CIE Chemistry A-Level

Topic 10 - Group 2

Flashcards

What is formed when group 2 elements react with oxygen?

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Group 2 metal oxide

(This is a redox reaction)

What is observed when group 2 elements react with oxygen?

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- Beryllium only reacts in powdered form.
- Magnesium burns with an intense white flame.
- Calcium burns with a bright white flame (red at the top).
- Strontium is reluctant to start burning but burns intensely with a white flame.
- Barium burns with a white flame.

Write an equation for the reaction between calcium and oxygen

Write an equation for the reaction between calcium and oxygen

$$Ca_{(s)} + \tfrac{1}{2}O_{2(g)} \rightarrow CaO_{(s)}$$

What is formed when group 2 elements react with water?

How do group 2 elements react with water?

An alkaline hydroxide and hydrogen gas

(This is a redox reaction)

Describe the trend in the reactions with water as you go down group 2

Describe the trend in the reactions with water as you go down group 2

As you go down the group, the reactions become more vigorous.

Write an equation for the reaction between strontium and water

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$$Sr + 2H_2O \rightarrow Sr(OH)_2 + H_2$$

Why does beryllium only react with steam at very high temperatures and not with cold water?

Why does beryllium only react with steam at very high temperatures and not with cold water?

Because beryllium is the least reactive group 2 metal.

Why does magnesium stop reacting with cold water after a short time?

Why does magnesium stop reacting with cold water after a short time?

Because an insoluble coat of magnesium hydroxide forms on the surface.

What is formed when group 2 elements react with dilute acids?

What is formed when group 2 elements react with dilute acids?

A salt and hydrogen gas

(This is a redox reaction)

Write an equation for the reaction between magnesium and hydrochloric acid

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$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

Describe the trend in the reactivity of group 2 metals with hydrochloric acid

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Reactivity increases / the reactions get more vigorous.

Describe and explain the trend in the reactivity of group 2 metals with sulfuric acid

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The reactions do not get more vigorous down the group due to the solubility of the sulfates produced.

- Beryllium and magnesium: soluble sulfates so similar reaction as with HCl
- Calcium: sparingly soluble sulfate
- Strontium and barium: insoluble sulfates

Calcium, strontium and barium only react with sulfuric acid for a short time as the formation of the insoluble sulfate on the metal stops the reaction.

Why might a precipitate be seen when a group 2 oxide reacts with water?

Why might a precipitate be seen when a group 2 oxide reacts with water?

Group 2 hydroxides are only slightly soluble in water so when the solution is saturated, the metal hydroxide doesn't dissolve (meaning it appears as a precipitate).

Write an equation for the reaction between calcium oxide and water

Write an equation for the reaction between calcium oxide and water

$$CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)}$$

Describe the trend in the solubility of group 2 hydroxides. Use this to explain the trend in pH

Describe the trend in the solubility of group 2 hydroxides. Use this to explain the trend in pH

The solubility of group 2 hydroxides increases down the group. As a result, more OH^- ions are release in solution meaning pH increases down the group.

Which group 2 oxide doesn't react with water?

Which group 2 oxide doesn't react with water?

Beryllium oxide

What is formed when group 2 oxides react with dilute acids?

What is formed when group 2 oxides react with dilute acids?

A salt and water

Write an equation for the reaction between barium oxide and hydrochloric acid

Write an equation for the reaction between barium oxide and hydrochloric acid

$$BaO + 2HCl \rightarrow BaCl_2 + H_2O$$

How do group 2 hydroxides behave in water? Use $Ca(OH)_2$ as an example

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Group 2 hydroxides dissociate in water to form their constituent ions:

$$Ca(OH)_{2(s)} \rightarrow Ca^{2+}_{(aq)} + 2OH^-_{(aq)}$$

What is formed when group 2 hydroxides react with dilute acids?

What is formed when group 2 hydroxides react with dilute acids?

A salt and water

E.g. $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

How do group 2 carbonates behave in water?

How do group 2 carbonates behave in water?

All group 2 carbonates are sparingly soluble in water. They do not react with water.

What is formed when group 2 carbonates react with dilute acids?

What is formed when group 2 carbonates react with dilute acids?

A salt, water and carbon dioxide gas

Write an equation for the reaction between magnesium carbonate and nitric acid

Write an equation for the reaction between magnesium carbonate and nitric acid

$$MgCO_3 + 2HNO_3 \rightarrow Mg(NO_3)_2 + CO_2 + H_2O$$

Describe how group 2 nitrates thermally decompose

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Upon heating, group 2 nitrates decompose to form a group 2 metal oxide, nitrogen dioxide and oxygen gas.

Write an equation for the thermal decomposition of strontium nitrate

Write an equation for the thermal decomposition of strontium nitrate

$$Sr(NO_3)_2 \rightarrow SrO + 2NO_2 + \frac{1}{2}O_2$$

What is the trend in thermal stability of group 2 nitrates?

(A level only)

What is the trend in thermal stability of group 2 nitrates? **(A level only)**

- Thermal stability increases down the group.
- This is because as you go down the group, charge density of the ion decreases.
- This means that the ability of the group 2 ion to polarise a nitrate ion decreases.

Describe the thermal decomposition of group 2 carbonates

Describe the thermal decomposition of group 2 carbonates

Upon heating, group 2 carbonates decompose to form a group 2 oxide and carbon dioxide.

E.g. $CaCO_3 \rightarrow CaO + CO_2$

What is the trend in thermal stability of group 2 carbonates?

(A level only)

What is the trend in thermal stability of group 2 carbonates? **(A level only)**

- Thermal stability increases down the group.
- This is because as you go down the group, charge density of the ion decreases.
- This means that the ability of a group 2 ion to polarise a carbonate ion decreases.

Explain the trend in the solubility of group 2 hydroxides

(A level only)

Explain the trend in the solubility of group 2 hydroxides **(A level only)**

- The solubility of group 2 hydroxides increases down the group.
- Lattice dissociation enthalpy and enthalpy change of hydration both decrease down the group, but lattice dissociation enthalpy decreases more.
- This means enthalpy change of solution is more exothermic further down the group.

Explain the trend in solubility of group 2 sulfates

(A level only)

Explain the trend in solubility of group 2 sulfates **(A level only)**

- As you go down the group, the solubility of group 2 sulfates decreases.
- This is because lattice dissociation enthalpy and the enthalpy change of hydration both decrease as you go down the group but hydration enthalpy decreases more.
- This leads to the enthalpy change of solution becoming more endothermic.

What is the use of $Ca(OH)_2$ and $CaCO_3$ in agriculture?

What is the use of $Ca(OH)_2$ and $CaCO_3$ in agriculture?

- Both compounds can be added to soil to raise the pH so that it is not too acidic to grow crops. This is because they react with and neutralise acids.
- $CaCO_3$ is used in the manufacture of quicklime, slaked lime, cement and mortar.
- $Ca(OH)_2$ is used for cement, mortar and sewage treatment.