The Periodic Table – properties of Group 2 elements

Topic
Periodic Table – Group 2

Timing
20 min.

Apparatus (per group)
- One student worksheet
- One clear plastic sheet (e.g. OHP sheet).

Chemicals (per group)
Solutions contained in plastic pipettes, see ‘Apparatus and techniques for microscale chemistry’ handout.
- Magnesium nitrate 0.5 mol dm\(^{-3}\)
- Calcium nitrate 0.5 mol dm\(^{-3}\)
- Strontium nitrate 0.5 mol dm\(^{-3}\)
- Barium nitrate 0.2 mol dm\(^{-3}\)
- Sodium hydroxide 1 mol dm\(^{-3}\)
- Sodium fluoride 0.5 mol dm\(^{-3}\)
- Sodium chloride 0.5 mol dm\(^{-3}\)
- Potassium bromide 0.2 mol dm\(^{-3}\)
- Potassium iodide 0.2 mol dm\(^{-3}\)
- Sodium carbonate 0.5 mol dm\(^{-3}\)
- Sodium sulphate 0.5 mol dm\(^{-3}\).

Observations

Magnesium
No precipitates should be seen. All the compounds are colourless and soluble at these concentrations.

Calcium
An immediate white cloudiness is seen with the carbonate ions. No precipitates are seen with chloride, bromide or iodide but a cloudiness is seen with fluoride (due to its high lattice energy CaF\(_2\) is insoluble).

Calcium hydroxide
This is clear at first but when left for a few minutes the drops become hazy as calcium carbonate is formed by absorbing carbon dioxide from the air:

\[
\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}
\]
Calcium sulphate also appears clear (the solubility product is not realised at these concentrations due, possibly, to ion-pairing).

**Strontium**
The sulphate and carbonate are insoluble and a white cloudiness is seen. For the sulphate, the precipitate forms slowly.

The halides are all soluble, except for the fluoride. The hydroxide is clear at first but becomes hazy – similar to calcium.

**Barium**
The sulphate and carbonate give immediate white precipitates.

The halides are soluble except for the fluoride. The hydroxide is (like calcium and strontium) clear at first, becoming hazy due to the formation of barium carbonate.

**Health & Safety**

Students must wear suitable eye protection (Splash resistant goggles to BS EN166 3).

Magnesium nitrate, 0.5 mol dm\(^{-3}\) Mg(NO\(_3\))\(_2\)\(\cdot\)6H\(_2\)O (aq), Calcium nitrate, 0.5 mol dm\(^{-3}\) Ca(NO\(_3\))\(_2\)\(\cdot\)4H\(_2\)O (aq), Strontium nitrate, 0.5 mol dm\(^{-3}\) Sr(NO\(_3\))\(_2\)\(\cdot\)4H\(_2\)O (aq) and Barium nitrate, 0.2 mol dm\(^{-3}\) Ba(NO\(_3\))\(_2\) are skin/eye irritants.

Sodium hydroxide solution, 1 mol dm\(^{-3}\) NaOH (aq) is CORROSIVE.

Sodium carbonate, 0.5 mol dm\(^{-3}\) Na\(_2\)CO\(_3\)\(\cdot\)10H\(_2\)O is an IRRITANT.

Sodium sulphate, 0.5 mol dm\(^{-3}\) Na\(_2\)SO\(_4\), Sodium chloride, 0.5 mol dm\(^{-3}\) NaCl (aq), Sodium fluoride, 0.5 mol dm\(^{-3}\) NaF (aq), Potassium iodide, 0.2 mol dm\(^{-3}\) KI (aq) and Potassium bromide, 0.2 mol dm\(^{-3}\) KBr (aq) are of low hazard.

**Credits**

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*Health & safety checked May 2018*

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