

3 This question is about aluminium and other metallic elements.

(a) Aluminium is extracted from purified bauxite by electrolysis. Fig. 3.1 shows a diagram of the electrolytic cell used.

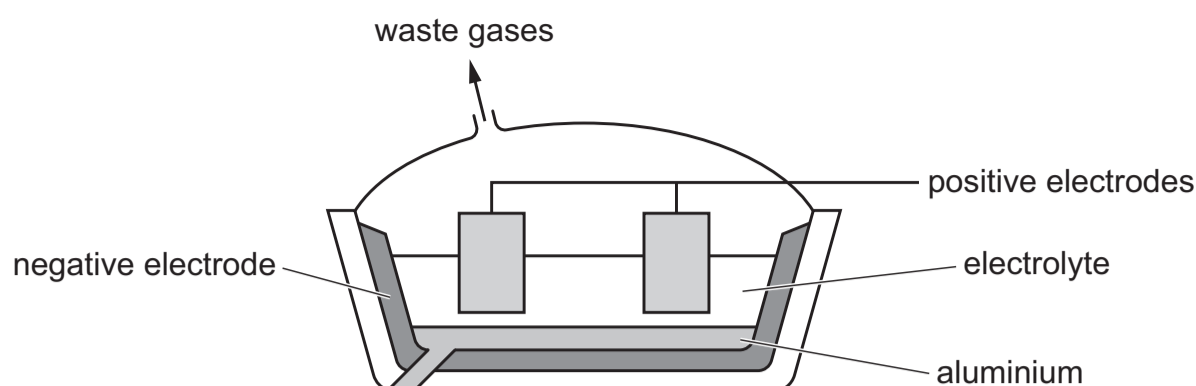


Fig. 3.1

(i) State the name of the aluminium compound present in bauxite.
 [1]

(ii) Name the substance that purified bauxite is dissolved in before electrolysis is carried out.
 [1]

(iii) Name the substance that is used for the positive electrodes.
 [1]

(iv) Write the ionic half-equation for the production of aluminium at the negative electrode.
 [2]

(b) Aluminium is above zinc in the reactivity series.

(i) When a piece of aluminium foil is added to aqueous zinc sulfate, a reaction is **not** immediately observed even though aluminium is above zinc in the reactivity series.

Explain why a reaction is **not** immediately observed.

.....
 [1]

(ii) After a few minutes, a displacement reaction occurs between aluminium and aqueous zinc ions.

Complete the ionic equation for this reaction.



(iii) State the oxidation number of zinc in:

Zn²⁺
 Zn. [2]

(iv) Define the term reduction in terms of oxidation number.
 [1]

(c) Aluminium reacts with iron(III) oxide. The equation is shown.



(i) State the meaning of the symbol ΔH .
 [1]

(ii) State what can be deduced about the reaction from the negative sign in $\Delta H = -850 \text{ kJ/mol}$.
 [1]

(d) Gallium has many similarities to aluminium. Gallium(III) oxide is an amphoteric oxide.

State what is meant by the term amphoteric.

.....
 [1]

(e) The reaction of gallium(III) oxide, Ga₂O₃, with aqueous sodium hydroxide forms a salt which contains the negative ion GaO₂⁻. The only other product is water.

Write a symbol equation for this reaction.

..... [2]

(f) Deduce the formula of:

- gallium(III) bromide
- gallium(III) sulfate.

[2]