# Haywards Heath College

| GETTING READY FOR PACK |
|---|
| **A Level Chemistry** |
| We are delighted you have chosen to study A Level Chemistry at Haywards Heath College |

| WHAT YOU WILL STUDY | |
|---|---|
| **Unit/Topic** | **Brief description of first year units/topics/assessments** |
| | Introduction to AQA A Level Chemistry: We will give you an overview of the AQA syllabus, including key topics and concepts covered during the course. This will help you familiarize yourself with the structure and expectations of the curriculum. |
| | Fundamental Concepts: We will dive deep into the fundamental principles of Chemistry, building upon your GCSE knowledge and strengthening your understanding. This section will act as a solid foundation for the more advanced topics you will encounter in the future. |
| | Preparatory Exercises: To help you reinforce your learning, we have included a series of exercises and questions for each topic covered in the Welcome Pack. These exercises will allow you to practice your problem-solving skills and identify areas that may require further attention. |
| | Recommended Reading and Resources: As Chemistry enthusiasts, we believe that knowledge knows no bounds. Brief description of first year units/topics/assessments |

| WHAT YOU NEED | |
|---|---|
| **Kit List** | Lab Coats provided |
| **Course Supplement** | Cambridge Chemistry Challenge Lower Sixth & The Olympiad challenge for Chemistry. |
| **Equipment** | Must have a scientific calculator that can perform log and inverse log functions. |
| **Essential Textbooks** | Ted Lister A level Chemistry AQA/CGP Book. Jim Clark Calculations for Chemistry |

| ENRICHMENT |
|---|

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| Trips | Sussex University STEM Visit |
|---|---|
| **Guest Speakers** | A range of experiences open to all students including career and progression support and advice, including from services such as the NHS |
| **Work experience**<br><br><br><br><br>**Competitions** | Competitive Work Placements at our local employer Edwards Vacuum on their Haywards Heath College Talent ID Programme<br><br>Opportunities to work on Research Projects with universities<br><br>EDT Industrial Cadets Gold Award<br><br><br><br><br>Royal Society of Chemistry International Olympiad<br>EDT Industrial Cadets Gold Award<br>Cambridge Chemistry Challenge<br>UK Chemistry Olympiad |

| OPTIONAL ADDITIONAL READING/STUDY | |
|---|---|
| | [Cambridge Chemistry Challenge (c3l6.com)](c3l6.com) Get a HeadStart with the lower sixth challenge by trying some of the past paper content |

| SUMMER WORKING TASK INFORMATION |
|---|
| **Completion Date: First Lesson Week Commencing 8/9/25** |
| This pack will help you make the best possible start to studying this subject. The tasks in this pack should take you about 4-6 hours to complete.<br>The tasks are designed to get a bit more difficult as you work through them as they are preparing you for studying at a higher level and to become an effective independent learner. You should try to get as far as you can working on your own but if you do need help, please email us at **info@haywardsheath.ac.uk** telling us which Getting Ready For pack you are working on and what help you need. Help is available throughout the summer holidays. |

| SUMMER WORKING TASK | |
|---|---|
| **Skills Focus** | Brief description of first year units/topics/assessments |

|  |  |
|---|---|
|  | • The specification and structure of the assessment<br>• Key skills activities to support the move from GCSE to A-level Chemistry.<br>• Understanding the specification and the assessments<br>• Transition activities to bridge the move from GCSE to the start of the A-level course. |
|  | **TASKS** |
| **Task 1-3** | Transition activity 1-3 Scientific vocabulary |
| **Task 4** | Transition activity 4 SI units and prefixes |
| **Task 5** | Transition activity 5 Converting data |
| **Task 6** | Transition activity 6 Using the delta symbol |
| **Task 7** | Transition activity 7 Practical skills: Electrolysis |
| **Task 8** | Transition activity 8 Using maths skills |
| **Task 9** | Transition activity 9 Atoms |
| **Task 10** | Transition activity 10 Formulae of common compounds |
| **Task 11** | Transition activity 11 Ions and ionic compounds |
| **Task 12** | Transition activity 12 Empirical formula |
| **Task 13** | Transition activity 13 Balancing equations |
| **Task 14** | Transition activity 14 Moles |
| **Task 15** | Transition activity 15 Isotopes and calculating relative atomic mass |
| **Task 16** | Transition activity 16 Extended writing: Types of bonding |

**Content common to AS and A-level**

| 3.1 Physical chemistry | 3.2 Inorganic chemistry | 3.3 Organic chemistry |
|---|---|---|
| 3.1.1 Atomic structure | 3.2.1 Periodicity | 3.3.1 Introduction to organic chemistry |
| 3.1.2 Amount of substance | 3.2.2 Group 2, the alkaline earth metals | 3.3.2 Alkanes |
| 3.1.3 Bonding | 3.2.3 Group 7(17), the halogens | 3.3.3 Halogenoalkanes |
| 3.1.4 Energetics | | 3.3.4 Alkenes |
| 3.1.5 Kinetics | | 3.3.5 Alcohols |
| 3.1.6 Chemical equilibrium, Le Chatelier's principle and $K_c$ | | 3.3.6 Organic analysis |
| 3.1.7 Oxidation, reduction and redox equations | | |

Each section of the content begins with an overview, which describes the broader context and encourages an understanding of the place each section has within the subject. This overview will not be directly assessed.

