# GCSE Combined Science: Chemistry (AQA - Trilogy)

## Paper 1

### 5.1 Atomic structure and the periodic table

### 5.1.1 A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes

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| | I can use the names and symbols of the first 20 elements in the periodic table and elements in Groups 1 and 7. |
| | I can name compounds from formulae and write word equations. |
| | I can write balanced symbol equations for reactions in this specification. |
| | (HT only) I can write balanced half equations and ionic equations. |
| | I can describe the processes of filtration, crystallisation, simple distillation, fractional distillation, and chromatography. |
| | I can suggest suitable separation and purification techniques for mixtures. |
| | I can describe how the model of the atom has changed over time and why. |
| | I can describe the plum pudding model and how it was replaced by the nuclear model. |
| | I can state the relative charges of protons, neutrons, and electrons. |
| | I can describe atoms using the nuclear model. |
| | I can calculate the numbers of protons, neutrons, and electrons in atoms and ions. |
| | I can relate the size and scale of atoms to real-world objects. |
| | I can calculate relative atomic mass from isotope data. |
| | I can represent the electronic structures of the first 20 elements using diagrams and numbers. |

### 5.1.2 The periodic table

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| | I can explain how an element's position in the periodic table relates to its atomic number and electron arrangement. |
| | I can predict the reactivity of elements based on their group. |
| | I can describe how the periodic table developed over time. |
| | I can explain how Mendeleev arranged elements and predicted properties. |

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| | I can explain the differences between metals and non-metals in terms of properties and structure. |
| | I can relate the reactions of elements to their atomic structure. |
| | I can describe and explain the properties of Group 0 elements (noble gases). |
| | I can predict trends down Group 0. |
| | I can describe and explain the properties and reactions of Group 1 elements (alkali metals). |
| | I can predict trends down Group 1. |
| | I can describe and explain the properties and reactions of Group 7 elements (halogens). |
| | I can predict trends down Group 7 and explain displacement reactions. |

## 5.2 Bonding, structure and the properties of matter

### 5.2.1 Chemical bonds, ionic, covalent and metallic

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| | I can describe and compare ionic, covalent, and metallic bonding. |
| | I can draw dot and cross diagrams for ionic compounds formed from Groups 1 & 2 with Groups 6 & 7. |
| | I can work out the charge on ions based on group number. |
| | I can describe the structure of ionic compounds and how to deduce the empirical formula from diagrams. |
| | I can draw dot and cross diagrams for simple covalent molecules including: $H_2$, $O_2$, $N_2$, $Cl_2$, $CH_4$, $NH_3$, $H_2O$, HCl |
| | I can represent covalent bonds using diagrams and describe their limitations. |
| | I can describe the structure of metals and explain metallic bonding. |

### 5.2.2 How structure and bonding are related to the properties of substances

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| | I can describe the states of matter and particle theory. |
| | I can predict states at different temperatures using melting and boiling points. |
| | I can use and explain state symbols in equations. |
| | I can describe and explain the properties of ionic compounds. |
| | I can describe the properties of small molecules including melting/boiling points and conductivity. |
| | I can describe the structure and properties of polymers. |

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| | I can describe the structure and properties of giant covalent substances like diamond and silicon dioxide. |
| | I can explain the properties of metals and alloys. |
| | I can explain why metals are good conductors of electricity and heat. |

### 5.2.3 Structure and bonding of carbon

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| | I can explain the structure and properties of diamond. |
| | I can explain the structure and properties of graphite and compare it to metals. |
| | I can describe the structure and uses of graphene and fullerenes. |

### 5.3 Quantitative chemistry

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| | I can explain the law of conservation of mass and use it to balance chemical equations. |
| | I can calculate relative formula masses (Mr) from relative atomic masses (Ar). |
| | I can explain mass changes in reactions where gases are involved. |
| | I can describe uncertainty in measurements and use range as a measure of uncertainty. |
| | (HT only) I can use the term 'mole' and calculate the number of moles in a given mass. |
| | (HT only) I can use balanced equations to calculate masses of reactants and products. |
| | (HT only) I can calculate balancing numbers in equations from mass data. |
| | (HT only) I can identify the limiting reactant in a reaction and explain its effect. |
| | I can calculate the concentration of a solution in $g/dm^3$, and (HT only) in $mol/dm^3$. |

