

IGCSE Co-ordinated Sciences 0654

Unit 11: C5 Materials and Structure & C6 Oxidation and Reduction

Recommended Prior Knowledge

Students should have familiarity with the terms “atom”, “molecule” and “ion”.

Context

Knowledge from this Unit will be useful in topic C16 Metals and Alloys

Outline

Some of the properties of materials are studied and related to their structures and uses. Use of redox reactions in the extraction of metals, and uses of other minerals are studied.

AO	Learning outcomes	Suggested Teaching activities	Learning resources
ABC	Understand some of the vocabulary used to describe the properties of materials (e.g. strength, elasticity, hardness, transparency, porosity, electrical and thermal conductivity and biodegradability [and their opposites]).	<p>Students can examine a range of materials to classify their physical properties.</p> <p>Students can heat materials and note changes of state.</p>	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 4.</p> <p><i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward</p>
AB	Appreciate that the forces holding atoms together in molecules are stronger than the forces between the molecules.	Data tables of melting and boiling points of compounds can be used to assess the physical state of materials and relate this to the forces between particles. This can be demonstrated by showing that materials do not decompose into constituent elements when heated, that they simply melt/boil, e.g. heat water and collect condensate to show that it is still water.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 4.

AO	Learning outcomes	Suggested Teaching activities	Learning resources
ABC	Understand why ionic compounds only conduct when molten or when in solution.	Conduction of ionic compounds when solid and when in aqueous solution can be investigated in a class practical. Conduction of a current through molten and solid lead(II) bromide can be compared by using a demonstration. Symbols for ions can be introduced. Students can work out the formulae of simple salts given a table of ion formulae. The web site gives instructions on how to name common salts.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 4. <i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward http://www.iun.edu/
AB	Understand the distinction between molecular structures and giant structures with the help of a limited range of examples such as water, carbon dioxide, oxygen, graphite, diamond and silicon(IV) oxide.	Melting and boiling points of the named examples can be compared. Data can be obtained from the web site.	http://www.revision-notes.co.uk/
ABC	Know that an ion is a charged particle and many compounds of metals with non-metals are ionic giant structures. Know that glass is made from silicon(IV) oxide combined with some metal oxides. Know that common ceramic objects are made from fired clay.	Look at diagrams and models of lattice structure of common ionic compounds e.g. sodium chloride. Glass tubing or rods can be heated to mould and work them. Examples of different types of glass may be examined and their uses discussed. Try making and firing pots from clay if this is feasible.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 4. <i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward http://www.craftscouncil.org.uk/
AB	Be able to deduce the formula of simple ionic compounds from the	Students can use data from a table of formulae of ions to work out the formulae of salts.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 4.

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	charges on their ions.		
AB	Know some advantages and disadvantages of recycling glass.	Advantage and disadvantage of recycling glass can be discussed and researched on the internet. Many good recycling sites.	http://www.recyclingglass.co.uk http://www.glassforever.co.uk/ http://www.parliament.uk/
AB	Understand that glass has a giant structure with a disordered arrangement of atoms.	Diagrams of glass structure can be examined.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 4.
AB	Know how to carry out calculations in moles for molecules and giant structures.	Students should solve simple quantitative problems based on formulae and equations.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 5.
ABC	Understand the terms oxidation and reduction in terms of the addition and removal of oxygen.	<p>Students may perform simple oxidation and reduction experiments such as burning magnesium and reduction of lead(II) oxide with carbon (in a fume cupboard).</p> <p>Link to the reactions of metals in topics C1 & C2.</p>	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 9.</p> <p>Teaching and Assessing Practical Skills in Science by Dave Hayward</p>
AB	Be able to write simple equations to describe oxidation and reduction using both words and symbols.	Simple oxidation and reduction reactions should be used as examples to construct word and symbol equations.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 9.
A	Know that rocks are an important source of chemicals, including metals.	Common ores such as haematite and malachite may be examined. Local rocks may provide a useful source.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 8 & 9.
ABC	Understand that some minerals are relatively pure compounds	Copper metal can be formed by heating crushed malachite mixed with carbon powder.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 8 & 9.

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	Understand the names and formulae of minerals given in tables of data.	Data tables of minerals and their formulae may be studied. The websites contain data about some minerals.	<p><i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward http://www.ccp14.ac.uk/ccp/web-mirrors/ill-hewat/dif/3D-crystals/minerals.html</p> <p>http://mineral.galleries.com/minerals/silicate/quartz.htm</p>
A	Appreciate the role of carbon in the extraction of metals from their ores.	Reactions used in the extraction of iron, copper and zinc may be studied. The role of limestone in the extraction of iron should be included. Details may be obtained from the websites.	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 8.</p> <p>Iron and steel manufacture: http://www.bbc.co.uk/history/games/blast/blast.shtm http://www.ohiosteel.org/</p>
AB	Understand that the ease of obtaining a metal from its ore is related to its position in the reactivity series.	<p>The thermite reaction may be demonstrated (using a fume cupboard or outside the classroom). Video clip shows thermite reaction in the web link.</p> <p>A comparison can be made between methods of extraction of iron and aluminium.</p> <p>Students may perform calculations to find the percentage of metals in ores.</p>	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 9.</p> <p>http://jchemed.chem.wisc.edu/</p>
AB	Appreciate that economic, social and environmental issues may be involved when minerals are mined	Students could prepare material for a talk or debate on the responsible exploitation of resources such as metal ores and limestone. Students may use the websites to prepare a written or oral presentation about the production of zinc and/or copper.	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 8.</p> <p>History of the production of zinc:</p>

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			<p>http://www.zincworld.org/</p> <p>Mining of copper: http://www.schoolscience.co.uk/content/4/chemistry/cumining/index.html</p>