The specification is presented in a two-column format:

- the left-hand column contains the specification content that you must cover, and that can be assessed in the written papers.
- the right-hand column exemplifies the opportunities for maths and practical skills to be developed throughout the course. These skills can be assessed through any of the content on the written papers, not necessarily in the topics we have signposted.

# Haywards Heath College

## Assessment structure

### AS

The assessment for the AS consists of two exams, which you will take at the end of the course.

| Paper 1 | | Paper 2 |
|---|---|---|
| **What's assessed** | **+** | **What's assessed** |
| <ul><li>Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 and 3.1.7)</li><li>Inorganic chemistry (Section 3.2.1 to 3.2.3)</li><li>Relevant practical skills</li></ul> | | <ul><li>Relevant Physical chemistry topics (sections 3.1.2 to 3.1.6)</li><li>Organic chemistry (Section 3.3.1 to 3.3.6)</li><li>Relevant practical skills</li></ul> |
| **How it's assessed** | | **How it's assessed** |
| <ul><li>Written exam: 1 hour 30 mins</li><li>80 marks</li><li>50% of the AS</li></ul> | | <ul><li>Written exam: 1 hour 30 mins</li><li>80 marks</li><li>50% of the AS</li></ul> |
| **Questions** | | **Questions** |
| <ul><li>65 marks of short and long answer questions</li><li>15 marks of multiple choice questions</li></ul> | | <ul><li>65 marks of short and long answer questions</li><li>15 marks of multiple choice questions</li></ul> |

## A-level

The assessment for the A-level consists of three exams, which you will take at the end of the course.

| Paper 1 | Paper 2 | Paper 3 |
|---|---|---|
| **What's assessed** | **What's assessed** | **What's assessed** |
| • Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 to 3.1.8 and 3.1.10 to 3.1.12)<br>• Inorganic chemistry (Section 3.2)<br>• Relevant practical skills | • Relevant Physical chemistry topics (sections 3.1.2 to 3.1.6 and 3.1.9)<br>• Organic chemistry (Section 3.3)<br>• Relevant practical skills | • Any content<br>• Any practical skills |
| **How it's assessed** | **How it's assessed** | **How it's assessed** |
| • Written exam: 2 hours<br>• 105 marks<br>• 35% of the A-level | • Written exam: 2 hours<br>• 105 marks<br>• 35% of the A-level | • Written exam: 2 hours<br>• 90 marks<br>• 30% of the A-level |
| **Questions** | **Questions** | **Questions** |
| • 105 marks of long and short answer questions | • 105 marks of short and long answer questions. | • 40 marks of questions on practical techniques and data analysis<br>• 20 marks of questions testing across the specification<br>• 30 marks of multiple choice questions |

Dear New Students,

Welcome to Haywards Heath College! We are thrilled that you have decided to pursue your studies in A Level Chemistry with us. Congratulations on making this excellent choice, as Chemistry is undeniably one of the most vital and captivating subjects in the realm of science.

We understand that transitioning from GCSE to A Level can be a significant leap, and we are here to support you every step of the way. To ensure a smooth and successful start to your Chemistry journey, we have prepared a comprehensive Welcome Pack designed specifically to bridge the gap between GCSE and A Level.

In this Welcome Pack, you will find a treasure trove of resources that will enable you to hit the ground running. Here's a sneak peek of what you can expect to find within its pages:

Introduction to AQA A Level Chemistry: We will give you an overview of the AQA syllabus, including key topics and concepts covered during the course. This will help you familiarize yourself with the structure and expectations of the curriculum.

Fundamental Concepts: We will dive deep into the fundamental principles of Chemistry, building upon your GCSE knowledge and strengthening your understanding. This section will act as a solid foundation for the more advanced topics you will encounter in the future.

Preparatory Exercises: To help you reinforce your learning, we have included a series of exercises and questions for each topic covered in the Welcome Pack. These exercises will allow you to practice your problem-solving skills and identify areas that may require further attention.

## Assessment objectives

As you know from GCSE, we have to write exam questions that address the Assessment objectives (AOs). It is important you understand what these AOs are, so you are well prepared. In Chemistry there are three AOs.

- AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques, and procedures (A-level about 30% of the marks).
- AO2: Apply knowledge and understanding of scientific ideas, processes, techniques, and procedures:
  - in a theoretical context
  - in a practical context
  - when handling qualitative data
  - when handling quantitative data
  (A-level about 45% of the marks).
- AO3: Analyse, interpret, and evaluate scientific information, ideas, and evidence, including in relation to:
  - make judgements and reach conclusions
  - develop and refine practical design and procedures
  (A-level about 25% of the marks).

## Other assessment criteria

At least 20% of the marks for AS and A-level Chemistry will assess mathematical skills, which will be equivalent to Level 2 (Higher Tier GCSE Mathematics) or above.

At least 15% of the overall assessment of AS and A-level Chemistry will assess knowledge, skills and understanding in relation to practical work.

## Command words

Command words are used in questions to tell you what is required when answering the question. You can find definitions of the command words used in chemistry assessments on the [website.](#) They are very similar to the command words used at GCSE.

## Subject-specific vocabulary

You can find a list of definitions of key working scientifically terms used in our AS and A-level specification [here.](#)

You will become familiar with, and gain understanding of, these terms as you work through the course.

# Transition activities

The following activities cover some of the key skills from GCSE science that will be relevant at AS and A-level. They include the vocabulary used when working scientifically and some maths and practical skills.

You can do these activities independently or in class. The booklet has been produced so you can complete it electronically or print it out and do the activities on paper.

The activities are **not a test**. Try the activities first and see what you remember and then use textbooks or other resources to answer the questions. **Don't** just go to Google for the answers, as actively engaging with your notes and resources from GCSE will make this learning experience much more worthwhile.

The answer booklet guides you through each answer. It is not set out like an exam mark scheme but is to help you get the most out of the activities.

## Understanding and using scientific vocabulary

Understanding and applying the correct terms are key for practical science. Much of the vocabulary you have used at GCSE for practical work will not change but some terms are dealt with in more detail at A-level so are more complex.

| Task 1 | Scientific vocabulary: Designing an investigation. |
|---|---|

Link each term on the left to the correct definition on the right.

| Hypothesis | | The maximum and minimum values of the independent or dependent variable |
|---|---|---|
| Dependent variable | | A variable that is kept constant during an experiment |
| Independent variable | | The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres |
| Control variable | | A proposal intended to explain certain facts or observations |
| Range | | A variable that is measured as the outcome of an experiment |
| Interval | | A variable selected by the investigator and whose values are changed during the investigation |

| **Task 2** | Scientific vocabulary: Making measurements. |

Link each term on the left to the correct definition on the right.

| True value | | The range within which you would expect the true value to lie |

| Accurate | | A measurement that is close to the true value |

| Resolution | | Repeated measurements that are very similar to the calculated mean value |

| Precise | | The value that would be obtained in an ideal measurement where there were no errors of any kind |

| Uncertainty | | The smallest change that can be measured using the measuring instrument that gives a readable change in the reading |

| Task 3 | Scientific vocabulary: Errors |
|---|---|

Link each term on the left to the correct definition on the right.

| Random error | | Causes readings to differ from the true value by a consistent amount each time a measurement is made |
|---|---|---|

| Systematic error | | When there is an indication that a measuring system gives a false reading when the true value of a measured quantity is zero |
|---|---|---|

| Zero error | | Causes readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next |
|---|---|---|

## Understanding and using SI units

Every measurement has a size (eg 2.7) and a unit (eg metres or kilograms). Sometimes, there are different units available for the same type of measurement. For example, milligram, gram, kilogram and tonne are all units used for mass.

There is a standard system of units, called the SI units, which are used for most scientific purposes.

These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China.

There are seven SI base units, which are given in the table

| Physical quantity | Unit | Abbreviation |
|---|---|---|
| Mass | kilogram | kg |
| Length | metre | m |
| Time | second | s |
| Electric current | ampere | A |
| Temperature | kelvin | K |
| Amount of substance | mole | mol |
| luminous intensity | candela | cd |

# Using prefixes and powers of ten

Very large and very small numbers can be complicated to work with if written out in full with their SI unit. For example, measuring the width of a hair or the distance from Manchester to London in metres (the SI unit for length) would give numbers with a lot of zeros before or after the decimal point, which would be difficult to work with.

So, we use prefixes that multiply or divide the numbers by different powers of ten to give numbers that are easier to work with. You will be familiar with the prefixes milli (meaning 1/1000), centi (1/100), and kilo (1 × 1000) from millimetres, centimetres and kilometres.

There is a wide range of prefixes. Most of the quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, we would quote a distance of 33 000 m as 33 km.

