

Reactivity trends in group 2 and the halogens

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Lab answers

These model answers use the sample results from the table. Your own colours may differ slightly, but the pattern of solubility in ammonia and the order of displacement must match.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** A Level 3.2.2-3.2.3

Question 1 Identify the solutions

A is **sodium chloride** (white, dissolves in dilute ammonia), B is **sodium iodide** (yellow, insoluble in conc. ammonia) and C is **sodium bromide** (cream, dissolves only in conc. ammonia). The hexane layers agree: iodine is violet, bromine orange-brown.

Question 2 Ionic equations

Tube A: $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$. Tube C with chlorine: $\text{Cl}_2(\text{aq}) + 2\text{Br}^-(\text{aq}) \rightarrow 2\text{Cl}^-(\text{aq}) + \text{Br}_2(\text{aq})$.

Question 3 Role of nitric acid

Nitric acid removes carbonate and hydroxide ions that give false precipitates with Ag^+ . Hydrochloric acid would add chloride ions and give a **false white precipitate**, ruining the test.

Question 4 Reactivity order

Chlorine displaced both bromine and iodine, while no displacement is possible the other way, so the order is $\text{Cl}_2 > \text{Br}_2 > \text{I}_2$ in oxidising power. The smaller the atom, the stronger the pull on an incoming electron.

Question 5 Mass of precipitate

$n(\text{AgCl}) = 0.00500 \times 0.200 = 1.00 \times 10^{-3} \text{ mol}$; mass = $1.00 \times 10^{-3} \times 143.4 = \mathbf{0.143 \text{ g}}$.

Question 6 Reliability

Silver bromide only partly dissolves in dilute ammonia, so the change is **gradual and hard to see by eye**. Compare with a control tube and use a fixed volume of ammonia, or use concentrated ammonia in a fume cupboard.

Question 7 Improvement

Use known standard solutions of each halide alongside the unknowns and compare side by side. Repeat each test to be certain of the colour, using a white card behind the tubes.