**KS4 Chemistry**

**Year Group 9:** Half Term 1

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| Number of Hours | Topic |
| 7 | 4.1 Atomic structure and the periodic table:* Atoms, elements and compounds
* Mixtures
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Understanding of atoms, elements and compounds needed for future topics such as bonding
* Knowledge of mixtures and their separation needed for chemical analysis topic when understanding formulations and testing for purity
* 4.1 needed for Paper 1
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**Year Group 9:** Half Term 2

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| Number of Hours | Topic |
| 8 | 4.1 Atomic structure and the periodic table:* The development of the model of the atom
* Relative electrical charges of subatomic particles
* Size and mass of atoms
* Relative atomic mass
* Electronic structure
* The periodic table
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Development of the model of the atom provides a historical context for students to show an understanding of why and describe how scientific theories develop over time
* The remainder of the topics covered here are the building blocks of chemistry and so features in future topics such as bonding, trends within periods and chemical reactivity. Being able to write the electronic structure supports development of understanding of bonding, position of elements in the periodic table, as well as, similarities and differences in reactivity within Group 1 metals and Group 7 non-metals
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**Year Group 9:** Half Term 3

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| Number of Hours | Topic |
| 6 | 4.1 Atomic structure and the periodic table:* Development of the periodic table
* Metals and non-metals
* Group 0
* Group 1
* Group 7
* Properties of transition elements - comparison with Group 1 elements and typical properties

4.2 Bonding, structure, and the properties of matter:* Chemical bonds
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| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Understanding about how metals become ions and non-metals become ions is fundamental to understanding ionic bonding – a future topic. More importantly it provides a scaffold to embed concepts such as – reactivity of metals in their ability to form positive ions, understanding how electrolysis works and in writing half ionic equations used in electrolysis.
* Dealing with the groups mentioned helps to revisit earlier ideas such as writing electronic structure
* 4.2 needed for Paper 1
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**Year Group 9:** Half Term 4

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| --- | --- |
| Number of Hours | Topic |
| 5 | 4.2 Bonding, structure, and the properties of matter:* Ionic bonding
* Ionic compounds
* Covalent bonding
* Metallic bonding
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * These four topics about bonding are supported by previously covered material and provide opportunity to revisit key fundamental ideas about the structure of an atom, metals and non-metals, dot and cross diagrams and chemical formula
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**Year Group 9:** Half Term 5

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| --- | --- |
| Number of Hours | Topic |
| 5 | 4.2 Bonding, structure, and the properties of matter:* The three states of matter
* State symbols
* Properties of ionic compounds
* Properties of small molecules
* Polymers
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * States of matter presents students with the visual stimulus via 2D and 3D representations. More importantly an understanding of what happens when substances melt and boil will be developed again when exploring the properties of ionic compounds, small molecules and giant structures
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**Year Group 9:** Half Term 6

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| --- | --- |
| Number of Hours | Topic |
| 7 | 4.2 Bonding, structure, and the properties of matter:* Giant covalent structures
* Properties of metals and alloys
* Metals as conductors
* Diamond
* Graphite
* Graphene and fullerenes
* Sizes of particles and their properties
* Uses of nanonparticles
 |
| As available | Revision Work |
| Reasons behind order of topic in this half term |
| * These topics ensure repetition with the idea concerning delocalised electrons which are present in graphite, graphene and metals but not diamond. Within each of these topics (giant covalent structures, properties of metals and alloys, metals as conductors, diamond, graphite, graphene and fullerenes) the need to revisit earlier ideas is necessary to provide a developed understanding.
* Sizes of particles and nanoparticles allow for mathematical ideas such as standard form, ratios, fractions, percentages and estimation to be covered.
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**Year Group 10:** Half Term 1

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 10 | 9  | 4.3 Quantitative chemistry* Conservation of mass and balanced chemical equations
* Relative formula mass
* Mass changes when a reactant or product is a gas
* Chemical measurements
* Moles
* Amount of substances in equations
* Using moles to balance equations
* Limiting reactants
* Concentration of solutions
* Percentage yield **(Separate Chemistry only)**
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Conservation of mass and balance chemical equation provide students with another opportunity to accessing this content, building on 4.1 atoms, elements and compounds
* The concept of a mole is embedded here since it is a fundamental idea within this section and future parts of chemistry – Chemical changes, Energy changes, Rates of reactions and The Haber process and the use of NPK fertilisers
* Recap of some mathematical skills are possible through this topic, as well as the development of others such as change the subject of an equation and substitute numerical values into algebraic equations using appropriate units for physical quantities
* Needed for Paper 1
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**Year Group 10:** Half Term 2

