HAMMERSMITH Academy

A Level Chemistry Transition Booklet

Welcome to Chemistry!

It is fair to say that the A level chemistry course is a significant step up from GCSE. This pack has been designed to help you bridge the gap from GCSE to A Level.

What can you do with your A Level?

With an A level in chemistry you will have shown that you possess a wide range of key skills that are valued by employers and universities. There is no other A level subject that covers such a wide range of transferable skills – foremost amongst these is attention to detail, but you will also need to develop mathematical skills, essential in problem-solving and in practical work, and skill in written expression, needed to produce clear, concise explanations. Chemistry explains the world around us, is an essential stepping stone to studying medicine, and will be at the forefront of the search for solutions to the global climate crisis. However, graduates of chemistry are highly valued in the financial world (accountancy or in the City), in management positions (either with specific companies or as management consultants), and in information technology (programming or running corporate computer networks). Many go on to become lawyers and even teachers!

Organising your learning

In September you will be issued with an exercise book and a manila wallet. The book will be for making notes and working independently in class. The wallet will be for storing your assessed tasks, so that we have a picture of your progress across the year, and so that you have a useful bank of resources to refer to when it comes to revision.
You will be expected to keep a supply of A4 lined paper that you can use to submit homework and to organize your notes.

How hard is this chemistry course going to be?

Chemistry is possibly the toughest A Level to have chosen! It shall be hard work and those that work the hardest, do the best. Over the course you will have approximately five hours of lessons a week. In these lessons you will cover all the theory and practical skills that you will need.
The biggest differences between GCSE and A level are:

- The requirement for you to be on top of all of your work on the time, and to be proactive in consolidating your understanding **before** the next lesson;
- The need for attention to detail: the language, the measurements, the calculations, and the diagrams involved in chemistry require a high degree of clarity at all times

There is plenty of support available to you, and the students who make most use of that support are the ones who do the best. Your main options should include consulting with your peers, looking at recommended resources, and coming to see your teachers. It is

essential that you quickly work out who you work best with, when you work best, and how you work best; there will always be somewhere for you to sit in the academy and work.

Additional support and expectations for starting the A level chemistry course includes:

- **Use the specification**

You will be expected to use a copy of the specification to monitor your own progress and structure your own revision. You need to know what you know and what you don't! You will use the first session to look at the specification in more detail.

- **Reading before a lesson**

You will be expected to read ahead, and to attend lessons with an awareness of the topic, and questions about things that are unclear to you. This maximises the effectiveness of our learning time.

- **Reading after a lesson**

Once your notes have been completed from a lesson, you will be expected to spend time in your non-contact periods, and at home, consolidating them.
Consolidation of your notes means that you refer to the specification, the textbook, and additional resources, and write an improved version of your notes for filing. This process should result in you feeling completely confident in your understanding of the topic. Anything you do not understand after this consolidation should be written down and brought as questions to your next lesson.
You should also read around the subject, taking an interest in latest developments and going beyond the specification. By doing this broader reading you reinforce your use of key terminology, your understanding of key topics and improve your ability to do well in university interviews for chemistry and chemistry-related courses.

- **Notes and Practice Exam Questions**

Your exercise book is for use in class; it is not a revision guide and does not act as your 'notes'.
You will be expected to make notes in lessons, work independently to answer questions, and complete homework tasks; these should be organized in a folder by topic. These folders can be supplied by the academy.

- **Websites**

Teams – You will automatically be a member of the class Team. The most important aspect of this is the Class Notebook, which will allow you access to annotated versions of all activities undertaken in class.

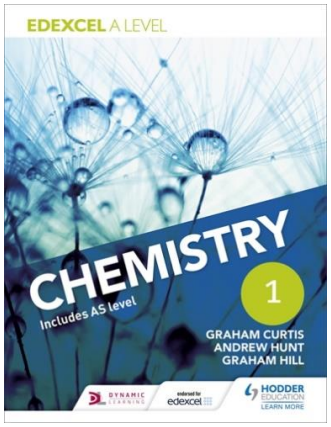
https://hamacad.sharepoint.com/sites/HA_Subjects_CH: This is where the recommended resources and lesson resources will be available

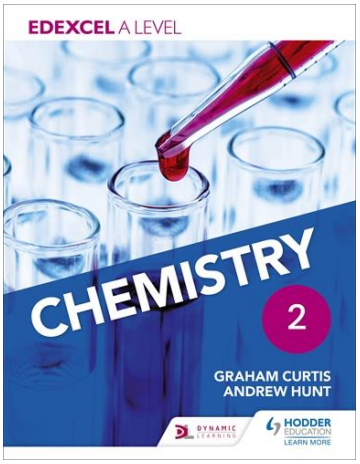
https://www.satchelone.com/login: This is where all your homework and assignments will be issued. Download the app and this will help you manage your workload across all subjects during the week.

