



GCSE Chemistry – 4.3 Quantitative Chemistry



Learning about this topic is important because:

Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas.

This builds on:

Year 9 Chemical Reactions topic

Year 8 Atoms, Elements and compounds topic

This leads to:

Year 12 3.1.2 Amount of substance

We will learn:

- The law of conservation of mass and the reasons why reactions appear to lose or gain mass.
- How to calculate the relative formula mass of an element or compound and calculate the percentage by mass of an element in a compound.
- What a mole is and how to calculate the number moles of a substance given the mass.
- What Avogadro constant is and how it can be used to calculate the number of particles reacting.
- Calculate the mass of a reactant or product using a balanced symbol equations when given mass of another substance in the reaction.
- Calculate molar ratio of reactants/ products in a reaction.
- Know what uncertainty is relating to an experiment and how it occurs and be able to calculate uncertainty about the mean.
- What a limiting reagent is and be able to identify which reagent is limiting and which is in excess in a reaction.

We will develop/practise skills including:

Balancing symbol equations
Using observed changes in mass to explain what is happening in a reaction taking place in a non-closed system
Maths Skills
Using math mathematical formula
Rearranging equations

Some of the vocabulary that we will use includes:

You could learn more about this topic by:





GCSE Chemistry – 4.3 Quantitative Chemistry



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Conservation of mass

In a chemical reaction, mass is not created or destroyed. The total mass of reactants equals the total mass of products.

Relative formula mass (Mr)

The sum of the relative atomic masses (Ar) of all atoms in a chemical formula. Used for compounds.

Relative atomic mass (Ar)

The average mass of an atom of an element compared to 1/12 of a carbon-12 atom.

Avogadro constant

6.02×10^{23} particles per mole. It tells how many atoms, ions, or molecules are in 1 mole.

Percentage yield

A measure of how much product is actually obtained compared to the maximum possible (theoretical) amount.

Formula: $(\text{actual yield} \div \text{theoretical yield}) \times 100$

Atom economy

A measure of how much of the reactants end up in the desired product. Higher atom economy means less waste.

Concentration

The amount of a substance (solute) dissolved in a certain volume of solution.

Common unit: mol/dm^3 (moles per cubic decimetre)

[Quantitative chemistry - GCSE Combined Science Revision - AQA Trilogy - BBC Bitesize](#)

[The Whole of AQA -QUANTITATIVE CHEMISTRY. GCSE Chemistry or Combined Science Revision Topic 3 for C1 - YouTube](#)

[GCSE Chemistry - The Mole \(Higher Tier\) #25 - YouTube](#)

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic test

Assessed extended writing

Assessed Required Practical

Educake Quizzes

Quick Check Homework's



Learning about this topic is important because:

The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity.

This builds on:

KS3 Materials Science, 4.8 Chemical analysis, 4.1 Atomic Structure and the Periodic table, 4.2 Structure and Bonding, 4.3 Quantitative Chemistry

This leads to:

4.7 Organic Chemistry

We will learn:

The composition of the Earth's atmosphere and how this has changed over time.

How greenhouse gases act to keep the earth at a temperature suitable for life

How increases in the levels of greenhouse gases such as carbon dioxide and methane can lead to climate change

How we can measure the greenhouse gas emissions of a person, product or event using carbon footprints

How burning fossil fuels can release pollutants such as CO₂, CO, Carbon particulates, Sulfur oxides and nitrogen oxides, how these pollutants can affect the environment and how we can reduce their emissions.

Understand how peer review is an important process in developing scientific theories

We will develop/practise skills including:

WS 1.4 Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.

WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.

WS 1.3 Appreciate the power and limitations of science and consider any ethical issues which may arise.

WS 1.6 Recognise the importance of peer review of results and of communicating results to a range of audiences.

WS 4.1 Use scientific vocabulary, terminology and definitions.



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Some of the vocabulary that we will use includes:

Greenhouse Gas

A gas in the atmosphere that **absorbs and emits infrared radiation**, contributing to the greenhouse effect.

Pollutant

A substance that **causes harm to the environment or living organisms**.

Climate

The **average weather conditions of a region over a long period of time**.

Carbon Footprint

The **total amount of greenhouse gases produced by a person, activity, product, or organisation**, usually measured in carbon dioxide equivalents (CO₂).

Peer Review

The process in which **scientists evaluate and check another scientist's work before it is published**.

You could learn more about this topic by:

[Chemistry of the atmosphere - GCSE Chemistry \(Single Science\) Revision - AQA - Bitesize](#)

[Bitesize](#)

[GCSE Science Revision Chemistry "The Atmosphere" - YouTube](#)



Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic test

Assessed extended writing task

Educake Quizzes

Quick Check Homework



GCSE Chemistry – 4.7 Organic Chemistry



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Learning about this topic is important because:

The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.

