Disappearing ink – teacher notes

Introduction
Students produce a solution in which the colour disappears due to an acid/base reaction.

Equipment
Apparatus
- Eye protection
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- Beaker, 100 cm$^3$
- Measuring cylinder, 10 cm$^3$
- Small paint brush to test the ink

Chemicals
- Ethanol
- Sodium hydroxide 0.4 mol dm$^{-3}$
- Thymolphthalein solution (50 per cent water, 50 per cent ethanol)

Health, safety and technical notes
- Read our standard health and safety guidance here https://rsc.li/3OEFuTD
- Always wear eye protection.
- Ethanol is highly flammable, see CLEAPSS Hazcard HC040a.
- Sodium hydroxide is an irritant, see CLEAPSS Hazcard HC091a.
- Thymolphthalein soluiton is flammable, see CLEAPSS Hazcard HC032.

Notes
- This ink is the same as those sold in trick and joke shops.
- The amount of indicator can be adjusted to give a deep blue colour.
- The compound produced, Na$_2$CO$_3$, is commonly called washing soda.
- Sodium hydroxide reacts with carbon dioxide in the air to form sodium carbonate.
  - $2\text{NaOH(aq)} + \text{CO}_2(\text{g}) \rightarrow \text{Na}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O(l)}$
- Sodium carbonate is less basic than sodium hydroxide and causes the indicator to change from blue to colourless.
- The colourless range for thymolphthalein is below pH 9.3.
- The blue range is above pH 10.5 and the colour change takes place between these two.
- The alcohol evaporates and leaves a clear and colourless residue.

Answers
1. Carbon dioxide
2. Sodium hydroxide + carbon dioxide $\rightarrow$ sodium carbonate + water
3. $2\text{NaOH} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$