

**GCSE Additional Science**



**Module C5 – Chemicals of the Natural Environment:**

**What you should know**

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|  **Name:** **Science Group:** **Teacher:** |

**R.A.G. each of the statements to help focus your revision:**

*R = Red: I don’t know this A = Amber: I partly know this*

*G = Green: I know this*

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| **C 5.1 What types of chemicals make up the atmosphere?** | **R.A.G.** |
| I can recall that dry air consists of gases, some of which are elements (for example oxygen, nitrogen and argon) and some compounds (for example carbon dioxide) |  |
| I can recall that the relative proportions of the main gases in the atmosphere are about 78% nitrogen, 21% oxygen, 1% argon and 0.04% carbon dioxide |  |
| I can recall the symbols for the atoms and molecules of these gases in the air |  |
| I can recall that most non-metal elements and most compounds between non-metal elements are molecular |  |
| I understand that some molecular elements and compounds have low melting and boiling points |  |
| I can interpret quantitative data (for example, melting and boiling points) and qualitative data about the properties of molecular elements and compounds |  |
| I understand that molecular elements and compounds, such as those in the air, have low melting and boiling points, and are gases at room temperature, because they consist of small molecules with weak forces of attraction between the molecules |  |
| I understand that pure molecular compounds do not conduct electricity because their molecules are not charged |  |
| I understand that bonding within molecules is covalent **and arises from the electrostatic attraction between the nuclei of the atoms and the electrons shared between them** |  |
| I understand that covalent bonds are strong, in contrast to the weak forces of attraction between small covalent molecules |  |
| I can translate between representations of molecules including molecular formulae, 2-D diagrams in which covalent bonds are represented by lines, and 3-D diagrams for: a. elements that are gases at 20°C b. simple molecular compounds. |  |
| **C 5.2 What reactions happen in the hydrosphere?** | **R.A.G.** |
| I can recall that the Earth’s hydrosphere (oceans, seas, lakes and rivers) consists mainly of water with some dissolved compounds, called salts |  |
| I understand that the ions in crystals of a solid ionic compound are arranged in a regular way forming a lattice |  |
| I understand that ions in a crystal are held together by forces of attraction between oppositely charged ions and that this is called ionic bonding |  |
| I understand how the physical properties of solid ionic compounds (melting point, boiling point, electrical conductivity) relate to their bonding and giant, three-dimensional structures |  |
| I can describe what happens to the ions when an ionic crystal dissolves in water |  |
| I can explain that ionic compounds conduct electricity when dissolved in water because the ions are charged and they are able to move around independently in the liquid |  |
| **I can work out the formulae for salts in seawater given the charges on ions (for example sodium chloride, magnesium chloride, magnesium sulfate, sodium sulfate, potassium chloride and potassium bromide)** |  |
| I understand that the ions in an ionic compound can be detected and identified because they have distinct properties and they form compounds with distinct properties |  |
| I understand that an insoluble compound may precipitate on mixing two solutions of ionic compounds |  |
| **I can write ionic equations for precipitation reactions when given appropriate information** |  |
| **I can interpret given information on solubility to predict chemicals that precipitate on mixing solutions of ionic compounds** |  |
| I understand that some metal ions can be identified in solution by adding alkali because they form insoluble hydroxides with characteristic colours |  |

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| **C 5.2 What reactions happen in the hydrosphere? *Continued*** | **R.A.G.** |
| I can interpret the results of adding aqueous sodium hydroxide to solutions of salts, given a data sheet of tests for positively charged ions and appropriate results |  |
| I understand that some negative ions in salts can be identified in solution by adding a reagent that reacts with the ions to form an insoluble solid |  |
| I can interpret the results of tests for carbonate, chloride, bromide, iodide and sulfate ions given a data sheet of tests for negatively charged ions and appropriate results (using dilute acid, lime water, silver nitrate and barium chloride or barium nitrate as the reagents). |  |

