RIVERSIDE SCHOOL

"EXCELLENCE FOR ALL"

INDUCTION BOOKLET

FOR A LEVEL CHEMISTRY

2021-2022

This booklet will hopefully help bridge the gap between GCSE Chemistry and the A level. Please use it to support your studies over the next two years.

How to use:

Read through the content and specification section to help understand how A Level Chemistry is structured.

Read the recommended reading and watching lists and read or watch something from it every week between now and September.

Complete one of the research activity tasks per week.

Complete one of the GCSE recap tasks per week.

Content and Specification

Throughout the A Level Chemistry course taught at Riverside, students will have the opportunity to study a wide range of chemical topics that will allow them to broaden and deepen their understanding of the world.

Students studying A-level will be following the **OCR** Chemistry A specification. This is a two-year linear course that encompasses six modules that will be formally assessed at the end of the two-year course with 3 papers.

Students will also be trained and assessed across a range of practical skills, which is assessed separately as part of their practical endorsement.

The specification can be found on the OCR website (https://www.ocr.org.uk/Images/171720-specification-accredited-a-level-gce-chemistry-a-h432.pdf) but the key points are listed below.

Content Overview	Assessment Overview	
Content is split into six teaching modules: • Module 1 – Development of practical skills in chemistry • Module 2 – Foundations in chemistry • Module 3 – Periodic table and energy • Module 4 – Core organic chemistry • Module 5 – Physical chemistry and transition elements • Module 6 – Organic chemistry and analysis Component 01 assesses content from modules 1, 2, 3 and 5. Component 02 assesses content from modules 1, 2, 4 and 6. Component 03 assesses content from all modules (1 to 6).	Periodic table, elements and physical chemistry (01) 100 marks 2 hours 15 minutes written paper	**37%** of total A level
	Synthesis and analytical techniques (02) 100 marks 2 hours 15 minutes written paper	**37%** of total A level
	Unified chemistry (03) 70 marks 1 hour 30 minutes written paper	**26%** of total A level
	Practical Endorsement in chemistry (04) (non exam assessment)	Reported separately (see Section 5)

Summary of the content:

Module 1 – Development of practical skills in chemistry

- Practical skills assessed in a written examination
- Practical skills assessed in the practical endorsement

Module 2 – Foundations in chemistry

- Atoms, compounds, molecules and equations
- Amount of substance
- Acid–base and redox reactions
- Electrons, bonding and structure

Module 3 – Periodic table and energy

- The periodic table and periodicity
- Group 2 and the halogens
- Qualitative analysis
- Enthalpy changes
- Reaction rates and equilibrium (qualitative)

Module 4 – Core organic chemistry

- Basic concepts
- Hydrocarbons
- Alcohols and haloalkanes
- Organic synthesis
- Analytical techniques (IR and MS)

Module 5 – Physical chemistry and transition elements

- Reaction rates and equilibrium (quantitative)
- pH and buffers
- Enthalpy, entropy and free energy
- Redox and electrode potentials
- Transition elements

Module 6 – Organic chemistry and analysis

- Aromatic compounds
- Carbonyl compounds
- Carboxylic acids and esters
- Nitrogen compounds
- Polymers
- Organic synthesis
- Chromatography and spectroscopy (NMR)

Module 1 is covered over both years.

Modules 2, 3 and 4 are completed in Year 12

Modules 5 and 6 are completed in Year 13

Suggested reading list for A level Chemists

Magazines, Newspapers & Journals - these also have free content on their websites

New Scientist - www.newscientist.com

BBC Science Focus - www.sciencefocus.com

Chemistry world - www.chemistryworld.com

Any scientific articles in newspapers

Websites

• https://www.rsc.org/ - Royal Society of Chemistry's site containing chemical news and educational resources

•https://www.rsc.org/periodic-table - Interactive periodic table

• https://www.physicsandmathstutor.com/ - Also contains chemistry revision content and exam questions

• http://www.chm.bris.ac.uk/motm/motm.htm - Molecule of the month website

• http://www.nobelprize.org – Details of the history of the best scientific discoveries

• https://www.sciencemuseum.org.uk/objects-and-stories/chemistry – Chemistry related objects and stories from London Science Museum

• https://www.royalsociety.org – Podcasts, news and interviews with scientists about recent scientific developments

• www.bbc.co.uk/news/science_and_environment - The BBC news page for Science and the Environment

Books

This is a mixture of pure chemistry books and other science books that link to A Level Chemistry in some way or another. Research a few to see which look interesting to you and try to read some before starting the course and some during the course.

