Programme of study for Chemistry Year 10

	Spring (1 st term)	Spring (2 nd Term)	Summer (1 st term)	Summer (2 nd term)
Topic / Big Question:	Topic / Big Question:	Topic / Big Question:	Topic / Big Question:	Topic / Big Question:
Quantitative chemistry	Continue with Chemical changes	Continue with rate of reaction	Continue with organic chemistry	Chemistry of the atmosphere
Chemical changes	Energy changes (chemical cells and fuel cells) Rate of reaction	Organic chemistry	Chemistry of the atmosphere	
Skills (students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; douglen and improve	Skills (students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; douglen and improve	Skills (students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; douelen and improve	Skills (students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions;	Skills (students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve
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element in the periodic reactants and products. using collision theory to alkenes and the products		•				
	• .	-		alkenes and the products		
i capie.	table.		explain the effect of a	of their addition reactions		

Students should be able	Students should be able	factor on the rate of a	with hydrogen, water, chlorine, bromine and	
to work out the charge	to change the subject of	reaction.	iodine.	
on the ions of metals	a mathematical	Students should be able	describe what happens	
and non-metals from	equation.	to explain catalytic	when any of the first four	
the group number of	Students should be able	action in terms of	alcohols react with	
the element, limited to	to explain the effect of a	activation energy.	sodium, burn in air, are	
the metals in Groups 1	limiting quantity of a	Students do not need to	added to water, react with	
and 2, and non-metals	reactant on the amount	know the names of	an oxidising agent	
in Groups 6 and 7.	of products it is possible	catalysts other than	recall the main uses of	
deduce that a	to obtain in terms of	those specified in the	these alcohols.	
compound is ionic from	amounts in moles or	subject content.	Students should know the	
a diagram of its	masses in grams.	Students should be able	conditions used for	
structure in one of the	calculate the mass of	to make qualitative	fermentation of sugar	
specified forms	solute in a given volume	predictions about the	using yeast.	
describe the limitations	of solution of known	effect of changes on		
of using dot and cross,	concentration in terms	systems at equilibrium	Students should be able to	
ball and stick, two and	of mass per given	when given appropriate	recognise alcohols from their names or from given	
three-dimensional	volume of solution	information.	formulae.	
diagrams to represent a	(HT only) explain how	Students should be able	lonnuae.	
giant ionic structure	the mass of a solute and	to interpret appropriate	Students do not need to	
work out the empirical	the volume of a solution	given data to predict	know the names of	
formula of an ionic	is related to the	the effect of a change in	individual alcohols other	
compound from a given	concentration of the	concentration of a	than methanol, ethanol,	
model or diagram that	solution.	reactant or product on	propanol and butanol.	
shows the ions in the	calculate the	given reactions at		
structure.	percentage yield of a	equilibrium.	Students are not expected	
Students should be	product from the actual	Students should be able	to write balanced	
familiar with the	yield of a reaction	to interpret appropriate	chemical equations for the reactions of alcohols other	
structure of sodium	(HT only) calculate the	given data to predict	than for combustion	
chloride but do not	theoretical mass of a	the effect of a change in	reactions.	
need to know the	product from a given	temperature on given	describe what happens	
structures of other ionic	mass of reactant and	reactions at equilibrium.	when any of the first four	
compounds.	the balanced equation	Students should be able	carboxylic acids react with	
draw dot and cross	for the reaction.	to interpret appropriate	carbonates, dissolve in	
diagrams for the	calculate the atom	given data to predict	water, react with alcohols	
molecules of hydrogen,	economy of a reaction	the effect of pressure	(HT only) explain why	
chlorine, oxygen,	to form a desired		carboxylic acids are weak	

