| Question | Answer | Extra information | Marks | AO / Spec ref. |
| --- | --- | --- | --- | --- |
| **01.1** | so it does not smudge/run/dissolve |  | 1 | AO3C8.1.3 |
| **01.2** | The spots would dissolve/would not rise up the paper. |  | 1 | AO3C8.1.3 |
| **01.3** | Any **three** from:* X contains six/6 colourings
* Y contains five/5 colourings
* both X and Y contain the same

five/5 colourings* both contain A **and** C
* neither contains B **or** D.
 | If neither of first two bullet points given, allow **1** mark for X contains more colours than Y or converse. | 3 | AO3C8.1.3 |
| **01.4** | 4.6 divided by 0.30 = 15.3 cm | Award **2** marks for 15 cm or 15.33 cm; evidence of rearranged *R*f equation **1** mark. | 11 | AO2C8.1.3MS1a, 2a, 3b |
| **02** | **Level 3 (5–6 marks):** Description of methods used to identify both positive **and** negative ions, with relevant results. | 6 | AO1×4AO2×2C8.3.1C8.3.3C8.3.4 |
| **Level 2 (3–4 marks):** Description of workable methods used, with results to identify positive **or** negative ions. |
| **Level 1 (1–2 marks):** Any description of a method used and/or a result given. |
| **Level 0 (0 marks):** No relevant content. |
| **Indicative content:*** **Test:** Add (platinum/nichrome) wire (for the flame test).
* **Result:** The sodium compounds result in a yellow/orange/gold flame or the potassium compound results in a lilac/purple/mauve flame.
* Accept any method of introducing the solution into the flame, e.g. a splint soaked in the solution or sprayed from a bottle.
* The student could state that potassium carbonate gives a different colour to the three sodium compounds, as long as it is clear that the flame test colour comes from Na+ or K+.
* **Test:** Add dilute nitric acid to all four solutions.

Allow any acid.* **Result:** Sodium carbonate and potassium carbonate will effervesce/ give off gas **or** sodium chloride and sodium iodide will not effervesce.
* **Test:** Add dilute nitric acid followed by silver nitrate.
* **Result:** Sodium chloride and sodium iodide produce a precipitate **or** sodium chloride produces a white precipitate and sodium iodide produces a yellow precipitate.

Accept sodium carbonate and potassium carbonate do not produce a precipitate.This indicative content is not exhaustive, other creditworthy responses should be awarded marks as appropriate. |  |
| **03.1** | chloride |  | 1 | AO1C8.3.4 |
| **03.2** | Solid silver chloride is formed;which does not dissolve/is insoluble (in water). | accept AgCl(s) | 11 | AO3C8.3.4 |
| **03.3** | Add hydrochloric acid;bubble gas produced through limewater that goes cloudy / misty / milky. |  | 11 | AO1C8.3.3 |
| **04.1** | Ca2+ |  | 1 | AO1 |
| **04.2** | Colours mix/one colour masks others. |  | 1 | AO3 |
| **04.3** | Not enough to test/chemicals lost/ used up. | Allow flame test not sensitive enough. | 1 | AO3C8.3.1 |
| **04.4** | flame emission spectroscopy |  | 1 | AO1C8.3.7 |
| **04.5** | Any **two** from:* more sensitive
* can detect more than one ion at once
* can determine ion concentrations.
 | Allow converse for flame test. | 2 | AO3C8.3.6 |
| **04.6** | green |  | 1 | AO2C8.3.1 |
| **04.7** | formulation |  | 1 | AO1 |
| **04.8** | rocket may not work/perform badly/ explode/produce unpredictable results | Allow any sensible answer | 1 | AO2C8.1.2 |
| **05** | A: lithium **and** carbonateB: iron(III) **and** bromideC: iron(II) **and** sulfate | Allow Li+ / CO32–Allow Fe3+ / Br–Allow Fe2+ / SO42– | 111 | AO2C8.3.1C8.3.2C8.3.3C8.3.4C8.3.5 |