C6.1.8 Extracting Aluminium

Previous learning:

C3.3.1 Redox reaactions
OILRIG oxidation is loss, reduction is gain (of electrons)

C6.1.6 Extracting metals
An ore is a rock or mineral that contains enough metal to make it economically worth extracting
Carbon can be used to extract a metal from its ore if the metal is less reactive than carbon

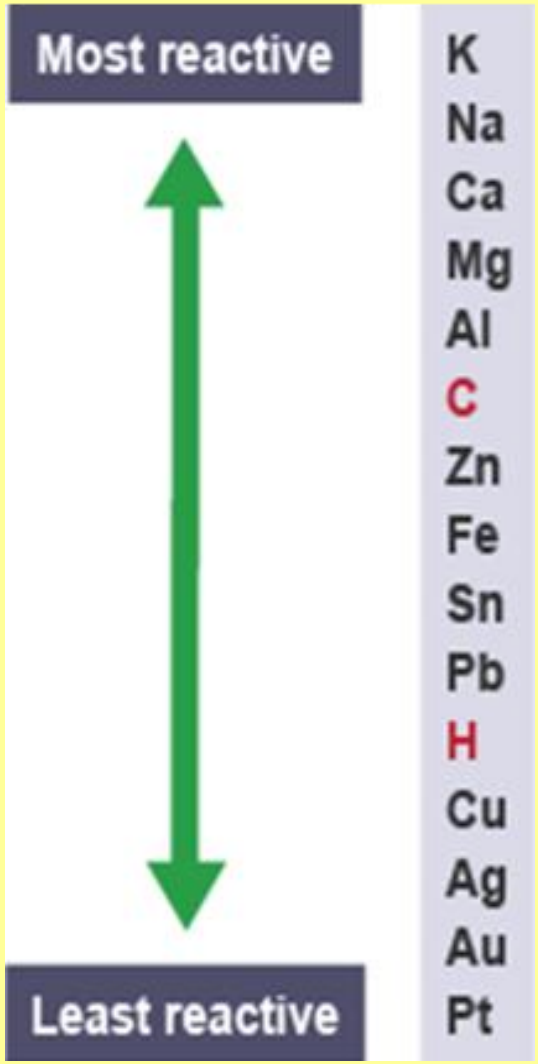
Learning Objectives

- Describe how aluminium is extracted from aluminium oxide
- Explain why electrolysis must be used to extract aluminium
- Write half equations for the extraction of aluminium

Videos (RSC and Fuse School)

- https://www.youtube.com/watch?v=NW1k4wNEq14
- https://www.youtube.com/watch?v=mvDHeYI-a00

Extraction of aluminium



- Aluminium ore is aluminium oxide (Al_2O_3) - bauxite
- Aluminium is more reactive than carbon
- Reduction with carbon will NOT work
- Electrolysis needs to be used

Extraction of aluminium

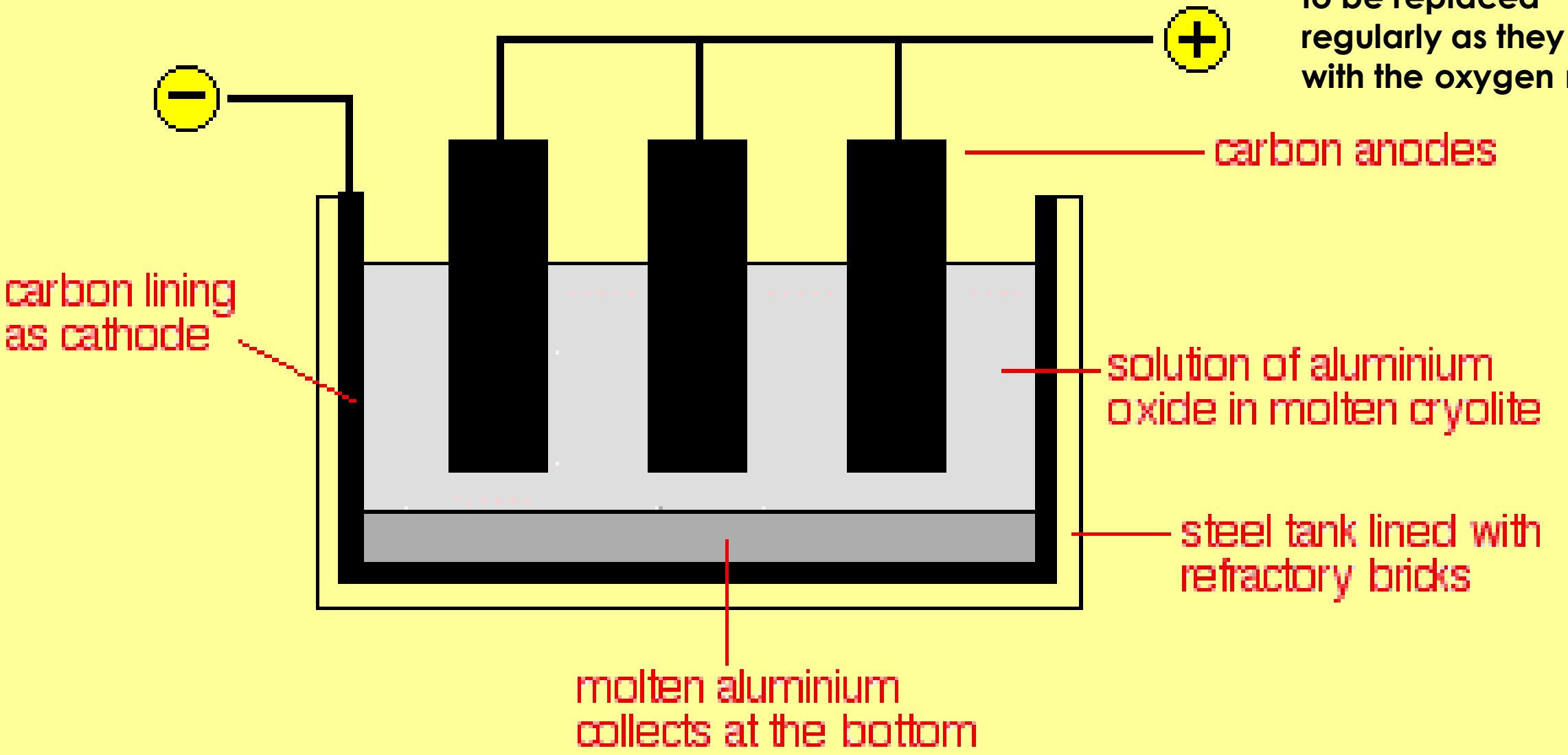
Problem

- Electrolysis only works for liquids
  - Aluminium oxide is not soluble in water
  - High melting point
    - Lots of energy needed to melt it (expensive)

Solution

- Dissolve in molten cryolite
- This has a lower melting point so will require less energy (cheaper)

Carbon anodes need to be replaced regularly as they react with the oxygen made



Half equations

Cathode (reduction – gain of electrons)

- $Al^{3+} + 3e \rightarrow Al$

Anode (oxidation – loss of electrons)

- $2O^{2-} \rightarrow O_2 + 4e$

Overall equation

Cathode

- $Al^{3+} + 3e \rightarrow Al$

Anode

- $2O^{2-} \rightarrow O_2 + 4e$

- This gives an overall equation of $2Al_2O_3 \rightarrow 4Al + 3O_2$