The most common prefixes you will encounter are given in the table.

| Prefix | Symbol | Power of 10 | Multiplication factor | |
|--------|--------|-------------|-----------------------|---|
| Tera | T | $10^{12}$ | 1 000 000 000 000 | |
| Giga | G | $10^{9}$ | 1 000 000 000 | |
| Mega | M | $10^{6}$ | 1 000 000 | |
| kilo | k | $10^{3}$ | 1000 | |
| deci | d | $10^{-1}$ | 0.1 | 1/10 |
| centi | c | $10^{-2}$ | 0.01 | 1/100 |
| milli | m | $10^{-3}$ | 0.001 | 1/1000 |
| micro | μ | $10^{-6}$ | 0.000 001 | 1/1 000 000 |
| nano | n | $10^{-9}$ | 0.000 000 001 | 1/1 000 000 000 |
| pico | p | $10^{-12}$ | 0.000 000 000 001 | 1/1 000 000 000 000 |
| femto | f | $10^{-15}$ | 0.000 000 000 000 001 | 1/1 000 000 000 000 000 |

| **Task 4** | Scientific vocabulary: SI Units and prefixes |
|---|---|

1. What would be the most appropriate unit to use for the following measurements?

   a. The mass of water in a test tube.
   b. The volume of water in a burette.
   c. The time taken for a solution to change colour.
   d. The radius of a gold atom.
   e. The number of particles eg atoms in a chemical.
   f. The temperature of a liquid.

2. Re-write the following quantities using the correct SI units.

   a. 0.5 litres
   b. 5 minutes
   c. 20 °C
   d. 70 °F
   e. 10 ml (millilitres)
   f. 5.5 tonnes
   g. 96.4 microlitres (μl)

3. Scientists have been developing the production of a new material through the reaction of two constituents.

   Before going to commercial production, the scientists must give their data in the correct SI units.

   a. The flow rate of the critical chemical was reported as 240 grams per minute at a temperature of 20 °C.
   Re-write this flow rate using the correct SI units. Show your working.

| **Task 5** | Converting Data |
|---|---|

**Re-write the following.**
1. 0.1 metres in millimetres

2. 1 centimetre in millimetres

3. 104 micrograms in grams

4. 1.1202 kilometres in metres

5. 70 decilitres in millilitres

6. 70 decilitres in litres

7. 10 $cm^3$ in litres

8. 2140 pascals in kilopascals

| Task 6 | Using the delta symbol |
|--------|------------------------|

## The delta symbol (Δ)

The delta symbol (Δ) is used to mean 'change in'. You might not have seen this symbol before in your GCSE Chemistry course, although it is used in some equations in GCSE Physics.

In exothermic and endothermic reactions there are energy changes.

The diagram below shows the reaction profile for the reaction between zinc and copper sulfate solution.



Progress of reaction
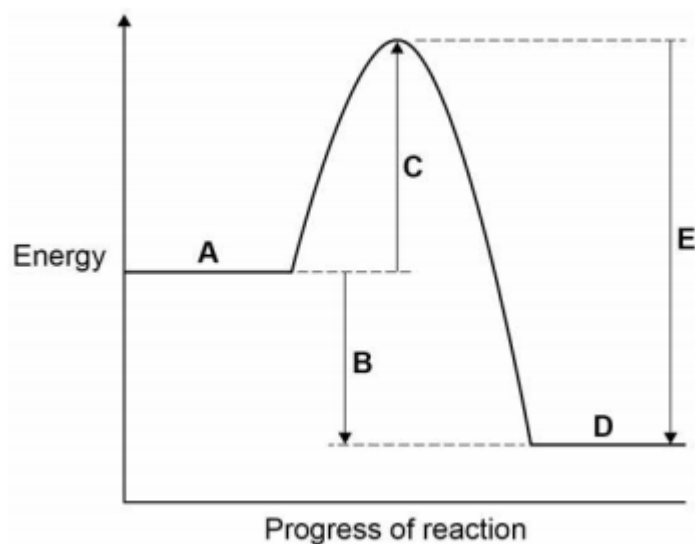
1.  Which letter represents the products of the reaction?


2.  Which letter represents the activation energy?


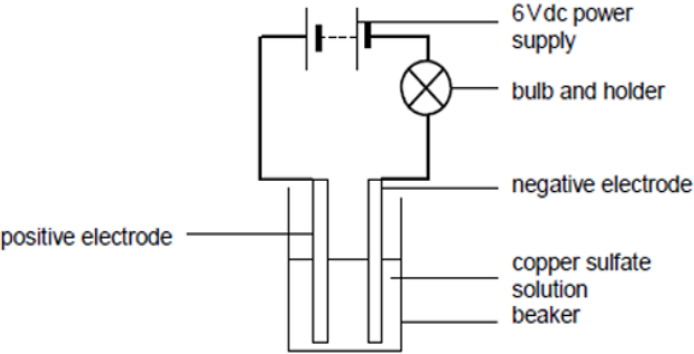3.  Complete the sentence using the words below.

