

| Sample | Observations                                                                                                                                                             |                                                       |                                                                                                                                                        | Inferences (anion present / ionic equation[s])                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | Test with BaCl <sub>2</sub> (aq)                                                                                                                                         | Test with AgNO <sub>3</sub> (aq)                      | Devarda's Alloy Test                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 1      | White ppt. (1) insol. dil. HNO <sub>3</sub> (aq) (1)                                                                                                                     | -----                                                 | -----                                                                                                                                                  | SO <sub>4</sub> <sup>2-</sup> present<br>Ba <sup>2+</sup> (aq) + SO <sub>4</sub> <sup>2-</sup> (aq) → BaSO <sub>4</sub> (s) (1)                                                                                                                                                                                                                                                                                                                                            |
| 2      | Yellow ppt. (1) sol. in dil. HNO <sub>3</sub> (aq) (1). Original soln. orange. (1)                                                                                       | -----                                                 | -----                                                                                                                                                  | CrO <sub>4</sub> <sup>2-</sup> present<br>CrO <sub>4</sub> <sup>2-</sup> (aq) + 2Ba <sup>2+</sup> (aq) → BaCrO <sub>4</sub> (s) (1)<br>BaCrO <sub>4</sub> (s) + 2H <sup>+</sup> (aq) → Ba <sup>2+</sup> (aq) + H <sub>2</sub> CrO <sub>4</sub> (aq) <i>or</i><br>2BaCrO <sub>4</sub> (s) + 4H <sup>+</sup> (aq) → Ba <sup>2+</sup> (aq) + H <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> (aq) + H <sub>2</sub> O(l) (1)<br>(Other variations are possible.)                 |
| 3      | No ppt. (1)                                                                                                                                                              | White ppt. (1) sol. in dil. NH <sub>3</sub> (aq) (1)  | -----                                                                                                                                                  | Cl <sup>-</sup> present<br>Ag <sup>+</sup> (aq) + Cl <sup>-</sup> (aq) → AgCl(s) (1)<br>AgCl(s) + 2NH <sub>3</sub> (aq) → [Ag(NH <sub>3</sub> ) <sub>2</sub> ] <sup>+</sup> (aq) + Cl <sup>-</sup> (aq) (1)                                                                                                                                                                                                                                                                |
| 4      | White ppt. (1) sol. dil. HNO <sub>3</sub> (aq) (1) with effervescence. Gas turns limewater milky. (1) <sup>1</sup><br>White ppt. in cold with MgCl <sub>2</sub> (aq) (1) | -----                                                 | -----                                                                                                                                                  | CO <sub>3</sub> <sup>2-</sup> present<br>Ba <sup>2+</sup> (aq) + CO <sub>3</sub> <sup>2-</sup> (aq) → BaCO <sub>3</sub> (s) (1)<br>BaCO <sub>3</sub> (s) + 2H <sup>+</sup> (aq) → Ba <sup>2+</sup> (aq) + H <sub>2</sub> O(l) + CO <sub>2</sub> (g) (1)<br>CO <sub>2</sub> (g) + 2OH <sup>-</sup> (aq) + Ca <sup>2+</sup> (aq) → CaCO <sub>3</sub> (s) + H <sub>2</sub> O(l) (1)<br>Mg <sup>2+</sup> (aq) + CO <sub>3</sub> <sup>2-</sup> (aq) → MgCO <sub>3</sub> (s) (1) |
| 5      | No ppt. (1)                                                                                                                                                              | Yellow ppt. (1) insol. conc. NH <sub>3</sub> (aq) (1) | -----                                                                                                                                                  | I <sup>-</sup> present<br>Ag <sup>+</sup> (aq) + I <sup>-</sup> (aq) → AgI(s) (1)                                                                                                                                                                                                                                                                                                                                                                                          |
| 6      | No ppt. (1)                                                                                                                                                              | No ppt. (1)                                           | No gas evolved when warmed with NaOH(aq). (1)<br>On addn. of alloy, gas evolved (1) turning red litmus blue (1), producing white smoke with HCl(g) (1) | NH <sub>4</sub> <sup>+</sup> absent (1)<br>NO <sub>3</sub> <sup>-</sup> present<br>2Al(s) + 2OH <sup>-</sup> (aq) + 6H <sub>2</sub> O(l) → 2[Al(OH) <sub>4</sub> ] <sup>-</sup> (aq) + 3H <sub>2</sub> (g) (1)<br>3NO <sub>3</sub> <sup>-</sup> (aq) + 18H <sub>2</sub> O(l) + 8Al(s) + 5OH <sup>-</sup> (aq) → 3NH <sub>3</sub> (aq) + 8[Al(OH) <sub>4</sub> ] <sup>-</sup> (aq) (1)                                                                                      |

33 marks