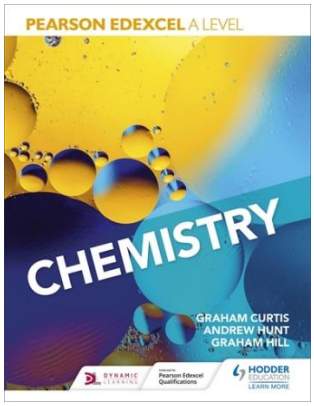
https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/chemistry-2015.html is the Edexcel chemistry website where materials including the specification and details about the core practicals are published.

- **Learning Resources**

The textbooks below match the course, and will be useful to you. There are other text books and learning resources that will be discussed when you join the course.
We do not provide hard copies of the text books, but a pdf is available.

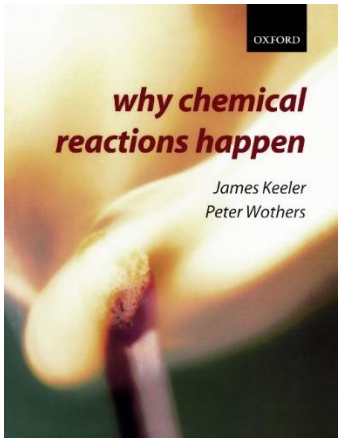


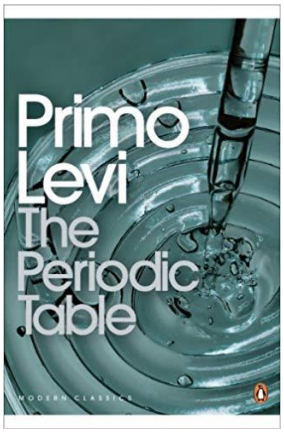




- **Recommended Reading**

We will use excerpts from Chemistry Review magazine in lessons from time to time. This is an excellent source of wider chemistry reading. We subscribe as a school, and you can also get your own copy (£15 for four issues a year). Sometimes this works well if two or three students share a subscription, so you get to read the whole magazine, but don't have to pay full price. See a teacher about this.





'Why Chemical Reactions Happen' will vastly improve your foundational understanding of chemistry.

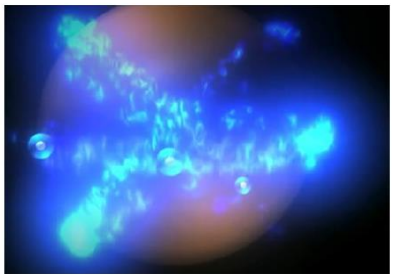
'The Periodic Table' will make you look at chemistry in a different way.

Transition Work

The answers to the questions below should be handed in during your first chemistry lesson. It should be on A4 lined paper and presented carefully. Incomplete or poorly-presented work will be handed back for resubmission. **Failure to complete to an adequate standard will jeopardise your place on the course**.

Task 1

A) Use the link or the QR code to watch the video 'Just how small is an atom?'



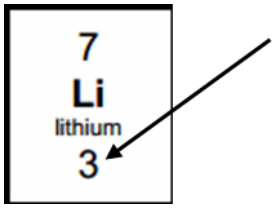
Just how small is an atom?
Available at :
https://www.ted.com/talks/just_how_small_is_an_atom
Just how small are atoms? Really, really, really small. This fast-paced animation from TED-Ed uses metaphors (imagine a blueberry the size of a football stadium!) to give a visceral sense of just how small atoms are.

https://www.ted.com/talks/just_how_small_i s_an_atom

B) Electronic configuration (electrons are arranged around the nucleus)

A periodic table can give you the proton / atomic number of an element, which also tells you how many electrons are in the atom.
You will have used the rule of electrons shell filling, where:
The first shell holds up to 2 electrons, the second up to 8, the third up to 8 and the fourth up to 18 (or you may have been told 8).