This builds on:

KS3 Materials Science, 4.8 Chemical analysis, 4.1 Atomic Structure and the Periodic table, 4.2 Structure and Bonding, 4.3 Quantitative Chemistry, 4.9 Chemistry of the Atmosphere

This leads to:

4.5 Energy Changes

We will learn:

Crude oil – how is it formed? What is it composed of?

How to describe how processes like fractional distillation and cracking can be used to process crude oil in to useful products and to help meet the demand for fuels.

What are hydrocarbons? How do they react with oxygen?

The general formula, molecular formula, displayed formula and names of the first four alkanes.

How the properties of hydrocarbons depends on the size of the molecules.

We will develop/practise skills including:

WS 1.2 Make models of alkane molecules using the molecular modelling kits.

WS 1.2, 4.1 Investigate the properties of different hydrocarbons.

Some of the vocabulary that we will use includes:

Hydrocarbon

A compound that contains **only hydrogen and carbon atoms**.

Fractional Distillation

A process used to **separate a mixture of liquids with different boiling points**.

Cracking

The process of **breaking down long-chain hydrocarbons into smaller hydrocarbons**, including alkenes and alkanes.

You could learn more about this topic by:

[FreeScienceLessons - Organic Chemistry Playlist](#)

[Organic chemistry - GCSE Combined Science Revision - AQA Trilogy - BBC Bitesize](#)





GCSE Chemistry – 4.7 Organic Chemistry



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Alkane

A **saturated hydrocarbon** containing only single carbon-carbon bonds.

Alkene

An **unsaturated hydrocarbon** containing at least one carbon-carbon double bond.

Homologous Series

A family of compounds with the **same functional group and similar chemical properties**, where successive members differ by CH_2 .

Polymerisation

The process in which **many small molecules (monomers) join together to form a polymer**.

Monomer

A **small molecule that can join with other similar molecules to form a polymer**.

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic test

Assessed extended writing tasks

Quick Check Homework

Educake Quizzes



GCSE Chemistry – 4.5 Energy Changes



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Learning about this topic is important because:

Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications.

This builds on:

Chemical Reactions (Year 9)

4.4 Chemical changes (GCSE)

This leads to:

4.6 Rate and Extent of Chemical Change

We will learn:

- The meaning of the terms endothermic and exothermic.
- How we can identify if a reaction is exothermic or endothermic using temperature changes.
- Examples of exothermic and endothermic reactions.
- The meaning of the term activation energy.
- How to draw and label reaction profiles for endothermic and exothermic reactions.
- What makes a reaction endothermic or exothermic in terms of bonds breaking and forming.

We will develop/practise skills including:

Use of appropriate apparatus and techniques to make and record a range of measurements accurately, including mass, time, temperature, and volume of liquids and gases.

Making and recording of appropriate observations during chemical reactions including changes in temperature

Safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products.

Translate information between graphical and numeric form.

Plot two variables from experimental or other data.

Some of the vocabulary that we will use includes:

Exothermic reaction

A reaction that transfers energy to the surroundings.

Activation energy

The minimum amount of energy that particles must have for a reaction to occur.

You could learn more about this topic by:

[Energy changes - GCSE Combined Science Revision - AQA Trilogy - BBC Bitesize](#)
[AQA GCSE Science Revision Chemistry "Exothermic and Endothermic Reactions" - YouTube](#)
[GCSE Chemistry - Exothermic and Endothermic Reactions #43 - YouTube](#)

[GCSE Chemistry - Bond Energies #44 \(Higher tier\) - YouTube](#)
[AQA GCSE Science Revision Chemistry "Bond Energy Calculations" - YouTube](#)





GCSE Chemistry – 4.5 Energy Changes



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Catalyst A substance that increases the rate of a reaction without being used up, by lowering the activation energy. Bond energy The energy needed to break one mole of a particular bond in a gaseous substance.	
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KS4 Chemistry – 4.6 The rate and extent of chemical change



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Learning about this topic is important because:

Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.

This builds on:

Particles Y7, Chemical Reactions Y8, 4.2 Structure and Bonding.

This leads to:

4.5 Energy Changes

We will learn:

How to Calculate rates of reactions in two different ways.

What factors affect the rates of a chemical reaction

What is Collision theory?

What is activation energy?

How does a Catalyst affect rate of reaction.

Practical skills.

How to calculate rate of reaction using a tangent and gradient from a graph.

What is a reversible reaction?

What is a dynamic Equilibrium.?

What is Le Chatelier's Principle?

What factors affect the yield of a chemical reaction.

Apply Le Chatelier's Principle to explain how factors affect the equilibrium and yield of product.

Energy changed during chemical reactions.

