**C14 Chemistry Specification**

**Module:** Module 14 Earth Resources

**Chapter:** C14

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| Lesson | Specification Link |  |
| C14 Lesson 1  Finite and Renewable resources | We rely on the Earth’s natural resources to make new products and provide us with energy  Some of these natural resources are finite – they will run out eventually if we continue to exploit them – e.g. fossil fuels  Others are renewable – they can be replaced as we use them up – e.g. crops grown to make biofuels  Estimates of the time left before fossil fuels run out can only be rough estimates because of the uncertainty involved in the calculations |  |
| C14 Lesson 2  Water Safe to Drink | Water of appropriate quality is essential for life. For humans, drinking water should have sufficiently low levels of dissolved salts and microbes. Potable water is water that is safe to drink. Potable water is not pure water in the chemical sense because it contains dissolved substances.  The methods used to produce potable water depend on available supplies of water and local conditions.  In the United Kingdom (UK), rain provides water with low levels of dissolved substances (fresh water) that collects in the ground and in lakes and rivers, and most potable water is produced by:  • choosing an appropriate source of fresh water  • passing the water through filter beds  • sterilising.  Sterilising agents used for potable water include chlorine, ozone or ultraviolet light.  If supplies of fresh water are limited, desalination of salty water or seawater may be required. Desalination can be carried out by distillation or by processes that use membranes such as reverse osmosis. These processes require large amounts of energy.  Students should be able to:  • distinguish between potable water and pure water  • describe the differences in treatment of ground water and salty water  • give reasons for the steps used to produce potable water. |  |
| C14 Lesson 3  Treating Waste Water | Urban lifestyles and industrial processes produce large amounts of wastewater that require treatment before being released into the environment. Sewage and agricultural wastewater require removal of organic matter and harmful microbes. Industrial waste water may require removal of organic matter and harmful chemicals.  Sewage treatment includes:  • screening and grit removal  • sedimentation to produce sewage sludge and effluent  • anaerobic digestion of sewage sludge  • aerobic biological treatment of effluent.  Students should be able to comment on the relative ease of obtaining potable water from waste, ground and salt water. |  |
| C14 Lesson 4  Extracting metals from their ores | The Earth’s resources of metal ores are limited.  Copper ores are becoming scarce and new ways of extracting copper from low-grade ores include phytomining, and bioleaching. These methods avoid traditional mining methods of digging, moving and disposing of large amounts of rock.  Phytomining uses plants to absorb metal compounds. The plants are harvested and then burned to produce ash that contains metal compounds.  Bioleaching uses bacteria to produce leachate solutions that contain metal compounds. The metal compounds can be processed to obtain the metal.  For example, copper can be obtained from solutions of copper compounds by displacement using scrap iron or by electrolysis.  Students should be able to evaluate alternative biological methods of metal extraction, given appropriate information |  |
| C14 Lesson 5  Life Cycle Assessments – Reduce, Reuse and Recycle | Life cycle assessments (LCAs) are carried out to assess the environmental impact of products in each of these stages:  • extracting and processing raw materials  • manufacturing and packaging  • use and operation during its lifetime  • disposal at the end of its useful life, including transport and distribution at each stage.  Use of water, resources, energy sources and production of some wastes can be fairly easily quantified. Allocating numerical values to pollutant effects is less straightforward and requires value judgements, so LCA is not a purely objective process.  Selective or abbreviated LCAs can be devised to evaluate a product but these can be misused to reach pre-determined conclusions, eg in support of claims for advertising purposes.  Students should be able to carry out simple comparative LCAs for shopping bags made from plastic and paper.  The reduction in use, reuse and recycling of materials by end users reduces the use of limited resources, use of energy sources, waste and environmental impacts.  Metals, glass, building materials, clay ceramics and most plastics are produced from limited raw materials. Much of the energy for the processes comes from limited resources. Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts.  Some products, such as glass bottles, can be reused. Glass bottles can be crushed and melted to make different glass products. Other products cannot be reused and so are recycled for a different use.  Metals can be recycled by melting and recasting or reforming into different products. The amount of separation required for recycling depends on the material and the properties required of the final product. For example, some scrap steel can be added to iron from a blast furnace to reduce the amount of iron that needs to be extracted from iron ore.  Students should be able to evaluate ways of reducing the use of limited resources, given appropriate information. |  |