Atomic number =3, electrons = 3, arrangement 2 in the first shell and 1 in the second or Li = 2,1



At A level you will learn that the electron configuration is more complex than this and can be used to explain a lot of the chemical properties of elements.
The 'shells' can be broken down into 'orbitals', which are given letters: 's' orbitals, 'p' orbitals and 'd' orbitals.
You can read about orbitals here.

Task

Write your answer in the format: 1s2, 2s2, 2p6 etc.

Q1. Write out the electron configuration of:

a) Ca b) Al c) S d) Cl e) Ar f) Fe g) V h) Ni i) Cu j) Zn

Q2. Extension question, can you write out the electron arrangement of the following ions:

a) K^+ b) O^{2-} c) Zn^{2+} d) V^{5+} e) Co^{2+}

Task 2

Oxidation and Reduction

At GCSE you learnt that oxidation is adding oxygen to an atom or molecule and that reduction is removing oxygen, or that oxidation is removing hydrogen and reduction is adding hydrogen. You may have also learnt that oxidation is losing electrons and reduction is gaining electrons.

At A level we use the idea of oxidation number a lot!

You know that the metals in group 1 react to form ions that are +1, i.e. Na^+ and that group 7, the halogens, form -1 ions, i.e. Br^-

We say that sodium, when it has reacted, has an oxidation number of +1 and that bromide has an oxidation number of -1. All atoms that are involved in a reaction can be given an oxidation number.
An element, Na or O_2, is always given an oxidation state of zero (0). Any element that has reacted has an oxidation state of + or –.

As removing electrons is reduction, if, in a reaction the element becomes more negative it has been reduced, if it becomes more positive it has been oxidised.

You can read about the rules for assigning oxidation numbers here.

Task: Work out the oxidation state of the **underlined** atom in the following:

a) $Mg\underline{C}O_3$ b) $\underline{S}O_3$ c) $Na\underline{Cl}O_3$ d) $\underline{Mn}O_2$ e) $\underline{Fe}_2O_3$ f) $\underline{V}_2O_5$

g) $K\underline{Mn}O_4$ h) $\underline{Cr}_2O_7^{2-}$ i) $\underline{Cl}_2O_4$

Task 3

Mass Spectrometry

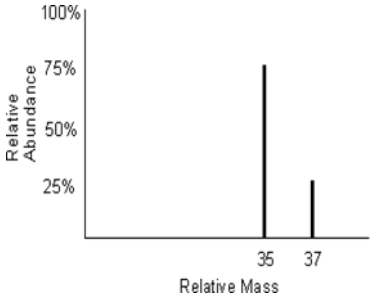
You will remember that isotopes are elements that have differing numbers of neutrons. Hydrogen has 3 isotopes: hydrogen-1; hydrogen-2 (deuterium); and hydrogen-3 (tritium). Isotopes occur naturally, so in a sample of an element you will have a mixture of these isotopes. We can accurately measure the abundance of an isotope using a **mass spectrometer**. You will need to understand what a mass spectrometer is and how it works at A level. You can read about a mass spectrometer here.

Task

Q1. What must happen to the atoms before they are accelerated in the mass spectrometer?

Q2. Explain why the different isotopes travel at different speeds in a mass spectrometer.

A mass spectrum for the element chlorine will give a spectrum like this:



75% of the sample consist of chlorine-35, and 25% of the sample is chlorine-37. We can calculate what the **mean** mass of the sample will be:

Mean mass = $((Mass_1 \times Abundance_1) + (Mass_2 \times Abundance_2)) / 100$

Mean mass = $((35 \times 75) + (37 \times 25)) /100 = 35.5$

If you look at a periodic table, this is why chlorine has an atomic mass of 35.5.

An A level periodic table has the masses of elements recorded much more accurately than at GCSE. Most elements have isotopes, which have been recorded using mass spectrometers.