    4.  The reaction is _____ and therefore ΔH is _____

    endothermic          exothermic          negative          positive

## Practical skills

The practical skills you learnt at GCSE will be further developed through the practical's you undertake at A-level. Your teacher will explain in more detail the requirements for practical work in Chemistry.

There is a practical handbook for Chemistry, which has lots of very useful information to support you in developing these important skills.  You can download a copy here:

| Task 7 | Electrolysis |
| --- | --- |

Students were investigating if the time the current flows through an electrolyte affects the amount of copper deposited on the negative electrode.

**Equipment:**
Measuring cylinder
Balance
Two suitable electrodes eg carbon rods
6V bulb and holder
0.5 moles per $dm^3$ copper sulfate solution
Stopwatch
Wires
Power supply
100 $cm^3$ beaker



**Method:**
1.  Measure 50$cm^3$ of the copper sulfate solution into the beaker.
2.  Measure and record the mass of the negative electrode.
3.  Set up the circuit, setting the power pack at 6V dc.
4.  Turn on the power supply for the time you have been given, then turn the power pack off.
5.  Remove and carefully dry the negative electrode.
6.  Measure and record the mass of the negative electrode.

1.  Write a hypothesis for this investigation.

2.  What do you predict will be the result of this investigation?

3.  For this investigation, give

    a.  the independent variable

    b.  the dependent variable

    c.  a control variable.

4. What is the difference between repeatable and reproducible results?

5. What would be the most likely resolution of the balance you use in a school lab?

6. How could you make the reading more precise?

7. Random errors cause readings to be spread about the true value.

   How could you reduce the effect of random errors and make the results more accurate?

8. The results the student recorded are given in the table.

| Time / minutes | Increase in mass / g | | | Mean |
|---|---|---|---|---|
| 2 | 0.62 | 0.64 | 0.45 | |
| 4 | 0.87 | 0.83 | 0.86 | |
| 6 | 0.99 | 1.02 | 0.97 | |
| 8 | 1.06 | 1.05 | 1.08 | |
| 10 | 1.10 | 1.12 | 1.10 | |

Calculate the mean increase in mass for each time measurement.

**9. Plot a graph of your results.**
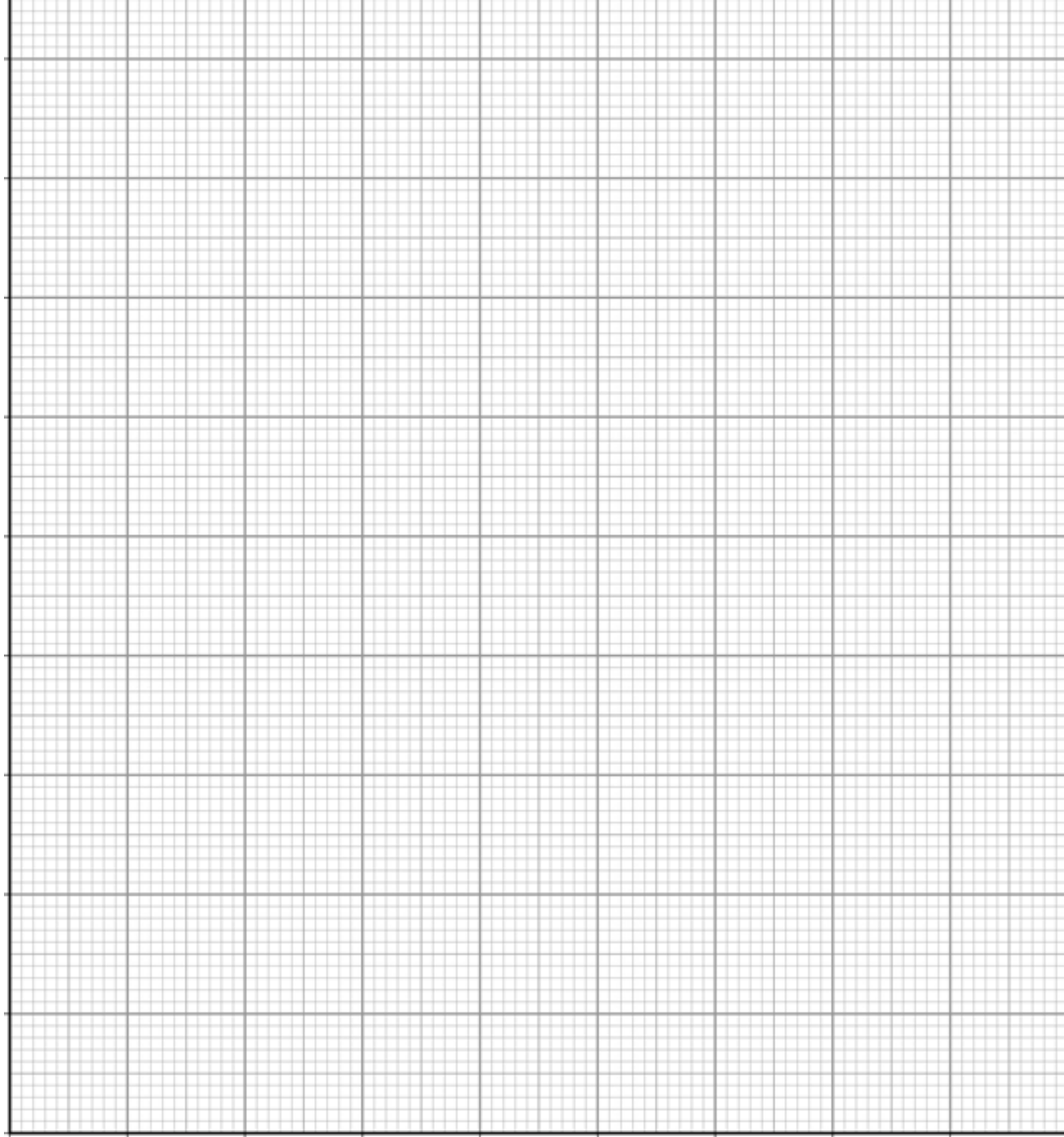
| **Task 8** | Using maths skills |
|---|---|

