

AS(8080) Chemistry

6243.02

3B

Tables
Questions

1 Flame tests

| FLAME COLOUR | INFERENCE |
|------------------|---------------|
| yellow or orange | sodium ion |
| lilac | potassium ion |
| carmine(red) | lithium ion |
| yellow-red | calcium ion |
| crimson | strontium ion |
| pale green | barium ion |

2 Identification of gases

| GAS | OBSERVATIONS |
|-------------------|---|
| oxygen | colourless gas which relights a glowing splint |
| carbon dioxide | colourless gas which gives a white ppte with limewater |
| sulphur dioxide | colourless gas which is acidic and decolourises acidified potassium manganate(VII) and turns acidified potassium dichromate(VI) orange to green |
| ammonia | colourless gas which turns moist red litmus paper blue |
| nitrogen dioxide | brown gas |
| hydrogen | colourless gas which ignites with a "pop" |
| hydrogen chloride | steamy fumes on exposure to moist air, acidic. |
| chlorine | pale green gas which bleaches moist litmus paper |
| bromine | brown gas |
| iodine | purple vapour |
| water vapour | turns blue cobalt chloride paper red |

3 Dilute acid (HCl or H₂SO₄)

| ACTION OF ACID | LIKELY CAUSE |
|------------------------------------|--------------------------------|
| carbon dioxide evolved | carbonate or hydrogencarbonate |
| sulphur dioxide evolved on warming | sulphite |
| nitrogen dioxide evolved | nitrite |
| hydrogen evolved | a metal |

4 Ammonium(NH₄⁺) salts and the nitrate(NO₃⁻) ion.

- If a salt gives off ammonia gas on heating with dilute sodium hydroxide solution alone it is an ammonium salt.
- If a salt fails to give off ammonia when heated with dilute sodium hydroxide solution alone but does so when warmed with dilute sodium hydroxide solution + a small piece of zinc or aluminium it is a nitrate.

5 Silver nitrate solution

Aqueous silver nitrate is commonly used to test for the presence of halide ions in solution. Anions which would interfere with the test (eg carbonate) are first removed by adding dilute nitric acid before the aqueous silver nitrate. The identity of a halide may be confirmed by the addition of aqueous ammonia, both dilute and concentrated.

| ANION | PRECIPITATE | | ADDITION OF AQUEOUS NH ₃ | |
|----------|-------------|---------|-------------------------------------|--------------|
| | colour | formula | dilute | concentrated |
| chloride | white | AgCl | soluble | – |
| bromide | cream | AgBr | slightly soluble | Soluble |
| iodide | yellow | AgI | insoluble | Insoluble |

6 Barium chloride solution

Aqueous barium chloride forms precipitates of insoluble barium salts with a number of anions but is usually used as the test for the sulphate, SO₄²⁻, ion. Aqueous barium chloride is usually used with dilute hydrochloric acid.

| ANION | PRECIPITATE | | ADDITION OF DILUTE HCl |
|-----------|-------------|-------------------|-----------------------------------|
| | Colour | Formula | |
| sulphate | white | BaSO ₄ | ppte is insoluble |
| sulphite | white | BaSO ₃ | ppte dissolves |
| carbonate | white | BaCO ₃ | ppte dissolves with effervescence |

If dilute hydrochloric acid is added to the anion solution before aqueous barium chloride then only the sulphate will form as a precipitate.

7 Concentrated sulphuric acid

When a few drops of concentrated acid are added to a solid halide the observed reaction products may be used to identify the particular halide ion present. This is a potentially hazardous reaction. It must be carried out on a small scale and in a fume cupboard.

| HALIDE | OBSERVATIONS ON ADDING CONC H ₂ SO ₄ | OBSERVED REACTION PRODUCTS |
|----------|---|---|
| chloride | steamy fumes | HCl |
| bromide | steamy fumes, brown vapour | HBr, Br ₂ (SO ₂) |
| iodide | steamy fumes, black solid, purple vapour, yellow solid, vigorous reaction | HI, I ₂ , S (H ₂ S) |

The products in brackets will not be observed since they are colourless gases. The halide ion may be identified without the need to test for these gases. No attempt should ever be made to detect these gases by smell.

8 Precipitates from Group 2 cations.

Group 2 cations form a number of insoluble compounds. These form as white precipitates on mixing the appropriate reagent with a solution of a Group 2 compound.

| REAGENT | OBSERVATION | GROUP 2 INFERENCE |
|--|-------------|--|
| sodium hydroxide solution, NaOH(aq). | White ppte | Mg ²⁺ , Ca ²⁺ , Sr ²⁺ or Ba ²⁺ |
| sodium carbonate solution, Na ₂ CO ₃ (aq). | White ppte | Mg ²⁺ , Ca ²⁺ , Sr ²⁺ or Ba ²⁺ |
| solution of sulphate ions eg H ₂ SO ₄ | White ppte | Ca ²⁺ , Sr ²⁺ or Ba ²⁺ |

9 Tests for organic functional groups

Some of these tests also give positive results with functional groups included in the A2 Specification. These are shown in brackets

| TEST | OBSERVATION | INFERENCE |
|--|--|--|
| Warm with acidified potassium dichromate(VI) | orange to green solution. | primary or secondary alcohol. (or aldehyde) |
| Shake with bromine solution | orange solution is decolourised. | alkene |
| Warm with aqueous sodium hydroxide, acidify with dilute nitric acid then add aqueous silver nitrate. | white ppte cream ppte yellow ppte. | halogenoalkane C-Cl, C-Br C-I |
| Phosphorus pentachloride | steamy fumes. | HCl(g) OH group in alcohols (or carboxylic acid) |