nitrogen, hydrogen	product from the	changes on given	acids in terms of ionisation	
chloride, water,	balanced equation	reactions at equilibrium.	and pH (see Strong and	
ammonia and methane	(HT only) explain why a		weak acids (HT only)). Students should be able to	
represent the covalent	particular reaction		recognise carboxylic acids	
bonds in small	pathway is chosen to		from their names or from	
molecules, in the	produce a specified		given formulae.	
repeating units of	product given		recognise addition	
polymers and in part of	appropriate data such		polymers and monomers	
giant covalent	as atom economy (if not		from diagrams in the	
structures, using a line	calculated), yield, rate,		forms shown and from the	
to represent a single	equilibrium position and		presence of the functional	
bond	usefulness of by-		group C=C in the	
describe the limitations	products.		monomers	
of using dot and cross,	Students should be able		draw diagrams to	
ball and stick, two and	to explain how the		represent the formation of	
three-dimensional	concentration of a		a polymer from a given	
diagrams to represent	solution in mol/dm3 is		alkene monomer	
molecules or giant	related to the mass of		relate the repeating unit to the monomer.	
structures	the solute and the		to the monomer.	
deduce the molecular	volume of the solution.		Students should be able to	
formula of a substance	calculate the volume of		explain the basic	
from a given model or	a gas at room		principles of condensation	
diagram in these forms	temperature and		polymerisation by	
showing the atoms and	pressure from its mass		reference to the	
bonds in the molecule.	and relative formula		functional groups in the	
Explain metallic bonding	mass		monomers and the	
and relate to properties	calculate volumes of		repeating units in the	
of metals.	gaseous reactants and		polymers.	
Predict the states of	products from a		Students should be able to name the types of	
substances at different	balanced equation and		monomers from which	
temperatures given	a given volume of a		these naturally occurring	
appropriate data	gaseous reactant or		polymers are made.	
explain the different	product		, ,	
temperatures at which	change the subject of a			
changes of state occur	mathematical equation.			
in terms of energy				
	Chamical changes			
	Chemical changes:			

transfers and types ofStudents should be ablebondingto explain reduction andrecognise that atomsoxidation in terms ofthemselves do not haveloss or gain of oxygen.themselves do not haveloss or gain of oxygen.the bulk properties ofrecall and describe thematerialsreactions, if any, of(HT only lexplain theparticite theory inmagnesium, zinc, ironreactions, if any, ofparticite theory inmagnesium, zinc, ironrelation to charges ofand copper with waterstate when particles areordif carcitivityprersented by soldwhere appropriate, toinelastic spheres whichplace these metals inhave no forces betweenorder of reactivitythem.explain how theStudents should be ablereactivity of metals withto include appropriatewater ordifuer acids isstate symbols inrelated to the tendencychemical equations forof the metal to form itsspecification.based on experimentalintermolecular forcesresults.are waak comparedinterpet or evaluatewith covalent bonds tospecificmationexplain the bulkprocesses wheng ivensubdants.off-and iterms of gainintermolecular forcesspecificmationspecification.deduce an order ofstate symbols tospecificmationexplain the bulkprocesses wheng ivenintermolecular forcesspecific metal extraction	tuonofous and tunce of			
recognise that atomsoxidation in terms of loss or gain of oxygen.themselves do not have the bulk properties of materialsloss or gain of oxygen.(HT only explain the particle theory in relation to changes of state when particles are or diute acids and order appropriate, to inelastic. spheres which a bace or diute acids and order or factivitybace these metals in to include appropriate state when particles are represented by solidord or diute acids and ord iute acids and ord iute acids and ord iute acids and order or factivityStudents should be able represented by solid to include appropriate, to include appropriate state when particles are relation to changes of a state symbols in related to the tendency order of reactivity of metals with to include appropriate state symbols in related to form its positive in specification.order of reactivity of the metal to form its bositive in reactivity of metals state symbols in reactivity of metals state symbols in reactivity of metals state symbols in specification.order of reactivity of the metal to form its positive in specification.specification.deduce an order of specification.deduce an order of specification.students should be able represent by subta changes of a specification.processe when given reactivity of metals specification.specification.gppropriate symbol specification.processe when given reactivity the subtances.students should be able to recognise polyme reduced in terms of gain row its in coxidised or to recognise polyme reduced in terms of gain reduced in terms of gain row its in coxid				
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to recognise giant reaction, symbol	Students should be able	-		
	to recognise giant			
	covalent structures	equation or half		

from diagrams showing equation which species their bonding and are oxidised and which	1
their bonding and are oxidised and which and the second se	
structure. are reduced.	
Students should be able explain in terms of gain	
to explain why alloys or loss of electrons, that	
are harder than pure these are redox	
metals in terms of reactions	
distortion of the layers identify which species	
of atoms in the are oxidised and which	
structure of a pure are reduced in given	
metal. chemical equations.	
Students should be able Knowledge of reactions	
to explain the limited to those of	
properties of diamond magnesium, zinc and	
in terms of its structure iron with hydrochloric	
and bonding. and sulfuric acids.	
Students should be able predict products from	
to explain the given reactants	
properties of graphite in use the formulae of	
terms of its structure common ions to deduce	
and bonding. the formulae of salts.	
Students should know Students should be able	
that graphite is similar to describe how to	
to metals in that it has make pure, dry samples	
delocalised electrons. of named soluble salts	
recognise graphene and from information	
fullerenes from provided.	
diagrams and describe the use of	
descriptions of their universal indicator or a	
bonding and structure wide range indicator to	
give examples of the measure the	
uses of fullerenes, approximate pH of a	
including carbon solution	
nanotubes. use the pH scale to	
Students should be able didentify acidic or	
to compare 'nano' alkaline solutions.	
dimensions to typical	

