

Exercise walk-through

2.3.1

Redox equations and Group 1/2 trends

Pearson Edexcel · International A-Level · Chemistry

Opposite solubility trends explain the evidence

- 1 **Set up** $\text{Ba}(\text{OH})_2$ is more soluble: its equal saturated volume contains more OH^- and needs more acid.
- 2 **Reason** BaSO_4 is less soluble: equal initial cation amounts give more solid with excess sulfate.
- 3 **Conclude** Solubility controls dissolved amount; it is different from dissociation strength.

Controls distinguish chemical evidence from contamination

- 1 Set up** Match measured amounts, particle size, apparatus and heating rate; compare sample temperature at a consistent decomposition criterion.
- 2 Reason** CO_2 : milky limewater; O_2 : glowing splint relights; NO_2 : brown and acidic.
- 3 Conclude** Clean flame-test wire and keep the flame region/loading consistent. Na yellow, K lilac, Ca brick-red, Sr crimson-red; sodium carry-over can mask another colour.

Independent identification

Your turn

$\text{C}_3\text{H}_6\text{O}$ has a carbonyl IR absorption and gives a positive Fehling's test. Which structure fits all evidence?

- A. CH_3COCH_3
- B. $\text{CH}_3\text{CH}_2\text{CHO}$
- C. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- D. CH_3COOH

Exercises 2.1·2.3

2.1 Find the oxidation numbers of O in Na_2O_2 , H in NaH and Mn in MnO_4^- . [3]

2.2 Write a balanced equation for calcium with cold water and state one observation. [3]

2.3 Explain why potassium reacts more readily with water than lithium. [3]

Exercises 2.1·2.3

2.1 Find the oxidation numbers of O in Na_2O_2 , H in NaH and Mn in MnO_4^- . [3]

2.1 $\text{O} = -1$; $\text{H} = -1$; $x + 4(-2) = -1$, so $\text{Mn} = +7$.

2.2 Write a balanced equation for calcium with cold water and state one observation. [3]

2.2 $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$. Effervescence/hydrogen gas or a cloudy hydroxide suspension.

2.3 Explain why potassium reacts more readily with water than lithium. [3]

2.3 Potassium has greater radius and more shielding, reducing attraction to its outer electron so it is lost more easily.

Exercises 3.1·3.3

3.1 Write half-equations and the overall ionic equation for aluminium reducing Cu^{2+} to

3.2 Compare decomposition of LiNO_3 and NaNO_3 . Give balanced equations and explain why lithium differs. State a test for one gas. [5]

3.3 A calcium compound gives a brick-red flame. Explain how the light arises. State the characteristic flame colours for lithium, sodium, potassium and barium, and distinguish a magnesium-ion flame test from burning magnesium metal. [5]

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3.1 $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$; $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$. Multiply by 2 and 3: $2\text{Al} + 3\text{Cu}^{2+} \rightarrow 2\text{Al}^{3+} + 3\text{Cu}$

3.2 Compare decomposition of LiNO_3 and NaNO_3 . Give balanced equations and explain why lithium differs. State a test for one gas. [5]

3.2 $4\text{LiNO}_3 \rightarrow 2\text{Li}_2\text{O} + 4\text{NO}_2 + \text{O}_2$; $2\text{NaNO}_3 \rightarrow 2\text{NaNO}_2 + \text{O}_2$. Smaller Li^+ has greater

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3.3 Excited electrons fall to lower energy levels and emit photons of characteristic energy. Lithium crimson and sodium yellow; potassium lilac and barium apple-green. Magnesium ions have no characteristic flame colour; bright white burning metal is a different observation.