## Using maths skills

Throughout your A-level Chemistry course you will need to be able to use maths skills you have developed in your GCSE Chemistry and GCSE maths courses, such as using standard form, rounding correctly and quoting your answer to an appropriate number of significant figures.

1.  Write the following numbers in standard form:

    a.  4000
    b.  1 000 000

2.  Zinc oxide can be produced as nanoparticles.

    A nanoparticle of zinc oxide is a cube of side 82nm.
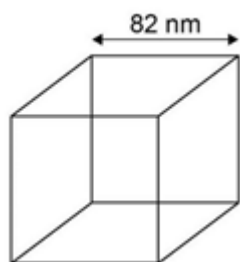
    

    Calculate the surface area of a nanoparticle of zinc oxide. Give your answer in standard form

3.  Express the following numbers to 3 significant figures:

    a.  57 658
    b.  0.045346

4.  Toothpaste may contain sodium fluoride (NaF).

    The concentration of sodium fluoride can be expressed in parts per million (ppm). 1 ppm represents a concentration of 1 mg in every 1 kg of toothpaste.

    A 1.00 g sample of toothpaste was found to contain $2.88 \times 10^{-5}$ mol of sodium fluoride.

    Calculate the concentration of sodium fluoride, in ppm, for the sample of toothpaste.

Give your answer to 3 significant figures.

**Use the following information to help you**

To convert moles to grams use g = moles × relative formula mass

Relative formula mass of NaF = 42

## Using the periodic table

During your course you will need to become familiar with the periodic table of the elements and be able to use information from the table to answer questions.

There is a copy of the periodic table that you will be given to use in your exams on the next page.