dimensions of atoms	describe how to carry			
and molecules.	out titrations using			
given appropriate	strong acids and strong			
information, evaluate	alkalis only (sulfuric,			
the use of nanoparticles	hydrochloric and nitric			
for a specified purpose	acids only) to find the			
explain that there are	reacting volumes			
possible risks associated	accurately			
with the use of	(HT Only) calculate the			
nanoparticles.	chemical quantities in			
	titrations involving			
	concentrations in			
	mol/dm3 and in g/dm3.			
	use and explain the			
	terms dilute and			
	concentrated (in terms			
	of amount of			
	substance), and weak			
	and strong (in terms of			
	the degree of			
	ionisation) in relation to			
	acids.			
	describe neutrality and			
	relative acidity in terms			
	of the effect on			
	hydrogen ion			
	concentration and the			
	numerical value of pH			
	(whole numbers only).			
	Higher Tier students			
	should be able to write			
	half equations for the			
	reactions occurring at			
	the electrodes during			
	electrolysis, and may be			
	required to complete			
L	1		1	1

Building understanding: Bationale / breakdown for your sequence of lessons:						
Bonding end of topic test		Chemical changes end of	topic test	Rates of reaction required	Rates of reaction required practical	
Required practical for chemical changes		Titration required practica	al	End of year exam		
and teacher marked piece(s) of work		teacher marked piece(s) c	of work	and teacher marked piece	e(s) of work	
Autumn Term – centrally		Spring Term – centrally planned, standardised and		Summer Term – centrally		
···	compound.					
	containing a single ionic					
	aqueous solutions					
	of the electrolysis of					
	to predict the products					
	Students should be able					
	continually replaced.					
	electrode must be					
	explain why the positive					
	used as the electrolyte					
	explain why a mixture is					
	in the molten state.					
	binary ionic compounds					
	of the electrolysis of					
	to predict the products					
	Students should be able					
	half equations.					
	and balance supplied					

Building understanding: Rationale / breakdown for your sequence of lessons:

Energy Changes

Starting with Energy Changes introduces students to foundational concepts, such as exothermic and endothermic reactions, conservation of energy, and energy transfer. Understanding these energy changes prepares students for later topics, as energy is integral to all chemical reactions.

Bonding

After learning about energy changes in reactions, Bonding is introduced to explain how atoms connect to form compounds. Understanding ionic, covalent, and metallic bonding allows students to grasp why substances have specific properties and behaviours, such as melting points, conductivity, and solubility. We cover ionic, covalent, and metallic bonds, relating them to energy changes and linking back to the energy required or released in bond formation. This topic lays the groundwork for understanding why substances react differently based on bond types, which is essential for quantitative chemistry and reaction rates.

Quantitative Chemistry

Quantitative Chemistry introduces stoichiometry and chemical calculations, allowing students to quantify reactants and products, and understand conservation of mass in reactions. This builds on their knowledge of bonding and energy changes, giving them tools to calculate precise amounts involved in reactions. In this topic we focus on moles, molar mass, and balanced chemical equations. Reinforce the link between bonding, energy changes, and how much of each substance participates in or is produced by a reaction. These calculations prepare students for understanding reaction rates, yields, and efficiencies in later topics

Chemical Changes

With a foundation in bonding and quantitative skills, students can now explore Chemical Changes, covering different types of chemical reactions and properties of acids, bases, salts, and redox reactions. This topic allows students to apply quantitative skills to practical chemical reactions and further explore the factors influencing these reactions. This topic introduces key reactions, such as neutralization and precipitation, and build on quantitative skills by calculating reactants and products. Link these changes to bonding and energy transformations, helping students make connections between theoretical concepts and real-life chemical processes.

(Energy changes) Chemical Cells and Fuel Cells

With an understanding of chemical changes, we go back to energy changes so students can now delve into Chemical Cells and Fuel Cells, exploring how chemical reactions can generate electricity. This topic highlights practical applications of chemical energy transformations and prepares students for further study of reaction rates and efficiency. Energy changes introduce the principles of chemical cells and fuel cells, emphasising how redox reactions and energy transfers are harnessed for power. Students can apply their knowledge of quantitative chemistry and bonding to calculate energy efficiency and understand electrode reactions.