We will develop/practise skills including:

Be able to carry out a practical investigating rate either by the amount of product produced over time or the amount of reactant used up over time.

Be able to carry out a REQUIRED on the effect of Concentration on rate of reaction and be able to analyse the results and answer examination style questions.

Be able to draw rate time graphs.

Be able to analyse a rate time graph and draw tangents and gradients to the curve to calculate rate of reaction.

Some of the vocabulary that we will use includes:

You could learn more about this topic by:





KS4 Chemistry – 4.6 The rate and extent of chemical change



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Activation Energy

The **minimum energy that particles must have for a reaction to occur.**

Collision Theory

The theory that reactions occur when particles **collide with enough energy and in the correct orientation.**

Surface Area

The **total area of the exposed surface of a substance.**

Concentration

The **amount of a substance dissolved in a given volume of solution.**

Pressure

The **force exerted per unit area by particles colliding with the walls of a container.**

Temperature

A measure of the **average kinetic energy of particles.**

Frequent Collisions

Collisions that occur **more often between reacting particles**, increasing the rate of reaction.

Equilibrium

The state in a reversible reaction where the **forward and reverse reactions occur at the same rate.**

Yield

The **amount of product formed in a chemical reaction.**

[GCSE Science Revision Chemistry "Effect of Concentration on Rate" - YouTube](#)

[GCSE Science Revision Chemistry "Effect of Temperature on Rate" - YouTube](#)

[GCSE Science Revision Chemistry "Catalysts" - YouTube](#)

[AQA GCSE Chemistry Topic 6: The Rate and Extent of Chemical Change Revision - PMT \(physicsandmathstutor.com\)](#)

[GCSE Science Revision Chemistry "Mean Rate of Reaction" - YouTube](#)

[GCSE Science Revision Chemistry "Effect of Surface Area on Rate" - YouTube](#)

[GCSE Science Revision Chemistry "Required Practical 5: Rates of Reaction" - YouTube](#)

[What Is Dynamic Equilibrium? | Reactions | Chemistry | FuseSchool - YouTube](#)

[Le Chatelier's Principle Part 1 | Reactions | Chemistry | FuseSchool - YouTube](#)

[Le Chatelier's Principle: Part 2 | Reactions | Chemistry | FuseSchool - YouTube](#)

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

Quick Check Homework's

Extended Response Questions

Educake Quizzes

End of topic test



GCSE Chemistry – 4.10 Using resources



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Learning about this topic is important because:

Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised.

This builds on:

How metals are extracted in KS4 4.4 chemical changes

How ammonium salts are produced in KS4 4.4 chemical changes

Uses of Polymers in organic KS4 4.7

How Carbon dioxide is produced and its contribution to global warming in KS4 4.9 chemistry of the atmosphere

This leads to:

Chemical equilibria in KS5 3.1.6 Chemical Equilibria, Le Chatelier's principle

We will learn:

The importance of limiting the use of the Earth's resources in order to keep sustainability

How Potable water is different from other types of water and how it is processed

The process involved in Waste water treatment

Alternative methods of extracting metals such as bioleaching and phytomining of low copper ores

The importance of Life cycle assessment and recycling for paper and plastic bags

Ways of reducing the use of resources

develop/practise skills including:

WS 1.4 Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.

WS 2.7

Evaluate methods and suggest possible improvements and further investigations.

WS 3.2 Translating data from one form to another.

WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions.

WS 3.8 Communicating the scientific rationale for investigations, methods used, findings and reasoned conclusions through paper-based and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms.

Some of the vocabulary that we will use includes:

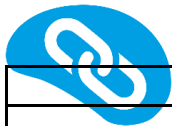
Potable

Water that is **safe to drink**.

You could learn more about this topic by:

[Using resources - GCSE Combined Science Revision - AQA Trilogy - BBC Bitesize](#)





GCSE Chemistry – 4.10 Using resources



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Renewable

A resource that is **replaced naturally** as it is used.

Finite

A resource that is **limited and will eventually run out**.

Sustainable

Using resources in a way that **meets current needs without compromising future generations' ability to meet their needs**.

Phytomining

The process of **using plants to absorb metal compounds from soil, then burning the plants to obtain the metal**.

Bioleaching

The use of **bacteria to extract metal compounds from low-grade ores**.

Resources

Useful materials or substances that **can be used to meet human needs**.

Corrosion

The **destruction of metals by chemical reactions with substances in the environment**, such as oxygen and water.

Sacrificial Protection

A method of preventing rusting where **a more reactive metal is attached to iron or steel and corrodes instead**.

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are: end of topic test and assessed homework

End of topic test

Assessed extended writing task

Assessed Required Practical task

Required Practical 8

Educake Quizzes

Quick Check Homework



GCSE Chemistry – 4.10 Using resources



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