**The Periodic Table of the Elements**

| Group 1 | 2 | | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | (18) 4.0 He helium 2 |
| (1) | (2) | Key | | | | | | | | | | | (13) | (14) | (15) | (16) | (17) | |
| 6.9 Li lithium 3 | 9.0 Be beryllium 4 | | relative atomic mass **symbol** name atomic (proton) number | | | | | | | | | | 10.8 B boron 5 | 12.0 C carbon 6 | 14.0 N nitrogen 7 | 16.0 O oxygen 8 | 19.0 F fluorine 9 | 20.2 Ne neon 10 |
| 23.0 Na sodium 11 | 24.3 Mg magnesium 12 | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | | 27.0 Al aluminium 13 | 28.1 Si silicon 14 | 31.0 P phosphorus 15 | 32.1 S sulfur 16 | 35.5 Cl chlorine 17 | 39.9 Ar argon 18 |
| 39.1 K potassium 19 | 40.1 Ca calcium 20 | 45.0 Sc scandium 21 | 47.9 Ti titanium 22 | 50.9 V vanadium 23 | 52.0 Cr chromium 24 | 54.9 Mn manganese 25 | 55.8 Fe iron 26 | 58.9 Co cobalt 27 | 58.7 Ni nickel 28 | 63.5 Cu copper 29 | 65.4 Zn zinc 30 | | 69.7 Ga gallium 31 | 72.6 Ge germanium 32 | 74.9 As arsenic 33 | 79.0 Se selenium 34 | 79.9 Br bromine 35 | 83.8 Kr krypton 36 |
| 85.5 Rb rubidium 37 | 87.6 Sr strontium 38 | 88.9 Y yttrium 39 | 91.2 Zr zirconium 40 | 92.9 Nb niobium 41 | 96.0 Mo molybdenum 42 | [97] Tc technetium 43 | 101.1 Ru ruthenium 44 | 102.9 Rh rhodium 45 | 106.4 Pd palladium 46 | 107.9 Ag silver 47 | 112.4 Cd cadmium 48 | | 114.8 In indium 49 | 118.7 Sn tin 50 | 121.8 Sb antimony 51 | 127.6 Te tellurium 52 | 126.9 I iodine 53 | 131.3 Xe xenon 54 |
| 132.9 Cs caesium 55 | 137.3 Ba barium 56 | 138.9 La * lanthanum 57 | 178.5 Hf hafnium 72 | 180.9 Ta tantalum 73 | 183.8 W tungsten 74 | 186.2 Re rhenium 75 | 190.2 Os osmium 76 | 192.2 Ir iridium 77 | 195.1 Pt platinum 78 | 197.0 Au gold 79 | 200.6 Hg mercury 80 | | 204.4 Tl thallium 81 | 207.2 Pb lead 82 | 209.0 Bi bismuth 83 | [209] Po polonium 84 | [210] At astatine 85 | [222] Rn radon 86 |
| [223] Fr francium 87 | [226] Ra radium 88 | [227] Ac † actinium 89 | [267] Rf rutherfordium 104 | [270] Db dubnium 105 | [269] Sg seaborgium 106 | [270] Bh bohrium 107 | [270] Hs hassium 108 | [278] Mt meitnerium 109 | [281] Ds darmstadtium 110 | [281] Rg roentgenium 111 | [285] Cn copernicium 112 | | [286] Nh nihonium 113 | [289] Fl flerovium 114 | [289] Mc moscovium 115 | [293] Lv livermorium 116 | [294] Ts tennessine 117 | [294] Og oganesson 118 |

* 58 – 71 Lanthanides

| 140.1 Ce cerium 58 | 140.9 Pr praseodymium 59 | 144.2 Nd neodymium 60 | [145] Pm promethium 61 | 150.4 Sm samarium 62 | 152.0 Eu europium 63 | 157.3 Gd gadolinium 64 | 158.9 Tb terbium 65 | 162.5 Dy dysprosium 66 | 164.9 Ho holmium 67 | 167.3 Er erbium 68 | 168.9 Tm thulium 69 | 173.0 Yb ytterbium 70 | 175.0 Lu lutetium 71 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

† 90 – 103 Actinides

| 232.0 Th thorium 90 | 231.0 Pa protactinium 91 | 238.0 U uranium 92 | [237] Np neptunium 93 | [244] Pu plutonium 94 | [243] Am americium 95 | [247] Cm curium 96 | [247] Bk berkelium 97 | [251] Cf californium 98 | [252] Es einsteinium 99 | [257] Fm fermium 100 | [258] Md mendelevium 101 | [259] No nobelium 102 | [262] Lr lawrencium 103 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Task 9 | Atoms |
|---|---|

1. Give the atomic number of:

    a. Osmium
    b. Lead
    c. Sodium
    d. Chlorine

2. Give the relative atomic mass ($A_r$) of:

    a. Helium
    b. Francium
    c. Barium
    d. Oxygen

3. What is the number of neutrons in each of the following elements?

    a. Fluorine
    b. Beryllium
    c. Gold

| Task 10 | Formulae of common compounds |
|---|---|

State the formulae of the following compounds:

1. Methane

2. Sulfuric acid

3. Potassium manganate (VII)

4. Water

| Task 11 | Ions and iconic compounds |
|---------|---------------------------|

The table below lists the formulae of some common ions.

| Positive ions | | Negative ions | |
|---------------|---------|---------------|---------|
| **Name** | **Formula** | **Name** | **Formula** |
| Aluminium | $Al^{3+}$ | Bromide | $Br^-$ |
| Ammonium | $NH_4^+$ | Carbonate | $CO_3^{2-}$ |
| Barium | $Ba^{2+}$ | Chloride | $Cl^-$ |
| Calcium | $Ca^{2+}$ | Fluoride | $F^-$ |
| Copper(II) | $Cu^{2+}$ | Iodide | $I^-$ |
| Hydrogen | $H^+$ | Hydroxide | $OH^-$ |
| Iron(II) | $Fe^{2+}$ | Nitrate | $NO_3^-$ |
| Iron(III) | $Fe^{3+}$ | Oxide | $O_2^-$ |
| Lead | $Pb^{2+}$ | Sulfate | $SO_4^{2-}$ |
| Lithium | $Li^+$ | Sulfide | $S^{2-}$ |
| Magnesium | $Mg^{2+}$ | | |
| Potassium | $K^+$ | | |
| Silver | $Ag^+$ | | |
| Sodium | $Na^+$ | | |
| Zinc | $Zn^{2+}$ | | |

Use the table to state the formulae for the following ionic compounds.

