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| Chemistry p.102-103  Trilogy p.86-87 | C6.1 Electrolysis | |
|  | What does the word electrolysis mean? | Splitting up using electricity |
| What is an electrolyte? | A substance that is broken down by electrolysis |
| What property must the electrodes used in electrolysis have? Why? | They must be inert or unreactive, so they do not react with the electrolyte or products. |
| Where do the positive and negative ions move to during electrolysis? | Positive ions move to the negative electrode.  Negative ions move to the positive electrode. |
| Why can’t we separate a solid using electrolysis? | Because the solid ionic substances do not conduct electricity, i.e. the ions are not free to move and carry their charge between the electrodes |
| Consider the electrolysis of molten copper chloride. Which ions will go to which electrode? | Copper is a metal so will have a positive ion and therefore go to the negative electrode.  Chlorine is a non-metal so will have a negative ion and therefore go to the positive electrode. |
| What you expect to see at the positive electrode?  (Hint: Think of what state chlorine is.) | You expect to see bubbles; this is chlorine gas forming. |
| **Electrolytes in solution** | Why can electrolysis of ionic substances be very difficult? | Because they have very high melting points |
| What can be done to get around this problem? | Dissolve the ionic substance in water |
| What is the problem with using solutions to perform electrolysis? | Water also forms ions so some of the products at the two electrodes are not always what we expect. |
| Draw the balanced symbol equation for the electrolysis of copper (II) chloride (CuCl2) dissolved in water. | CuCl2(aq) → Cu(s) + Cl2(g) |

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| Chemistry p.104–105  Trilogy p88-89 | C6.2 Changes at the electrodes | |
|  | Do negatively charged ions gain or lose electrons at the electrode? | Lose electrons |
| Do positively charged ions gain or lose electrons at the electrode? | Gain electrons |
| Explain what is happening to lead ions (Pb2+) when they reach the negative electrode. | Each ion gains two electrons at the electrode to become a neutral lead atom. |
| What does the term reduction mean? | It is another way of saying gaining electrons. |
| Explain what is happening to the bromide ions (Br -) when they reach the positive electrode. | Each ion gains a single electron to become a neutral bromine atom. Two bromine atoms bond covalently to form a bromine molecule (Br2). |
| What does the term oxidation mean? | It is another way of saying losing electrons. |
| **HIGHER**  **Half equations** | Write the half equations for the electrolysis of CuCl2. | At the negative electrode: Cu2+ + 2e- → Cu  At the positive electrode: 2Cl- → Cl2 + 2e- |
| What does OILRIG stand for? | Oxidation Is Loss, Reduction Is Gain |

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| **The effect of water** | What rule helps us to work out what will be formed at an electrode when using aqueous solutions? | If two elements can be produced at an electrode the least reactive element will usually be formed. |
| When using aqueous ionic solutions what ions will always be attracted to the negative electrode? | The positively charged metal ions and H+ ions (from water) |
| If an aqueous sodium compound is split using electrolysis, what would be produced at the negative electrode? Why?  (Hint: Sodium is more reactive than hydrogen.) | Hydrogen would be produced at the electrode instead of sodium; the sodium would stay in solution. |
| What is the ‘order of discharge’ at the positive electrode? | Halide ion > hydroxide > all other negatively charged ions |
| What is given off at the positive electrode when hydroxide ions are discharged? | Oxygen gas |

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| Chemistry p.106-7  Trilogy p.90–91 | C6.3 The extraction of aluminium | |
|  | What method is used to extract aluminium? | Electrolysis |
| What ore do we get aluminium oxide from? | Bauxite |
| What is the first step in the extraction of aluminium from this raw material? | To separate aluminium oxide from the ore |
| **Electrolysis of aluminium oxide** | What must be done first to the aluminium oxide? Why? | It must be melted; this enables the ions to move to the electrodes. |
| What is the melting temperature of aluminium oxide? | 2050°C |
| How can energy be saved when melting aluminium oxide? | By mixing the aluminium oxide with molten cryolite, this reduces the temperature required to keep the aluminium oxide molten |
| How many electrons does each aluminium ion gain at the negative electrode to produce aluminium atoms? | 3 electrons |
| How is the aluminium collected? | It collects at the bottom of the electrolysis tank and is syphoned off. |
| How many electrons does each oxide ion lose at the positive electrode to produce oxygen atoms? | 2 electrons |
| Why do the carbon electrodes need to be periodically replaced? | The oxygen reacts with the hot carbon electrodes forming carbon dioxide; this process is effectively burning the electrode away. |

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| Chemistry p.188–189  Additional Science p.158–159 | C2 5.7 Electrolysis of brine | |
|  | What is brine? | Concentrated sodium chloride solution |
| What **three** products do we get from the electrolysis of brine? | *1. Chlorine gas* |
| *2. Hydrogen gas* |
| *3. Sodium hydroxide* |
| What happens at the positive electrode? | ⦁ Chloride ions attracted to positive electrode  ⦁ Each chloride ion loses one electron at the electrode (become oxidised)  ⦁ Chlorine joins with covalent bonds to form chlorine gas (Cl2) |
| Why is hydrogen and not sodium formed at the negative electrode? | Because sodium is more reactive than hydrogen so hydrogen is discharged and sodium stays in solution |
| Are hydrogen ions oxidised or reduced at the negative electrode? | Reduced |
| **The remaining solution** | Why does the remaining solution become alkaline? | The H+ and Cl- ions are removed at the electrodes leaving the Na+­ and OH- ions, i.e. leaving a solution of sodium hydroxide (an alkaline solution) |