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined | Topic |
| 12 | 9 | 4.3 Quantitative chemistry* Atom economy **(Separate Chemistry only)**
* Using concentrations of solutions in mol/dm3 **(Separate Chemistry only)**
* Use of amount of substance in relation to volume of gases **(Separate Chemistry only)**

4.4 Chemical changes* Reactivity of metals
* The reactivity series
* Extraction of metals and reduction
* Oxidation and reduction in terms of electrons
* Reactions of acids with metals
* Neutralisation and salt production
* Soluble salts
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * The topic Chemical changes is supported by previous topics where the concept of atoms and ions was explored.
* Understanding the ideas behind chemical change enables students to make connections between earlier ideas such as atoms, compounds, mixtures, physical separation techniques (4.1)
* Ideas from 4.3 are used again here which can include ideas regarding excess and limiting reactants when making a soluble salt
* 4.4 needed for Paper 1
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**Year Group 10:** Half Term 3

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 9 | 5 | 4.4 Chemical changes* Soluble salts
* The pH scale and neutralisation
* Titrations **(Separate Chemistry only)**
* Strong and weak acids
* The process of electrolysis
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Application of 4.3 when dealing with the calculations associated within titrations.
* Recall of 4.3 in understanding about units of concentration
* Application of previously used key words such as atoms, ions, molecules and the development of ideas regarding oxidation and reduction to include the term electrons and not just oxygen.
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**Year Group 10:** Half Term 4

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 9 | 7 | 4.4 Chemical changes* Electrolysis of molten ionic compounds
* Using electrolysis to extract metals
* Electrolysis of aqueous solutions
* Representation of reactions at electrodes as half equations

4.5 Energy changes* Exothermic and endothermic reactions
* Reaction profiles
* The energy changes of reactions
* Cells and batteries **(Separate Chemistry only)**
* Fuel cells **(Separate Chemistry only)**

4.6 The rate and extent of chemical change* Calculating rates of reactions
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Application of previously used key words such as atoms, ions, molecules and the development of ideas regarding oxidation and reduction to include the term electrons and not just oxygen through electrolysis and the representation of reactions at electrodes as half equations. This terminology is then used again when dealing with cells, batteries and fuels cells.
* 4.5 deals with another classification of a chemical change and so naturally comes after 4.4.
* 4.5 has units of kJ/mol so because 4.3 is taught before this topic then moles can be recovered briefly. Knowledge about 4.2 is useful in supporting the understanding about breaking and making bonds.
* 4.5 needed for Paper 1
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**Year Group 10:** Half Term 5

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 8 | 8 | 4.6 The rate and extent of chemical change* Calculating rates of reactions
* Factors which affect the rates of chemical reactions
* Collision theory and activation energy
* Catalysts
* Reversible reactions
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Concept of concentration has been covered earlier so should support the progress of the students.
* Catalysts has been covered in transition metals and so allows for further embedding by students.
* The graphical aspect ensures the opportunity for students to develop their mathematical skills such as drawing and interpreting appropriate graphs from data to determine the rate of reaction, determine the slope and intercept of a linear graph and draw and use the slope of a tangent to a curve as a measure of the rate of reaction
* Reversible reactions is needed prior to the teaching of 4.10 in preparation for the content of Paper 2
* 4.6 needed for Paper 2
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**Year Group 10:** Half Term 6

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 10 | 10 | 4.6 The rate and extent of chemical change* Reversible reactions
* Energy changes and reversible reactions
* Equilibrium
* The effect of changing conditions on equilibrium
* The effect of changing concentration
* The effect of temperature changes on equilibrium
* The effect of pressure changes on equilibrium

4.7 Organic chemistry* Crude oil, hydrocarbons as fuels and feedstock
 |
| As available | Revision Work |
| Reasons behind order of topic in this half term |
| * Concept of equilibrium required for 4.10 when discussing the Haber Process and gives opportunity to revisit key words such as reactants, products, balancing equations, yield, exothermic, endothermic reactions, as well as, reaction profiles
* Dealing with crude oil ensures another opportunity to build on material first taught in 4.1 – mixtures and the techniques used to separate mixtures.
* 4.7 needed for Paper 2
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**Year Group 11:** Half Term 1

