

The Periodic Table – solubility of sulphates and carbonates of Groups 1 and 2

Topic

Periodic Table – Groups 1 and 2.

Timing

20 min.

Apparatus (per group)

- One student worksheet
- One clear plastic sheet (eg 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
- Lithium bromide 1 mol dm⁻³
- Sodium chloride 0.5 mol dm⁻³
- Potassium bromide 0.2 mol dm⁻³
- Sodium carbonate 0.5 mol dm⁻³
- Sodium sulphate 0.5 mol dm⁻³.

Observations

There should be no precipitates in Group 1, indicating that all Group 1 carbonates and sulphates are soluble.

For Group 2, magnesium sulphate is soluble while strontium and barium sulphates are insoluble. Calcium sulphate is particularly interesting because although it is only sparingly soluble its solubility is much higher than is expected from the solubility product. This is due to ion pairing of the calcium and sulphate ions in aqueous solution. No precipitate will be seen.

The concepts of solubility product and ion pairing may be too complex for most pre-16 students.

Tips



Students might think that the Group 1 part of this experiment is rather dull. However, they can be told that chemistry experiments that seem to produce no visual results may nevertheless still produce useful information!

Students should also observe that all the precipitates are white not coloured. The accompanying solubility data will be useful.

Solubility data

Solubility in grams per 100 cm³ of water at 20 °C (except where indicated with a superscript).

	Carbonate	Hydroxide	Sulphate	Fluoride
Magnesium	0.0106	0.0009	73.8	0.0076 ²⁸
Calcium	0.0014	0.185	0.209	0.0016 ¹⁸
Strontium	0.0011	0.41	0.0113	0.012 ²⁷
Barium	0.002	5.6	0.00022	0.12 ²⁵

(Source: *CRC handbook of chemistry and physics*, 74th edn. 1993–4.)

Health & Safety

Students must wear eye protection.

Magnesium nitrate, 0.5 mol dm⁻³ Mg(NO₃)₂·6H₂O (aq), Calcium nitrate, 0.5 mol dm⁻³ Ca(NO₃)₂·4H₂O (aq), Strontium nitrate, 0.5 mol dm⁻³ Sr(NO₃)₂·4H₂O (aq) and Barium nitrate, 0.2 mol dm⁻³ Ba(NO₃)₂ are skin/eye irritants

Sodium sulphate, 0.5 mol dm⁻³ Na₂SO₄(aq), Sodium chloride, 0.5 mol dm⁻³ NaCl (aq), Lithium bromide, 1 mol dm⁻³ LiBr (aq) and Potassium bromide, 0.2 mol dm⁻³ KBr (aq) are low hazard.

Sodium carbonate, 0.5 mol dm⁻³ Na₂CO₃·10H₂O is a skin/eye irritant

Credits

© Royal Society of Chemistry

Health & safety checked May 2018

Page last updated August 2018

