

Department Curriculum and Assessment Outline

Department: Science **Year Group:** 10 **Teaching, learning and assessment during the course:** Chemistry (Combined)

Timing (Weeks, half terms)	Unit Title (as applicable)	Key Question(s) e.g. Why do we need maps and how do we use them? How do quest stories work?	How will we know that pupils can answer the key question(s)? Data that will inform attainment grade	Key Themes of the unit e.g. grammar, processes, events, styles
Autumn 1	C1/C2 States of matter/Methods of Separating and purifying substances	How is matter organised? How can different substance be separated?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> States of matter. Separating substances using different methods. Purification of drinking water.
Autumn 2	C3 Atomic structure C4 The Periodic table	What is an atom and how does its structure determine its position in the periodic table?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> The structure of the atom. Electron configuration and the periodic table.
Spring 1	C5/C6/ Ionic bonding/covalent bonding.	How can atoms be bonded together?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> How are ionic and covalent bonds formed. How do ionic and covalent bonds differ?
Spring 2	C7/C8 Types of substance/Acids and Alkalis	What are the different types of indicator and what do they detect?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> Indicators and their uses. Acids and alkalis and the pH scale. Investigating neutralisation.
Summer 1	C9 Calculations involving masses.	What is a mole? How is mass conserved in reactions?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> Mole calculations. Using empirical formulae and conservation of mass.
Summer 2	C10 electrolytic processes.	What is electrolysis?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> Describing the process of electrolysis and the products formed. Half equations.

Department Curriculum and Assessment Outline

Department: **Science** Year Group: **11** Teaching, learning and assessment during the course: **Chemistry (Combined)**

Timing (Weeks, half terms)	Unit Title (as applicable)	Key Question(s) e.g. Why do we need maps and how do we use them? How do quest stories work?	How will we know that pupils can answer the key question(s)? Data that will inform attainment grade	Key Themes of the unit e.g. grammar, processes, events, styles
Autumn 1	C11 Obtaining and using metals C12 Reversible reactions and equilibria	How and why do metals vary in reactivity? What is a REDOX reaction?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • Reactivity • Ores • REDOX • Dynamic equilibria.
Autumn 2	C13 Groups in the periodic table	What patterns can be found in groups in the periodic table?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • Patterns in group 1, 7 and 0 of the periodic table.
Spring 1	C14 Rates of reaction C15 Heat energy changes in chemical reactions	What are the factors affecting reaction rates? How are exothermic and endothermic reactions different?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • Factors affecting rate of reaction including temperature, catalysts, surface area and concentration.
Spring 2	C16 Fuels	What is meant by a homologous series? How do we obtain fractions of crude oil?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • Fractional distillation. • Complete and incomplete combustion. • Breaking down hydrocarbons.
Summer 1	C17 Earth and atmospheric science	How has our atmosphere changed over time?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • The early and changing atmosphere. • Climate change.
Summer 2	Review and GCSE preparation		Key words test Past papers Revision booklet	<ul style="list-style-type: none"> • Review and prepare for the Biology GCSE

Department Curriculum and Assessment Outline

Department: Science

Year Group: 10

Teaching, learning and assessment during the course: Chemistry (**Separate**)

Timing (Weeks, half terms)	Unit Title (as applicable)	Key Question(s) e.g. Why do we need maps and how do we use them? How do quest stories work?	How will we know that pupils can answer the key question(s)? Data that will inform attainment grade	Key Themes of the unit e.g. grammar, processes, events, styles
Autumn 1	C1/C2 States of matter/Methods of Separating and purifying substances	How is matter organised? How can different substance be separated?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> States of matter. Separating substances using different methods. Purification of drinking water.
Autumn 2	C3 Atomic structure C4 The Periodic table	What is an atom and how does its structure determine its position in the periodic table?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> The structure of the atom. Electron configuration and the periodic table.
Spring 1	C5/C6/ Ionic bonding/covalent bonding.	How can atoms be bonded together?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> How are ionic and covalent bonds formed. How do ionic and covalent bonds differ?
Spring 2	C7/C8 Types of substance/Acids and Alkalis	What are the different types of indicator and what do they detect?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> Indicators and their uses. Acids and alkalis and the pH scale. Investigating neutralisation.
Summer 1	C9 Calculations involving masses. C10 electrolytic processes.	What is a mole? How is mass conserved in reactions? What is electrolysis?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> Mole calculations. Using empirical formulae and conservation of mass. Describing the process of electrolysis and the products formed.
Summer 2	C11 Obtaining and using metals C12 Reversible reactions and equilibria	How and why do metals vary in reactivity? What is a REDOX reaction?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> Reactivity Ores REDOX Dynamic equilibria.