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| **C5.3 What types of chemicals make up the Earth’s lithosphere?** | **R.A.G.** |
| I can recall that the Earth’s lithosphere (the rigid outer layer of Earth made up of the crust and the part of the mantle just below it) is made up of a mixture of minerals |  |
| I can recall that diamond and graphite are minerals, both of which are composed of carbon atoms |  |
| I can explain the properties of diamond in terms of a giant structure of atoms held together by strong covalent bonding (for example, melting point, boiling point, hardness, solubility and electrical conductivity) |  |
| I unnderstand how the giant structure of graphite differs from that of diamond, and how this affects its properties |  |
| I can recall that silicon, oxygen and aluminium are very abundant elements in the Earth’s crust |  |
| I can interpret data about the abundances of elements in rocks |  |
| I can recall that much of the silicon and oxygen is present in the Earth’s crust as the compound silicon dioxide |  |
| I understand that silicon dioxide is another giant covalent compound and so has properties similar to diamond. |  |

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| **C 5.4 How can we extract useful metals from minerals?** | **R.A.G.** |
| I can recall that ores are rocks that contain varying amounts of minerals from which metals can be extracted |  |
| I understand that for some minerals, large amounts of ore need to be mined to recover small percentages of valuable minerals (for example in copper mining) |  |
| I can recall that zinc, iron and copper are metals that can be extracted by heating their oxides with carbon, and write simple word equations for these reactions |  |
| I understand that when a metal oxide loses oxygen it is reduced while the carbon gains oxygen and is oxidised |  |
| I understand that some metals are so reactive that their oxides cannot be reduced by carbon |  |
| I can write word equations when given appropriate information |  |
| I can interpret symbol equations, including the number of atoms of each element, the number of molecules of each element or covalent compound and the number of ‘formulas’ of ionic compounds, in reactants and products |  |
| **I can balance unbalanced symbol equations** |  |
| **I can write balanced equations, including the state symbols (s), (*l* ), (g) and (aq), when given appropriate information** |  |
| I can recall and use state symbols: (s), (l), (g) and (aq) in equations |  |
| I can use the Periodic Table to obtain the relative atomic masses of elements |  |
| I can use relative atomic masses to calculate relative formula masses |  |
| I can calculate the mass of an element in the gram formula mass of a compound |  |
| **I can calculate the mass of the metal that can be extracted from a mineral given its formula or an equation** |  |
| I can describe electrolysis as the decomposition of an electrolyte with an electric current |  |
| I understand that electrolytes include molten ionic compounds |  |
| I can describe what happens to the ions when an ionic crystal melts |  |

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| **C 5.4 How can we extract useful metals from minerals? *Continued*** | **R.A.G.** |
| I understand that, during electrolysis, metals form at the negative electrode and non-metals form at the positive electrode |  |
| I can describe the extraction of aluminium from aluminium oxide by electrolysis |  |
| **I understand that during electrolysis of molten aluminium oxide, positively charged aluminium ions gain electrons from the negative electrode to become neutral atoms** |  |
| **I understand that during electrolysis of molten aluminium oxide, negatively charged oxide ions lose electrons to the positive electrode to become neutral atoms which then combine to form oxygen molecules**  |  |
| **I can use ionic theory to explain the changes taking place during the electrolysis of a molten salt to account for the conductivity of the molten salt and the changes at the electrodes** |  |
| I understand that the uses of metals are related to their properties (limited to strength, malleability, melting point and electrical conductivity) |  |
| I can explain the physical properties of high strength and high melting point of metals in terms of a giant structure held together by strong bonds (metallic bonding) |  |
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| **I understand that in a metal crystal there are positively charged ions held closely together by a sea of electrons that are free to move, and use this to explain the physical properties of metals, including malleability and conductivity** |  |
| I can evaluate, given appropriate information, the impacts on the environment that can arise from the extraction, use and disposal of metals |  |

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| **Grades A\* - C (Higher)** | All statements shown in **bold** as well as all statements shown in normal type. |
| **Grades C – G (Foundation)** | All statements shown in normal type. |