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 11 | 7 | 4.7 Organic chemistry* Crude oil, hydrocarbons as fuels and feedstock
* Fractional distillation and petrochemicals
* Properties of hydrocarbons
* Cracking and alkenes
* Structure and formulae of alkenes **(Separate Chemistry only)**
* Reactions of alkenes **(Separate Chemistry only)**
* Alcohols **(Separate Chemistry only)**
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * These topics are taught sequential since this approach ensures that there is a scaffold approach to develop organic chemistry on.
* Knowing about naming of the alkanes, that they are an example of a homologous series, that they have a general formula which can be used to predict the formula of other alkanes is useful before addressing similar ideas but with alkenes, alcohols, carboxylic acids and finally esters.
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**Year Group 11:** Half Term 2

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 14 | 7 | 4.7 Organic chemistry* Carboxylic acids **(Separate Chemistry only)**
* Addition polymerisation **(Separate Chemistry only)**
* Condensation polymerisation **(Separate Chemistry only)**
* Amino acids **(Separate Chemistry only)**
* DNA **(Separate Chemistry only)**

4.8 Chemical analysis* Pure substances
* Formulations
* Chromatography
* Identification of common gases – H2, O2, CO2 and Cl2
* Flame tests **(Separate Chemistry only)**
* Metal hydroxides **(Separate Chemistry only)**
* Carbonates **(Separate Chemistry only)**
* Halides **(Separate Chemistry only)**
* Sulfates **(Separate Chemistry only)**
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Being aware of functional groups is beneficial when trying to understand polymerisation since it is key to be able to identify the functional groups present in the molecules which are reacting during these polymerisation reactions.
* Knowing about displayed formula and structural formula prior to polymerisation reactions ensures that students do not have overload with key terms when dealing with polymerisation.
* Pure substances revisits the understanding of elements, mixtures and compounds which is useful to have clarity about these so that the idea of formulations can be developed.
* Identification of metal ions and non-metal ions offers revisiting of ions, balancing equations, ionic equations, writing chemical formula, making salts – all topics covered throughout Year 9 and Year 10.
* 4.8 needed for Paper 2
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**Year Group 11:** Half Term 3

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 10 | 7 | 4.8 Chemical analysis* Instrumental methods **(Separate Chemistry only)**
* Flame emission spectroscopy **(Separate Chemistry only)**

4.9 Chemistry of the atmosphere* The proportions of different gases in the atmosphere
* The Earth’s early atmosphere
* How oxygen increased
* How carbon dioxide decreased
* Greenhouse gases
* Human activities which contribute to an increase in greenhouse gases in the atmosphere
* Global climate change
* The carbon footprint and its reduction
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * A sequential development of how the Earth’s atmosphere has developed over time and how originally the greenhouse gases supported the development of life on Earth leads into the issues now associated with an increase in these gases.
* A revisit into to concept of combustion and the formation of oxides is possible within this topic when taught here.
* 4.9 needed for Paper 2
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**Year Group 11:** Half Term 4

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours Combined | Topic |
| 10 | 5 | 4.9 Chemistry of the atmosphere* Atmospheric pollutants from fuels
* Properties and effects of atmospheric pollutants

4.10 Using the Earth’s resources and sustainable development* Using the Earth’s resources
* Potable water
* Waste water treatment
* Alternative methods of extracting metals
* Life cycle assessment
* Ways of reducing the use of resources
* Corrosion and its prevention **(Separate Chemistry only)**
* Alloys as useful materials **(Separate Chemistry only)**
* Ceramics, polymers and composites **(Separate Chemistry only)**
* The Haber process **(Separate Chemistry only)**
* Production and uses of NPK fertilisers **(Separate Chemistry only)**
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| As available | Revision work |
| Reasons behind order of topic in this half term |
| * The final topic 4.10 connects key ideas already covered – reactivity, electrolysis, displacement reactions, mathematical skills (ratios, significant figures, graphs, fractions and percentages), use of energy in extraction processes, writing word equations, polymers, rate of reactions, equilibria, naming salts, making salts and percentage of elements in chemical formula. Because so much of the previous topics are required within 4.10 this is why it is taught last.
* 4.10 needed for Paper 2
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**Year Group 11:** Half Term 5

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| Number of Hours | Topic |
| 7 | Revision work, past papers, material on Frog learning seminars and GCSE examsTo consolidate Y9, Y10, Y11 work, exam practice needed to prepare for GCSE exams |