Department Curriculum and Assessment Outline

Department: Science

Year Group: 11

Teaching, learning and assessment during the course: Chemistry (Separate)

Timing (Weeks, half terms)	Unit Title (as applicable)	Key Question(s) e.g. Why do we need maps and how do we use them? How do quest stories work?	How will we know that pupils can answer the key question(s)? Data that will inform attainment grade	Key Themes of the unit e.g. grammar, processes, events, styles
Autumn 1	C13 Transition metals, alloys and corrosion C14 Quantitative analysis C15 Dynamic equilibria and calculations C16 Chemical cells and fuel cells	What is alloying and electroplating? Why are yields and atom economy important? What factors affect equilibria. How do cells work?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • The reactivity series. • Electroplating and alloying. • Ores and REDOX reactions. • Transition metals. • Atom economy. • Titrations • Equilibria. • Chemical cells and fuel cells.
Autumn 2	C17 Groups in the periodic table C18 Rates of reaction C19 Heat energy changes in chemical reactions	What patterns can be found in groups in the periodic table? What are the factors affecting reaction rates? How are exothermic and endothermic reactions different?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • Patterns in group 1, 7 and 0 of the periodic table. • Factors affecting rate of reaction including temperature, catalysts, surface area and concentration.
Spring 1	C20 Fuels C21 Earth and atmospheric science	What is meant by a homologous series? How do we obtain fractions of crude oil? How has our atmosphere changed over time?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • Fractional distillation. • Complete and incomplete combustion. • Breaking down hydrocarbons. • The early and changing atmosphere. Climate change.
Spring 2	22 Hydrocarbons 23 Alcohols and carboxylic acids 24 Polymers	What is the difference between alkanes and alkenes?	End of topic review. End of unit test. Activelearn assessment. Core practical write-up.	<ul style="list-style-type: none"> • Reactions of alkanes and alkenes. • Ethanol production • Polymerisation • Condensation polymerisation.

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		<p>What are alcohols and carboxylic acids?</p> <p>What are some problems with polymers?</p>		
<p>Summer 1</p>	<p>C25 Quantitative analysis. Test for ions. C26 Bulk and surface properties of matter</p>	<p>How is a flame test completed?</p> <p>What is a nanoparticle?</p>	<p>End of topic review. End of unit test. Activelearn assessment. Core practical write-up.</p>	<ul style="list-style-type: none"> • Photometry • Testing for ions • Choosing the best materials (including composites)
<p>Summer 2</p>	<p>Review and GCSE preparation</p>		<p>Key words test Past papers Revision booklet</p>	<ul style="list-style-type: none"> • Review and prepare for the Biology GCSE

Department Curriculum and Assessment Outline

Department: **Chemistry** Year Group: **12** Teaching, learning and assessment during the course:

Timing (Weeks, half terms)	Unit Title (as applicable)	Key Question(s) e.g. Why do we need maps and how do we use them? How do quest stories work?	How will we know that pupils can answer the key question(s)? Data that will inform attainment grade	Key Themes of the unit e.g. grammar, processes, events, styles
Autumn 1 Teacher A	Topic 1: Atomic Structure and The Periodic Table (1–7) Topic 1: Atomic Structure and The Periodic Table (8–19) Topic 1: Atomic Structure and The Periodic Table (20–25)	What makes an atom? How are atoms organised into the periodic table?	Homework question assessment. End of topic review/test. Core Practical write-up.	Plot a graph of IE across a period and / or down a group and use these to help explain the quantum model for electron configurations. Plot graphs of the successive ionisation energies of a selection of atoms and use these to predict the group to which the element belongs.
Autumn 1 Teacher B	Topic 5: Formulae, Equations and Amounts of Substance (6, 14–16) Topic 5: Formulae, Equations and Amounts of Substance (1–5) Topic 5: Formulae, Equations and Amounts of Substance (7–10) Topic 5: Formulae, Equations and Amounts of Substance (11–13)	What is a Mole? How do we calculate and write formulae for compounds and molecules?	Homework question assessment. End of topic review/test. Core Practical write-up.	Carry out experiments to determine the molar ratio in a reaction e.g. iron and sulfuric acid. Carry out experiments to investigate thermal decomposition of carbonates (e.g. 'Carbonate rocks!' – RSC).
Autumn 2 Teacher A	Topic 2A: Bonding (1–9) Topic 2A: Bonding (22), Topic B: Structure (23–25) Topic 2A: Bonding (13–19, 20 iv) Topic 2A: Bonding (10–12, 21 i–iv), Topic 2B: Structure (26–27)	How are bonds formed. How are ionic, covalent and metallic structures different?	Homework question assessment. End of topic review/test. Core Practical write-up.	Carry out research task based on physical properties and uses of halogens. Carry out displacement reactions of halogens and use outcomes to inform discussion on reactivity of Group 7 elements. Carry out comparison of reactions of Ca and Mg with HCl and use observations as a lead in to discuss trend in reactivity. Carry out experiments on properties of Group 2 compounds. Class can be divided into

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				groups to focus on one particular aspect, to then feedback to their peers.
Autumn 2 Teacher B	Topic 3 – Redox (1–13)	What is meant by ‘oxidation number?’	Homework question assessment. End of topic review/test. Core Practical write-up.	Predict likely effect of conc. sulfuric acid on halide compounds and test predictions by experiment. Research test for halide ions and use it to determine nature of an unknown halide solution.
Spring 1 Teacher A	Topic 4A: The Elements of Groups 1 and 2 (1–8) Topic 4B: The Elements of Group 7 (9–11) Topic 4B: The Elements of Group 7 (12–14), Topic 4C: Analysis of inorganic compounds (15)	What patterns appear in the periodic table?	Homework question assessment. End of topic review/test. Core Practical write-up.	Understand the trend in reactivity of Group 7 elements in terms of the redox reactions of Cl ₂ , Br ₂ and I ₂ with halide ions in aqueous solution, followed by the addition of an organic solvent.
Spring 2 Teacher B	Topic 6A: Introduction to Organic Chemistry (1–7) Topic 6B: Alkanes (8–13), Topic 2A: Bonding (20 vii, viii) Topic 6B: Alkanes (15–17)	What products can be formed from oil? What are the formulae of some organic compounds?	Homework question assessment. End of topic review/test. Core Practical write-up.	Carry out experiments to test for unsaturation. Research and plot data of boiling temperatures for a range of alkanes. Explain overall trend as well as discuss any anomalies in terms of London forces. Carry out cracking of liquid paraffin to form ethene and / or fractional distillations of crude oil.

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Summer 1 Teacher A	Topic 6C: Alkenes (18–22) Topic 6C: Alkenes (24–29) Topic 6D: Halogenoalkanes (30–36) Topic 6E: Alcohols (37, 38, 39 i, ii, iv), Topic 6B: Alkanes (14)	What products can be formed from oil? What is a 'radical'? How do alcohols react?	Homework question assessment. End of topic review/test. Core Practical write-up.	Carry out partial and complete oxidation of ethanol, testing products using Benedict's /Fehling's and sodium carbonate solution. Carry out preparation and separation of ethanol by fermentation and distillation, comparing process to manufacture of ethanol from ethene and steam. Carry out a preparation of an alkene from an alcohol (e.g. cyclohexene from cyclohexanol).
Summer 2 Teacher B	Topics 7A (1) & 7B (2): Mass Spectrometry and Infrared (IR) Spectroscopy Topic 8: Energetics I (1–5) Topic 8: Energetics I (6–11) Topic 9: Kinetics I (1– 9) Topic 10: Equilibrium I (1–4)	How are rates of reaction affected controlled?	Homework question assessment. End of topic review/test. Core Practical write-up.	Carry out a series of experiments to see how a variety of variables affect the rate of a reaction. Produce suitable graphs which can then be annotated to describe trends and explain them using collision theory. Research bond enthalpy data and use to produce spreadsheet that will calculate the enthalpy changes for reactions. Carry out experiments to determine enthalpy change of reaction and combustion, producing appropriate energy level diagrams and evaluation of data.

