

OCR B GCSE Chemistry

Topic 3: Chemicals of the natural environment

What are electrolytes and what happens during electrolysis?

Notes



1. Describe electrolysis in terms of the ions present and reactions at the electrodes

- During electrolysis, positively charged ions move to the negative electrode (cathode), and negatively charged ions move to the positive electrode (anode).
- Ions are discharged at the electrodes producing elements, this process is called electrolysis

2. Predict the products of electrolysis of binary ionic compounds in the molten state

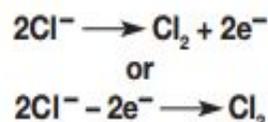
if ionic compounds are molten it is much more simple to predict the products of electrolysis as there are no ions present except those in the ionic compound:

- identify which ions there are within the ionic compound
- the + ions will go to the cathode
- the - ions will go to the anode

3. Recall that metals (or hydrogen) are formed at the cathode and non-metals are formed at the anode in electrolysis using inert electrodes

4. (HT only) use the names and symbols of common elements and compounds and the principle of conservation of mass to write half equations

- This is an example of a half equation; the small number is always the same as the 2 larger numbers within the equation. & electrons are represented by the symbol 'e⁻'
- writing half equations for the reactions at each electrode:
 - negative electrode: $X^+ \rightarrow X$, so ionic equation must be: $X^+ + e^- \rightarrow X$, electrons gained, so positive ions are reduced
 - positive electrode: $X^- \rightarrow X$, so ionic equation must be: $X^- \rightarrow e^- + X$, electrons are lost, so negative ions are oxidised



5. (HT only) explain reduction and oxidation in terms of gain or loss of electrons, identifying which species are oxidised and which are reduced

- Oxidation Is Loss (of electrons) and Reduction Is Gain (of electrons) see above picture to help you remember OIL RIG
- ANODE – loss of electrons, oxidation (positive electrode) anions come to it
- CATHODE – gain of electrons, reduction (negative electrode) cations come to it





6. Explain how electrolysis is used to extract some metals from their ores including the extraction of aluminium

- Metals that are more reactive than carbon e.g aluminium are extracted by electrolysis of molten compounds.
 - Too reactive to be extracted by reduction with carbon
 - Aluminium is manufactured by the electrolysis of a molten mixture of aluminium oxide and cryolite using carbon as the positive electrode (anode).
- Metals that react with carbon can be extracted by electrolysis as well
- Large amounts of energy are used in the extraction process to melt the compounds and to produce the electrical current

7. Describe competing reactions in the electrolysis of aqueous solutions of ionic compounds in terms of the different species present, including the formation of oxygen, chlorine and the discharge of metals or hydrogen linked to their relative reactivity

- When you have a ionic solution (NOT a molten ionic compound), your solution will contain: the ions that make up the ionic compound, and the ions in water (OH^- and H^+)
- at the cathode (-):
 - hydrogen (from H^+ in water) is produced UNLESS the + ions in the ionic compound are from a metal less reactive than hydrogen
 - if the metal is less reactive, it will be produced instead
- at the anode (+):
 - oxygen (from OH^- in water) will be produced UNLESS the ionic compound contains halide ions (Cl^- , Br^- , I^-)
 - if there are halide ions, the halogen will be produced instead (e.g. Cl_2)





8. Describe the technique of electrolysis of an aqueous solution of a salt

Generally...

- aqueous solution of salt in beaker
- two electrodes in the solution, one attached to the positive and one to the negative terminal
- ions will be attracted to and then discharged at the anode/cathode (see 7 to see what will be produced)

e.g. electrolysis of:

- Copper chloride solution
 - Cu^+ ions go to cathode, Cu (s) is produced (Cu is less reactive than hydrogen)
 - Cl^- ions go to anode, Cl_2 (g) is produced (Cl^- are halide ions)
- Sodium chloride solution
 - H^+ ions go to cathode, H_2 (g) is produced (Na is more reactive than hydrogen)
 - Cl^- ions go to anode, Cl_2 (g) is produced (Cl^- are halide ions)

