Checkpoint Science Scheme of Work

Chemistry – Year 2

Topic: Atoms and elements

Aims
That pupils should be able to:

- give symbols to the common elements
- understand that elements are made of atoms

Links
Checkpoint curriculum – Cm 1, Cm2
IGCSE Chemistry 4, IGCSE Co-ordinated Sciences C 1, IGCSE Combined Sciences Chemistry Topic One, IGCSE Physical Science 3.1

Words
element, atom, compound, chemical symbol

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
explain what is meant by an element.	Provide students with the spherical model of the atom. Explain that elements contain only one type of atom and therefore cannot be split into different substances. They have only one name. Discuss how they might be arranged in solids, liquids and gases.	
name the lightest twenty elements.	Students are provided with a list of the names (or possibly samples in twenty tubes) of the lightest twenty elements, with picture / description.	Give a definition of an element.
research and present a profile of an element.	An element can be chosen and its properties, uses and history researched to construct an 'element profile' to present to the class.	
identify some elements by their flame tests.	Flame colours for elements can be observed.	Safety goggles must be worn. Use dilute hydrochloric acid for cleaning and recommend using any sodium compounds last because of their

		strong colour.
learn the symbols of the first twenty elements	The first twenty symbols must be learnt, students can test each other as a team game. e.g. “my symbol is the end of my footwear” Ans. sock = K = potassium “my symbol is a lot of water and a note” Ans. C and a = calcium Alternatively they can make up crosswords or wordsearches.	
explain the formation of simple compounds.	Simple combinations of elements can be carried out, accompanying each with a word equation. E.g. burning magnesium or steel wool in air/ oxygen heating iron wool in iodine vapour Students can be given names/ samples of common chemicals and can identify the elements that they contain.	Safety goggles must be worn. Introduce the term compound. This must be carried out in a fume cupboard.

Resources

http://funbrain.com:80/periodic/index.html
http://www.creative-chemistry.org.uk/activities/flametests.htm
http://www.webelements.com/
http://sciencespot.net/Pages/classchem.html#Anchor4

Topic: Further Reactions

Aims
That pupils should be able to:

- explain the idea of compounds
- name some common compounds including oxides, hydroxides, chlorides, sulphates and carbonates
- use a word equation to describe a reaction

Links
Checkpoint curriculum – Cm 2, Cc1, Cc4, Cc7
IGCSE Chemistry 8.1, IGCSE Co-ordinated Sciences C 9, IGCSE Combined Sciences Chemistry Topic Four, IGCSE Physical Science 6

Words
oxides, hydroxides, sulphates, carbonates, salts

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
prepare crystals of common salt	Students can prepare salt but it is best to demonstrate the neutralisation and then provide students with solution. This is then evaporated to reduce and then left to cool. The crystals can be examined. Commercial production of salt can be researched.	It is important that students are evaporating a solution which is neutral. A pH probe can be demonstrated if available. Safety goggles must be worn.
know that other chlorides can be prepared by the same method	Other chlorides can be prepared by adding metals (magnesium, zinc, iron) to dilute hydrochloric acid.	Safety goggles must be worn. Word equations should be applied to each reaction.
know how salts of sulphuric acid are prepared.	Students prepare salts of sulphuric acid such as zinc and acid, copper oxide and acid, calcium carbonate and acid. Magnesium sulphate, Epsom salts, is an old remedy for constipation.	Safety goggles must be worn. Word equations should be applied to each reaction.
know how salts of nitric acid are prepared	Students prepare “fertiliser”, salts of nitric acid using a carbonate, such as calcium, with dilute acid.	Safety goggles must be worn. Word equations should be applied to each reaction.
know that oxides can be prepared by combustion.	The simplest reaction is the combustion of	Safety goggles must be worn.

	elements to form oxides. Charcoal can be burned to form carbon dioxide which can be collected and identified. Magnesium can be burned in a crucible. It can be weighed before and after to show addition of oxygen. Iron and copper can be burned in oxygen.	Word equations should be applied to each reaction. Burning magnesium in air should not be viewed directly due to its brightness. Link this to its use in flares and fireworks. Results are not reliable due to loss of magnesium oxide.
know how some hydroxides can be prepared.	Some coloured hydroxides can be observed by adding a little sodium hydroxide to solutions containing ions of aluminium, zinc, calcium, copper, iron (II) or iron (III).	Common names of caustic soda, slaked lime, limewater should be given.
know some of the properties of carbonates.	Carbonates other than those used above, can be observed and their properties investigated, such as sodium hydrogen carbonate and copper carbonate.	Common names of sodium bicarbonate, limestone and, possibly, malachite.