Hugh Aldersey-Williams: Periodic Tales: The Curious Lives of the Elements

Andy Brunning: Why Does Asparagus Make Your Wee Smell?: And 57 other curious food and drink questions

Bill Bryson: A Short History of Nearly Everything

John Emsley: The Elements of Murder: A History of Poisons

Chemistry at Home: Exploring the Ingredients in Everyday Products

Ben Goldacre: Bad Science

Theodore Gray: Elements: A Visual Exploration of Every Known Atom in the Universe

Reactions: An Illustrated Exploration of Elements, Molecules, and Change in the Universe

Primo Levi: The Periodic Table

Sam Kean: Caesar's Last Breath: Decoding the Secrets of the Air Around Us

The Disappearing Spoon...and other true tales from the Periodic Table

Mark Miodownik: Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World

Randall Munroe: What If?: Serious Scientific Answers to Absurd Hypothetical Questions

Mark Schatzker: The Dorito Effect: The Surprising New Truth About Food and Flavor

George Zaiden: Ingredients: The Strange Chemistry of What We Put in Us and on Us

To watch:

Films and TV shows:

There are few films that have strong links to chemistry and very few that display it even remotely accurately. The following have some strong links to the A Level specification.

Dark Waters (2019) – legal thriller based on the true story of Robert Bilott's case against the chemical manufacturing corporation DuPont after they contaminated a town with unregulated chemicals

An Inconvenient Truth (2006) – documentary about former US Vice President Al Gore's campaign to educate the world about global warming

The Martian (2015) – science fiction film about an astronaut's struggle to survive after being left alone on Mars

Chemistry: A Volatile History (2010) – BBC series about how the elements were discovered and mapped

Youtube channels:

Periodic videos - https://www.youtube.com/user/periodicvideos/videos

Videos produced by the University of Nottingham. Short videos about every element and lots of experiments shown and conducted.

Reactions - https://www.youtube.com/user/ACSReactions/featured

Videos produced by the American Chemical Society uncovering the chemistry all around us

Chemistry at The University of Manchester - https://www.youtube.com/channel/UCXf3CFkyGpa2eleT5wz_Prw

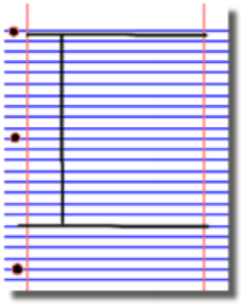
Videos explaining the research done at the University of Manchester's chemistry department

Research activities:

The following tasks are designed to help you to develop your independent study skills which is a key skill for all A-level students. It comprises of a variety of tasks that will help you strength your key concepts from GCSE and push towards A-level content.

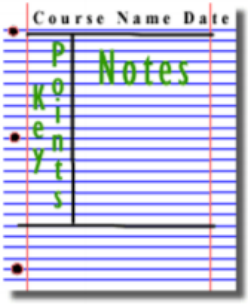
Research, reading and note making are essential skills for A level Biology study. For the following task you are going to produce 'Cornell Notes' to summarise your reading.

1. Divide your page into three sections like this

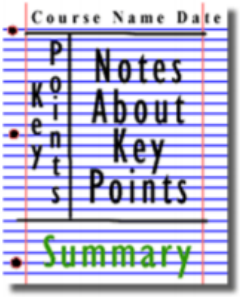


2. Write the name, date and topic at the top of the page

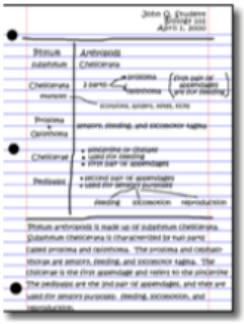
3. Use the large box to make notes. Leave a space between separate idea. Abbreviate where possible.