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Autumn 1 Teacher A	Topic 11: Equilibrium II (1–4) Topic 12: Acid-base equilibria (1–8) Topic 12: Acid-base equilibria (9–15) Topic 12: Acid-base equilibria (16–24)	What is the equilibrium constant? What is the difference between a strong acid and a weak acid? How do we calculate pH? What is a 'buffer solution'?	Homework question assessment. End of topic review/test. Core Practical write-up.	Carry out experiments to determine equilibrium constants (e.g. ester hydrolysis, redox reactions). Calculate K_c for a reaction at different temperatures then link back to Le Chatelier to justify change in value. Carry out experiments to find the pH of a range of solutions of different concentration. Compare experimental value to calculated value. Carry out experiments to find the pH of a weak acid at different concentrations. Use this data to find K_w to show this is a more useful way of comparing acidic strength
Autumn 1 Teacher B	Topic 13A: Lattice energy (1–11) Topic 13B: Entropy (12–17) Topic 13B: Entropy (18–22)	How do we calculate entropy changes? What is an enthalpy change? How do we calculate lattice energy?	Homework question assessment. End of topic review/test. Core Practical write-up.	Design an experiment to find the enthalpy of solution of a salt and use the result as part of a Hess cycle to find Lattice Enthalpy. Carry out a series of reactions to estimate changes in disorder due to system and surroundings. Use qualitatively to justify why a reaction occurs under a particular set of conditions. Carry out a series of calculations to confirm, using the total entropy change, whether a reaction is feasible under a given set conditions.
Autumn 2 Teacher A	Topic 14: Redox II (1–6) Topic 14: Redox II (7– 11) Topic 14: Redox II (12– 17) Topic 14: Redox II (18– 19)	What is meant by 'standard electrode potential'? What is a disproportionate reaction?	Homework question assessment. End of topic review/test. Core Practical write-up.	Carry out experiments to compare electrode potentials against alternative reference (e.g. copper / copper sulfate), using platinum electrodes where necessary. Carry out experiments to investigate how E_{cell} varies with concentration.

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		How do we carry out a REDOX titration?		<p>Use the difference between E^\ominus values to predict feasibility of reactions. Write an equation for each proposed reaction, calculate E^\ominus_{cell}, then test whether a reaction is observed.</p> <p>Build fuel cell using kits. Write equations to show reactions at both electrodes. Use simulations or models to illustrate changes at electrodes.</p>
Autumn 2 Teacher B	<p>Topic 15A: Principles of transition metal chemistry (1–11)</p> <p>Topic 15A: Principles of transition metal chemistry (12–19)</p> <p>Topic 15B: Reactions of transition elements (20–27)</p> <p>Topic 15B: Reactions of transition elements (28–35)</p>	<p>How and why do molecules and compounds vary in shape?</p> <p>What are oxidation states?</p> <p>How do we construct ionic equations?</p> <p>How does a catalytic converter work?</p>	<p>Homework question assessment.</p> <p>End of topic review/test.</p> <p>Core Practical write-up.</p>	<p>Practice a number of electronic configurations of atoms and ions, using copper and chromium as challenge activities.</p> <p>Research role of cis-platin in cancer treatments. Listen to podcast about cis-platin and produce summary notes.</p> <p>Carry out experiments to investigate reactions of transition metal ions with sodium hydroxide and ammonia, writing ionic equations for each change. Observations/equations can be self-assessed.</p> <p>Carry out a series of to show ligand exchange reactions of $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$, recording colour changes, writing ionic equations and explaining any changes in coordination number.</p> <p>Students can make predictions regarding mechanism of catalysis in the reaction and investigate a number of possible transition metal ions as catalysts.</p>
Spring 1	<p>Topic 16: Kinetics II (1–3, 4 i, 6 ii, 7)</p> <p>Topic 16: Kinetics II (4 ii, 5, 6 i)</p> <p>Topic 16: Kinetics II (8–12)</p>	<p>What is the 'rate' law?</p> <p>What experiments can we use to investigate reaction rates?</p> <p>How can we use data to make predictions about species involved in</p>	<p>Homework question assessment.</p> <p>End of topic review/test.</p> <p>Core Practical write-up.</p>	<p>Carry out a range of experiments to revisit the factors that affect rate, using a variety of techniques. These could include reactions between CaCO_3 and HCl (by gas collection), iodine and propanone (by titration and/or initial-rate method) or iodide ions and hydrogen peroxide (by a 'clock' reaction).</p> <p>Design an experiment to find the activation energy for the oxidation of glucose solution with MnO_4^- ions (in acidic or alkaline conditions).</p>