Resources

http://www.science-house.org/learn/CountertopChem/exp9.html

Topic: Compounds and mixtures

Aims
That pupils should be able to:
- explain the differences between elements, compounds and mixtures

Links
Checkpoint curriculum – Cm 3
IGCSE Chemistry 3, IGCSE Co-ordinated Sciences C 1, IGCSE Combined Sciences Chemistry Topic One, IGCSE Physical Science 3.2

Words
compounds, fractional, distillation

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
revise the concept of elements	Students should revise earlier ideas about elements e.g. through a word search or researching the cost of some of the elements in your body / earth's crust.	
distinguish between an element, a mixture and a compound.	Students compare the properties of an iron/sulphur mix with the product of a reaction between the elements. The mixture should be heated strongly until it begins to react. Show that the formation of a mixture is physical in nature whereas the formation of a compound is a chemical reaction. Other examples include heating of copper and sulphur, burning of magnesium or iron in chlorine.	Do as a demonstration or give a reminder of safety precautions. Safety goggles must be worn. Characteristics include exchange of energy and the formation of new material with different properties from reactants. Chlorine gas should only be used in demonstration in a fume cupboard.
describe the physical properties of solutions.	Students can investigate how the addition of salt to ice / water changes its freezing point / boiling point. The value and limitations of different tests for water can be observed and discussed.	Safety goggles must be worn for heating salt water. Link with use on roads for preventing freezing. Tests include B.Pt of a sample, use of cobalt chloride paper, anhydrous copper sulphate or UI paper.
separate compounds from mixtures of compounds.	Students should plan and carry out the preparation of clean samples of one or both constituents from a mixture of e.g.	Safety goggles must be worn. It could be run as a competition to get the most salt possible from their mixture, verify by weighing.

	sand and sugar sand and salt powdered chalk and copper sulphate	Desalination can be discussed.
separate elements from some compounds.	Copper chloride solution can be split by electrolysis. Copper carbonate can be heated to give copper oxide which can be heated in the presence of hydrogen to give copper.	Safety goggles must be worn. Link with the use of chlorine to sterilise drinking water.
know how the elements of water can be separated and how the ratio of volumes relates to the formula of water.	The electrolysis of acidified water can be investigated and tests for hydrogen and oxygen carried out. The ratio of volumes of hydrogen to oxygen should be measured and used to represent the idea of a formula as a short hand for a compound.	Other simple formulae can be introduced eg. CO_2, NaOH, H_2SO_4. Note that it is beyond the scope of Checkpoint to learn formulae or balance equations.
know how liquids can be separated by fractional distillation.	Students should observe the fractional distillation of a mixture of liquids and compare with the electrolysis of water i.e. no fixed ratio of constituents. Crude oil can be distilled in this way. Link with the uses of the fractions.	The products can be hazardous so this should be done by demonstration with very good ventilation. A safer method using made up crude oil exists (refer to CLEAPPS Haz-cards (ASE).

Topic: Metals and non-metals

Aims
That pupils should be able to:

- describe and explain physical and chemical differences between metals and non-metals

Links
Checkpoint curriculum – Cm 4, Cc1, Cc4
IGCSE Chemistry 10, IGCSE Co-ordinated Sciences C 16, IGCSE Combined Sciences Chemistry Topic Two, IGCSE Physical Science 8

Words
density, malleability, ductility, combustion, alkali metals

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
	Note that much of the material in this section is given as background information. Reactions of metals can be confined to sodium, magnesium, zinc, iron, copper, silver and gold.	
order properties of metals and non-metals for comparison.	A scale of hardness for metals and non-metals can be produced by a "which scratches which?" process. Pins, paperclips, graphite, etc can be used. A density scale can be made, by finding the masses of similar cubes. Flexibility can be investigated by trying to bend strips of metals and non-metals. Melting points from a database can be treated graphically to compare metals and non-metals.	
state the properties of metals and say in what ways some are exceptional.	Students can discover from practical work or resources which metals do not share the general properties of metals. Examples of exceptions are: hardness and melting point Sodium density Magnesium, aluminium magnetic properties Iron, nickel, cobalt	Sodium must be demonstrated by the teacher.