4. Review and identify the key points in the left hand box

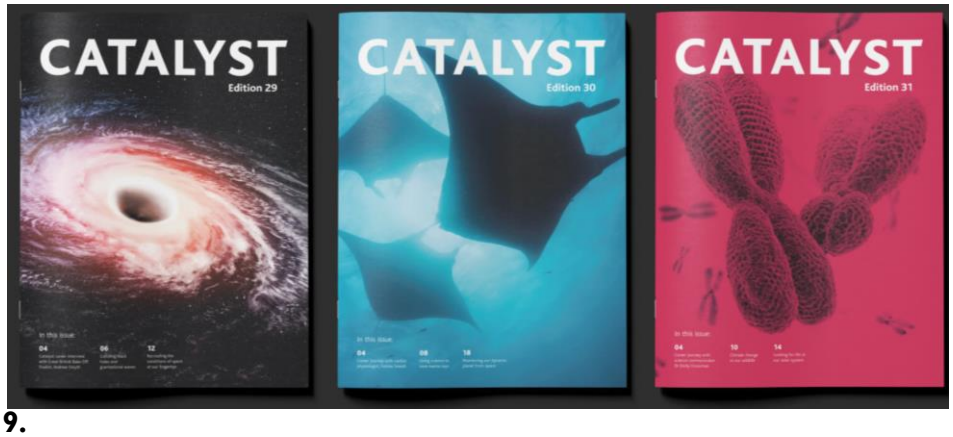


5. Write a summary of the main ideas in the bottom space



Images taken from http://coe.jmu.edu/learningtoolbox/cornellnotes.htm

Catalyst is a topical magazine that offers features on a wide range of themes from the science curriculum bringing them to life with insights into cutting-edge research and practical applications of complex science in the world around us. Catalyst magazine is aimed mainly at science students aged 14-19.



For each of the following topics, you are going to use the resources to produce one page of Cornell style notes. Use the links to take you to the resources.

Topic 1: Process Chemistry https://www.stem.org.uk/rxuv6

A Catalyst article describing how process chemists work in the pharmaceutical industry, devising methods of making new drugs. Process chemists are a link in the chain from an initial idea to a new drug making it to the market. It generally takes at least 10 years from an idea by a medicinal chemist to a new treatment for patients – during this time, the process chemist devises the best possible method for producing the drug in large quantities. This article describes the role that the process chemist plays.

This article is from Catalyst: Secondary Science Review 2008, Volume 19, Issue 1.

Topic 2: Plastics: an Insoluble Problem https://www.stem.org.uk/rxv3o

A Catalyst article about the problems of recycling plastics. The article looks at novel uses for products made from recycled plastics. It also looks at the make-up of polymers and the history of their manufacture. Finally, alternatives to plastics are examined.

This article is from Catalyst: GCSE Science Review 2002, Volume 13, Issue 1.

Topic 3: Mass Spectroscopy https://www.stem.org.uk/rxstx

This resource looks at how cutting-edge science is being used to answer archaeological questions, as well as solving present day problems, such as the identification of meat in processed foods. Analysis of mitochondrial DNA was performed, at the University of York, on samples from skeletal remains unearthed by the University of Leicester. The remains were thought to be those of the King Richard III. Five centuries after its burial, a range of techniques were used to identify the skeleton.

This resource funded by Research Councils UK (RCUK)

Topic 4: Carbon Capture https://www.stem.org.uk/rxuut

A Catalyst article explaining how carbon capture and storage can reduce the amount of carbon dioxide entering the atmosphere and may reduce the effects of climate change. Burning fossil fuels releases carbon dioxide into the atmosphere. This is a major contributor to climate change but can CO2 be captured and stored as it is produced? This article describes progress in the science and technology of carbon capture.

This article is from Catalyst: GCSE Science Review 2010, Volume 20, Issue 4.