Rate of reaction

At this stage, students have a solid understanding of reactions, energy changes, and quantitative relationships, making them ready to study Rate of reaction. Here, they learn about reaction kinetics and equilibrium, understanding how reaction rates can be controlled and optimised in industrial and environmental processes.

Organic Chemistry

With knowledge of bonding, chemical changes, and reaction rates, students are prepared to study Organic Chemistry. This topic explores carbon-based compounds, their reactions, and industrial significance, especially in fuels and polymers. Organic Chemistry is a critical part of applied chemistry, so understanding reaction conditions and bond types helps students appreciate its societal impact. In this topic students are introduced to hydrocarbons, functional groups, and polymerisation, building on bonding and reaction kinetics to explain these compounds' diverse structures and uses. This sets the stage for understanding both the benefits and challenges of organic compounds, particularly in relation to environmental impact.

Chemistry of the Atmosphere

Ending with Chemistry of the Atmosphere allows students to synthesise their understanding of chemical reactions, bonding, organic chemistry, and energy changes within the context of real-world environmental issues. This topic ties together concepts from earlier topics and encourages students to think about the implications of human activities on atmospheric chemistry.

Home – Learning:

Revision workbooks for all units are given to students to complete throughout the duration of unit delivery.

Reading / High Quality Text:

Students are encouraged to prior reading on topics. In lessons students are taught how to construct answers through use of writing frames and exemplar answers where extended writing is required and command words and keywords that are relevant to the topic are consistently assessed in lessons through questioning and exam practice.

Chemguide online reading resource is excellent for GCSE Chemistry students: <u>https://www.chemguide.co.uk/gcsebook.html</u>

Numeracy:

Recognise and use expressions in decimal form: Recognise and use expressions in standard form; Use ratios, fractions and percentages; Make estimates of the results of simple calculations.

Handling data: Use an appropriate number of significant figures; Find arithmetic means; Construct and interpret frequency tables and diagrams, bar charts and histograms; Make order of magnitude calculations

Algebra: Understand and use the symbols: =, <>, >, \propto , \sim ; Change the subject of an equation; Substitute numerical values into algebraic equations using appropriate units for physical quantities

Graphs: Translate information between graphical and numeric form; Understand that y = mx + c represents a linear relationship; Plot two variables from experimental or other data; Determine the slope and intercept of a linear graph; interpret graphs to show changes in level of greenhouse gases. Use of tables to interpret materials for resources.

Enrichment / opportunities to develop cultural capital (including careers, WRL and SMSC):

Chemistry related trips are arranged during science week.

SMSC:

Chemistry of the Atmosphere:

Spiritual: This topic can inspire awe about the natural balance in the Earth's atmosphere, the role of greenhouse gases, and the delicate systems that sustain life. It invites students to reflect on the interdependence of natural systems.

Moral and Social: Discussing global warming, pollution, and the greenhouse effect highlights human responsibility for environmental stewardship.

Energy changes:

Moral and Social: Discussing energy changes, like exothermic and endothermic reactions, opens up conversations on energy sources (e.g., fossil fuels vs. renewable energy) and their impact on climate change.

Chemical changes:

Moral and Social: Discuss the impact of chemical manufacturing on society and the environment, including pollution and sustainable practices. For example, the production of acids and alkalis has environmental risks, so students could explore the moral responsibility of chemical industries to minimise waste and prevent pollution.

Bonding:

Social: Looking at the role of Bonding in Everyday Life. Bonding explains why materials have specific properties, like conductivity in metals or hardness in diamonds. Discussing these properties in the context of everyday materials—such as kitchen utensils, electronic devices, and clothing fabrics—helps students appreciate how bonding affects daily life and society.

Rate and extent of chemical changes:

Social and Cultural: Consider how improving reaction rates can make processes more efficient, benefitting society by reducing waste and costs in industries like pharmaceuticals, food production, and energy.

Quantitative chemistry:

Spiritual: Quantitative chemistry involves precise calculations and predictable patterns in chemical reactions. This precision can inspire a sense of wonder and curiosity about the order and structure of the natural world. For instance, understanding how atoms combine in exact ratios to form compounds can encourage students to appreciate the underlying structure and interconnectedness in nature.

Organic chemistry:

Cultural: The history of organic chemistry includes discoveries from diverse cultures worldwide, such as natural dyes and medicinal compounds, fostering cultural respect and awareness.