	colour Gold, copper state at room temperature Mercury	Mercury should be in a sealed bottle.
know the methods of extraction of some metals and some non-metals.	Students can observe some ores, preferably at least one obtainable in powdered form. Methods of extraction can be studied, such as obtaining copper by heating copper oxide in a stream of hydrogen or by plating a coin by electrolysis. Non-metals occur mainly in air, the sea and in organic materials. Extraction of oxygen from air can not be demonstrated, electrolysis to obtain hydrogen may have been seen earlier. Carbon can be released during burning of organic materials such as paper, wax etc.	Safety goggles must be worn. Note that no details of metal extraction will be tested at this level. The mining of copper etc can be discussed as with particular reference to social and environmental issues. Recycling can be discussed as a way of saving resources.
know how metals and non-metals react with oxygen.	The combustion of some elements in oxygen, if not already seen, can be demonstrated. Observations to be made are: not all metals react at the same rate, some products can be dissolved in water. These can be tested with Universal indicator paper to make a comparison between metals and non-metals. Partial oxidation of copper is an interesting experiment. A small sheet of copper is folded in four and heated strongly. Once the metal is cooled and unfolded, fascinating patterns reveal the partial oxidation.	Safety goggles must be worn. Word equations should be used. Acid rain and global warming can be raised as an issue here.
know how metals and non-metals react with water.	The reaction of a range of metals and non-metals with water / steam can be investigated. Examples include sodium (must be demonstrated), lithium, magnesium, iron, copper and carbon, sulphur.	Safety goggles must be worn. Screens must also be used for sodium. The solution resulting can be shown to be alkaline hence ‘alkali metals’.
know how metals and non-metals react with acids.	The reaction of some metals with dilute acids can be investigated. The hydrogen gas given off should be tested.	Safety goggles must be worn. Word equations should be used. A general equation can be given i.e. metal + acid = salt + hydrogen

Resources

http://www.chem4kids.com/elements/010_ne/index.html

Topic: Corrosion

Aims
That pupils should be able to:

- describe chemical reactions which are not useful

Links
Checkpoint curriculum – Cc 2
IGCSE Chemistry 10, IGCSE Co-ordinated Sciences C 15, IGCSE Combined Sciences Chemistry Topic Three, IGCSE Physical Science 8

Words
corrosion, rusting, oxidation

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
describe some reactions which happen relatively quickly.	Rapid combustion can be demonstrated with a fine powder such as cornflour in a tin with a lighted candle. When the flour is blown with a straw the explosion can blow the lid off the tin. This is a danger in mills, coal mines etc.	A screen should protect pupils. Safety goggles should be worn. The lid should not be placed on too tightly to avoid splitting the tin.
describe some reactions which happen relatively slowly.	Slow oxidation of fats and oils takes place turning them rancid. Students can examine some food labels to check which contain **antioxidants**.	
state the conditions necessary for the formation of rust.	A suitable introduction would be a survey of cars or bikes to find out where and at what age rusting mostly occurs. Students can set up tubes containing nails under different conditions. Include one in dry air (add anhydrous copper sulphate), one in boiled distilled water and one dipping in water and open to the air.	Safety goggles should be worn.
know that rusting is an oxidation process.	Students should learn that the reaction forming rust is one of oxidation, the remaining gases in the air are not involved, apart from water vapour. It can be shown that rust causes a gain in weight.	

know the factors which increase the rate of rusting.	Students can design an investigation into other factors such as temperature and presence of salt in the water.	
know ways of preventing rust.	Students should learn about ways of preventing rust from forming e.g. painting, greasing, galvanising, plastic coating and then suggest where they could be most appropriately used. Students can bring in or look at a bike and suggest how different parts are protected from corrosion.	
recognise other examples of corrosion.	Examples of metals which corrode are copper, bronze, silver and aluminium (although the oxide layer formed prevents further corrosion). Students might be able to suggest these or others from their own experience or pictures. Students could research the uses of iron and suggest why it is used even though it rusts.	

Resources

http://ericir.syr.edu