1. Magnesium bromide

2. Barium oxide

3. Zinc chloride

4. Ammonium chloride

5. Ammonium carbonate

6. Aluminium bromide

7. Calcium nitrate

8. Iron (II) sulfate

9. Iron (III) sulfate

| Task 12 | Empirical formula |

Use the periodic table on page 21 to help you answer these questions.

1.  The smell of a pineapple is caused by ethyl butanoate.
    A sample is known to contain:

    0.360 g of carbon
    0.060 g of hydrogen
    0.160 g of oxygen.

    What is the empirical formula of ethyl butyrate?

2.  What is the empirical formula of a compound containing:

    0.479 g of titanium
    0.180 g of carbon
    0.730 g of oxygen

3.  A 300g sample of a substance is analysed and found to contain only carbon, hydrogen and oxygen.
    The sample contains 145.9 g of carbon and 24.32 g of hydrogen.

    What is the empirical formula of the compound?

4.  Another 300 g sample is known to contain only carbon, hydrogen and oxygen.
    The percentage of carbon is found to be exactly the same as the percentage of oxygen.
    The percentage of hydrogen is known to be 5.99%.

    What is the empirical formula of the compound?

| Task 13 | Balancing equations |
| --- | --- |

1. Write balanced symbol equations for the following reactions.

   You'll need to use the information on the previous pages to work out the formulae of the compounds.

   Remember some of the elements may be diatomic molecules.

   a. Aluminium + oxygen → aluminium oxide

   b. Methane + oxygen → carbon dioxide + water

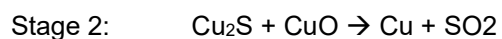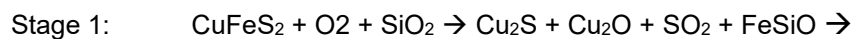   c. Calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

2. Chalcopyrite is a sulfide mineral with formula $CuFeS_2$.

   Chalcopyrite is the most important copper ore. It is a sulfide mineral, a member of iron (2+) sulfides and a copper sulfide.

   Copper can be produced from rock that contains $CuFeS_2$ in two stages.

   Balance the equations for the two stages in this process.
   **Hint: remember that sometimes fractions have to be used to balance equations.**

   Stage 1: $CuFeS_2 + O_2 + SiO_2 \rightarrow Cu_2S + Cu_2O + SO_2 + FeSiO \rightarrow$

   Stage 2: $Cu_2S + CuO \rightarrow Cu + SO_2$

| Task 14 | Moles |
|---------|-------|

The amount of a substance is measured in moles (the SI unit). The mass of one mole of a substance in grams is numerically equal to the relative formula mass of the substance. One mole of a substance contains the same number of the stated particles, atoms or ions as one mole of any other substance. The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is

$6.02 \times 10^{23}$ per mole.

Complete the table. Use the periodic table on page 21 to help you.

| Substance | Mass of substance in grams | Amount in moles | Number of particles |
|-----------|---------------------------|-----------------|---------------------|
| Helium | | | $18.12 \times 10^{23}$ |
| Chlorine (Cl) | 14.2 | | |
| Methane | | 4 | |
| Sulfuric acid | 4.905 | | |

| Task 15 | Isotopes and calculating relative atomic mass |
|---------|-----------------------------------------------|

1. What is the relative atomic mass of bromine if the two isotopes $^{79}$Br and $^{81}$Br exist in equal amounts?

2. A sample of neon is made up of three isotopes:

   $^{20}$Ne accounts for 90.9%
   $^{21}$Ne accounts for 0.3%
   $^{22}$Ne accounts for 8.8%.

   What is the relative atomic mass of neon?
   Give your answer to 4 significant figures.

3. Copper's isotopes are $^{63}$Cu and $^{65}$Cu.

If the relative atomic mass of copper is 63.5, what are the relative abundances of these isotopes?

# Extended writing

The ability to write coherently in a logical, well-structured way is an essential skill to develop. At GCSE the 6-mark extended response questions are used so students can demonstrate this skill. At A-level you will still need to write precise answers using the correct scientific language.

The command word in a question, like at GCSE, is important as it gives you an indication of what to include in your answers. For example, 'explain' means you must give reasons why things are happening, not just give a description. A comparison needs advantages and disadvantages or points for and against.

| Task 16 | Types of bonding |
|---------|------------------|
| Compare the similarities and differences between ionic, covalent and metallic bonding. | |