### 5.4 Chemical changes

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| | I can explain oxidation and reduction in terms of oxygen transfer. |
| | I can describe the reactions of metals with acids and water and use them to place metals in a reactivity series. |
| | I can explain how metals are extracted from their oxides by reduction. |
| | (HT only) I can explain oxidation and reduction in terms of electron transfer. |
| | I can describe the reactions of acids with metals to produce salts and hydrogen. |
| | I can explain how acids react with alkalis and bases to produce salts and water. |
| | I can describe how to make soluble salts from acids and insoluble substances. |
| | I can use the pH scale to identify acidic or alkaline solutions. |

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| | (HT only) I can explain the difference between strong and weak acids. |
| | I can describe the process of electrolysis and how ions move in electrolytes. |
| | I can predict the products of electrolysis of molten ionic compounds. |
| | I can explain how electrolysis is used to extract metals. |
| | I can predict products of electrolysis of aqueous solutions. |
| | (HT only) I can write half equations for reactions at electrodes. |

## 5.5 Energy changes

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| | I can identify reactions as exothermic or endothermic based on temperature changes. |
| | I can describe practical applications of exothermic and endothermic reactions. |
| | I can draw and interpret reaction profiles showing activation energy and energy changes. |
| | (HT only) I can calculate energy changes from bond energies and explain them. |

## Paper 2

### 5.6 The rate and extent of chemical change

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| | I can calculate and interpret the rate of reaction from graphs and data. |
| | I can describe and explain the effects of surface area, temperature, concentration, and catalysts on reaction rate. |
| | I can use collision theory to explain how factors affect the rate of reaction. |
| | I can describe how catalysts increase the rate by lowering activation energy. |
| | I can describe reversible reactions and recognise them in symbol equations. |
| | I can explain that energy changes in reversible reactions are equal and opposite. |
| | I can explain what equilibrium is in a closed system. |
| | (HT only) I can use Le Chatelier's Principle to predict the effects of changing conditions. |
| | (HT only) I can explain how changes in concentration, temperature, and pressure affect equilibrium. |

### 5.7 Organic chemistry

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| | I can describe the composition and origin of crude oil and identify alkanes. |
| | I can explain how fractional distillation separates hydrocarbons. |
| | I can describe trends in boiling point, viscosity and flammability of hydrocarbons. |
| | I can write balanced equations for complete combustion of hydrocarbons. |
| | I can describe and explain the process and usefulness of cracking. |
| | I can identify alkenes and describe how to test for them using bromine water. |

### 5.8 Chemical analysis

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| | I can define a pure substance and identify pure substances using melting and boiling points. |
| | I can describe what a formulation is and identify examples. |
| | I can explain how chromatography separates substances and how to calculate Rf values. |
| | I can describe the test for hydrogen (squeaky pop), oxygen (relights splint), carbon dioxide (limewater cloudy), and chlorine (bleaches damp litmus). |

### 5.9 Chemistry of the atmosphere

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| | I can recall the approximate proportions of gases in the Earth's atmosphere today. |

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| | I can describe the Earth's early atmosphere and explain how it changed over time. |
| | I can explain how photosynthesis led to increased oxygen. |
| | I can describe how carbon dioxide levels fell due to oceans, photosynthesis and sediment formation. |
| | I can describe the greenhouse effect and the role of greenhouse gases. |
| | I can recall two human activities that increase carbon dioxide and methane levels. |
| | I can describe potential effects of global climate change. |
| | I can explain how to reduce a carbon footprint and why there may be limitations. |
| | I can describe how combustion of fuels produces atmospheric pollutants. |
| | I can explain problems caused by pollutants like carbon monoxide, sulfur dioxide and particulates. |

## 5.10 Using resources

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| | I can identify finite and renewable resources and describe sustainable development. |
| | I can describe how potable water is produced and how to distinguish it from pure water. |
| | I can describe the stages in wastewater treatment. |
| | (HT only) I can describe alternative methods for extracting metals such as phytomining and bioleaching. |
| | I can interpret simple life cycle assessments and describe their limitations. |
| | I can evaluate ways of reducing the use of resources through reuse and recycling. |

## 5.11 Key ideas

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| | I understand that matter is made of atoms and elements show periodic relationships. |
| | I understand bonding involves transfer or sharing of electrons. |
| | I know that shapes of molecules and structures affect their behaviour. |
| | I know that reactions occur through proton, electron transfer or sharing. |
| | I know that energy is conserved in chemical reactions. |