2024 Ch H1 Q23

Section: Chemistry in Society

Topic: Equilibria

Question Summary

Bromine solution is governed by the equilibrium:
$Br_2(aq) + H_2O(l) \leftrightarrow Br^-(aq) + 2H^+(aq) + OBr^-(aq)$

Which reagent, when a few drops of a concentrated solution are added, makes the red colour fade? Options: A HCl, B KBr, C $AgNO_3$, D NaOBr.

Worked Solution

The red colour comes from $Br_2(aq)$. Fading means $[Br_2]$ decreases, so the equilibrium must shift to the right.

Assess each option using Le Chatelier's principle:
- A HCl: adds H^+ (a product). Adding a product shifts the equilibrium left -> more Br_2, darker colour. Not correct.
- B KBr: adds Br^- (a product). Adding a product shifts the equilibrium left -> more Br_2, darker colour. Not correct.
- C $AgNO_3$: removes Br^- by forming a precipitate $AgBr(s)$. Removing a product shifts the equilibrium right to replace Br^-, consuming Br_2, so the red colour fades. Correct.
- D NaOBr: adds OBr^- (a product). Adding a product shifts the equilibrium left -> more Br_2, darker colour. Not correct.

Final Answer C

AgNO3 (removes Br- as AgBr, driving the equilibrium to the right and decolourising the solution).

Revision Tips

- Colour cue: Br2(aq) is red/orange; Br-, H+, and OBr- are colourless.
- Adding a product (H+, Br-, OBr-) shifts left (more Br2, deeper colour).
- Removing a product (e.g., precipitating Br- with Ag+) shifts right (less Br2, fading).
- Common exam trigger: AgNO3 removes halide as an insoluble AgX(s), pulling equilibria to the right.