GCSE

11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9
27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17

A Level

10.8 **B** 5 boron	12.0 **C** 6 carbon	14.0 **N** 7 nitrogen	16.0 **O** 8 oxygen	19.0 **F** 9 fluorine
27.0 **Al** 13 aluminium	28.1 **Si** 14 silicon	31.0 **P** 15 phosphorus	32.1 **S** 16 sulphur	35.5 **Cl** 17 chlorine

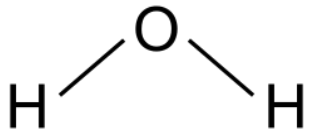
Task

Use the percentages of each isotope to calculate the accurate atomic mass of the following elements:

a. Antimony has 2 isotopes: Sb-121 57.25% and Sb-123 42.75%
b. Gallium has 2 isotopes: Ga-69 60.2% and Ga-71 39.8%
c. Silver has 2 isotopes: Ag-107 51.35% and Ag-109 48.65%
d. Thallium has 2 isotopes: Tl-203 29.5% and Tl-205 70.5%
e. Strontium has **4** isotopes: Sr-84 0.56%, Sr-86 9.86%, Sr-87 7.02% and Sr-88 82.56%

Task 4

Have you ever wondered why your teacher drew a water molecule like this?
The lines represent a covalent bond, but why draw them at an unusual angle? If you are unsure about covalent bonding, read about it here.



At A level you are also expected to explain why molecules have certain shapes. You can read about shapes of molecules here.

Task

Q1. Draw a dot and cross diagram to show the bonding in a molecule of aluminium chloride ($AlCl_3$)
Q2. Draw a dot and cross diagram to show the bonding in a molecule of ammonia (NH_3)
Q3. What is the shape of and bond angle in a molecule of methane (CH_4)?

Task 5

Balancing chemical equations

Balancing chemical equations is the stepping stone to using equations to calculate masses in chemistry. There are loads of websites that give ways of balancing equations and lots of exercises in balancing.

Some of the equations to balance may involve strange chemicals- don't worry about that, the key idea is to get balancing right.

You can practice balancing here.

Task:

Balance the following equations

a. $H_2 + O_2 \rightarrow H_2O$

b. $S_8 + 02 \rightarrow SO_3$

c. $HgO \rightarrow Hg + O_2$

d. $Zn + HCl \rightarrow ZnCl_2 + H_2$

e. $Na + H_2O \rightarrow NaOH + H_2$

f. $Fe + O_2 \rightarrow Fe_2O_3$

g. $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

h. $Fe_2O_3 + H_2 \rightarrow Fe + H_2O$

i. $Al + FeO \rightarrow Al_2O_3 + Fe$

Task 6

Moles: From this point on you need to be using an A level periodic table, not a GCSE one. You can find this on page 111 of the specification.

Now that we have our chemical equations balanced, we need to be able to use them in order to work out masses of chemicals we need or we can produce. The ***mole*** is the chemists equivalent of a dozen. Atoms are so small that we cannot count them out individually, we weigh out chemicals.

For example:magnesium + sulfur → magnesium sulfide

$$Mg + S \rightarrow MgS$$

We can see that one atom of magnesium will react with one atom of sulfur. If we had to weigh out the atoms we need to know how heavy each atom is.

From the periodic table: Mg = 24.3 and S = 32.1

If I weigh out exactly 24.3g of magnesium this will be 1 mole of magnesium. If we counted how many atoms were present in this mass it would be a huge number

(Avogadro's number: 6.02×10^{23}).
If I weigh out 32.1g of sulfur then I would have 1 mole of sulfur atoms.

So 24.3g of Mg will react precisely with 32.1g of sulfur, and will make 56.4g of magnesium sulfide.

Answer the following questions on moles.

a) How many moles of phosphorus pentoxide (P_4O_{10}) are in 85.2g?

b) How many moles of potassium are in 73.56g of potassium chlorate (V) ($KClO_3$)?

c) How many moles of water are in 249.6g of hydrated copper sulfate(VI) ($CuSO_4.5H_2O$)?

   For this one, you need to be aware the dot followed by $5H_2O$ means that the molecule comes with 5 water molecules so these have to be counted in as part of the molecules mass.

d) What is the mass of 0.125 moles of tin sulfate ($SnSO_4$)?

e) If I have 2.4g of magnesium, how many grams of oxygen(O_2) will I need to react completely with the magnesium?

   $2Mg + O_2 \rightarrow MgO$