Haber process).