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		the rate-determining step?		
Spring 2	Topic 17A: Chirality (1–5) Topic 17B: Carbonyl compounds (6–8) Topic 17C: Carboxylic acids (9–16)	<p>What is optical isomerism?</p> <p>How do we identify the aldehyde and ketone functional groups?</p> <p>How does hydrogen bonding affects the physical properties of carboxylic acids, in relation to their boiling temperatures and solubility?</p>	<p>Homework question assessment.</p> <p>End of topic review/test.</p> <p>Core Practical write-up.</p>	<p>Prepare a dry sample of a 2,4-dinitrophenylhydrazine derivative and identify the carbonyl compound by determining the melting temperature of the derivative.</p> <p>Carry out a preparation of iodoform, using propanone. Alternatively carry out the iodoform reaction as qualitative test to distinguish between methanol and ethanol.</p> <p>Carry out an ester hydrolysis (e.g. preparation of aspirin). If you have contacts with a the outreach team at a local university the RSC have developed resources for the preparation and subsequent analysis of aspirin, which can be used as a synoptic task towards the end of the course.</p> <p>Students could prepare a number of esters (test tube scale, with acids and alcohols) and practice writing equations and names of products. Alternatively (or additionally) they could carry a larger scale preparation of an ester (e.g. methyl benzoate, oil of wintergreen).</p>

Department Curriculum and Assessment Outline

Department: Chemistry

Year Group: 13

Teaching, learning and assessment during the course:

Timing (Weeks, half terms)	Unit Title (as applicable)	Key Question(s) e.g. Why do we need maps and how do we use them? How do quest stories work?	How will we know that pupils can answer the key question(s)? Data that will inform attainment grade	Key Themes of the unit e.g. grammar, processes, events, styles
Summer 1	Topic 18A: Arenes (1–3) Topic 18A: Arenes (4–7) Topic 18B: Amines, amides etc. (8–13) Topic 18B: Amines, amides etc. (14–17)	What are the reactions of Benzene? What is the the mechanism of the electrophilic substitution reactions of benzene? What are amino acids?	Homework question assessment. End of topic review/test. Core Practical write-up.	Draw and annotate energy level diagrams for hydrogenation of benzene and cyclohexene and use these as evidence for the delocalised model. Carry out small scale experiments to investigate the reactions of benzene, using safe derivatives of benzene. Carry out experiments to investigate the reactions of amines. Reasearch pK_a of a number of amines and use the data to list amines in order of basic strength. Justify order in terms of structure of amines. Carry out experiments to show the properties of amino-acids, including paper chromatography of amino acids.
Summer 2	Topic 19C: Chromatography (6–8) Topic 19B: NMR (2–5)	How do we calculate relative molecular mass?	Homework question assessment. End of topic review/test. Core Practical write-up.	Calculate R_f values of amino acids on paper chromatogram and attempt to match to accepted values for solvent used. Carry out qualitative tests on a series of unknown organic compounds and use the observations and

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	Topic 19A: Mass spectrometry (1), Topic 18 C: Organic synthesis (18) Topic 18 C: Organic Synthesis (19–20) Topic 18 C: Organic Synthesis (22)	What analyses can we carry out on organic and inorganic unknowns? How can we plan reaction schemes?		data from Combustion analysis, IR, Mass Spectrometry, and NMR to identify them.
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What is each attainment grade based on?

	7	8	9	10	11	12	13
Mid Term Autumn							
Report Autumn							
Mid Term Spring							
Report Spring							
Mid Term Summer							
Report Summer							