A level Chemistry will use your knowledge from GCSE and build on this to help you understand new and more demanding ideas. Complete the following tasks to make sure your knowledge is up to date and you are ready to start studying:

1. The atom

Knowledge of the structure of an atom is obviously a key concept for chemistry and your understanding will increase during AS, especially in terms of electron structure. An understanding of the size and scale of the atom is also useful in understanding the difficulty of studying it. Understanding of the model of the atom developed helps you to understand how new evidence can change scientific theories. This task will ensure that your knowledge from GCSE is up to date and allow you to touch upon some A Level concepts and some wider reading.

Read the information on these websites (you could make more Cornell notes if you wish):

https://www.bbc.co.uk/bitesize/guides/z3sg2nb/revision/1 - this is all GCSE knowledge but ensure you are familiar with all of it – cover all six sections

https://www.dummies.com/education/science/chemistry/atomic-structure-the-quantum-mechanical-model/ - this is more optional, touches on AS content so read to the extent you are happy with it

https://science.howstuffworks.com/environmental/earth/geology/carbon-14.htm - explains how isotopes can be useful, in this case in working out how old something is

Watch/use at these videos/interactives:

https://www.youtube.com/watch?v=NSAgLvKOPLQ – history of the atoms, key models including quantum model

https://www.youtube.com/watch?v=yQP4UJhNn0I – video helping you understand how small an atom really is and how small the subatomic particles are

https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html - change numbers of subatomic particles and see how it affects mass number, atomic number and charge. Have a go at the game section, a decent way to apply your knowledge

Task: Produce a two-page revision guide summarising:

The structure of the atom on one page and a timeline covering the history of the atom on the other. Your revision guide should include: Key words and definitions, clearly labelled diagrams, short explanations of key ideas, names of key scientists and dates of their discoveries, analogies to understand the scale of the atom.

2. The mole

Atoms are so very tiny that we never want to consider the interactions between single atoms during a chemical reaction. We use moles to describe the amount of chemicals involved. The mole can be a tricky concept for some pupils to get their heads around. This task recalls some GCSE information and helps you to understand the history and size of the mole.

Read the information on these websites (you could make more Cornell notes if you wish):
https://www.bbc.co.uk/bitesize/guides/z24xcj6/revision/1 - this mostly recaps GCSE content though the number of particles equation is new content so do learn it properly. Try the test section as well.

If you don't remember concepts that come up such as M_r then cover that again using your GCSE text book or search online

http://www.docbrown.info/page04/4_73calcs07mam.htm - similar information. Slightly hard to read but gives lots of examples of working out

Watch this video:

https://www.ted.com/talks/daniel_dulek_how_big_is_a_mole_not_the_animal_the_other_one?language=en – video showing the scale of the mole

Task: One page sheet of key definitions and equations you have learnt in the sections above.

https://1.cdn.edl.io/BMx4x5UdA7gWvoSwHqF08OnWaFtUK0Ya3C1hRiQrQq79rZib.pdf - answer the questions on this page. Answers and working out are below to help you understand.

http://www.docbrown.info/page04/4_73calcs/MAMsaTEST.htm - answer the questions on this website. Can refresh the same quiz for different questions until you are happy with the calculations involved.

3. Chemical bonding

A chemical bond is a lasting attraction between atoms, ions or molecules that enables the formation of chemical compounds. The bond may result from the electrostatic force of attraction between oppositely charged ions as in ionic bonds or through the sharing of electrons as in covalent bonds.

Read the information on these websites. Split your page into three columns and recap GCSE content on covalent, ionic and metallic bonding. Have a look at the section titled shapes of molecules. This is A-level content which you will be looking into now.

https://www.bbc.co.uk/bitesize/guides/z6k6pbk/revision/1

https://alevelnotes.com/notes/chemistry/elements-of-life/bonding

Complete the following quiz: https://www.quia.com/quiz/258608.html?AP_rand=432830619

Watch the following video showing shapes of molecules and make a similar table shown in the video in your notes:

https://www.youtube.com/watch?v=sjFH_q3Wgy0

Read the information found on this website and add to your notes on shapes of molecules: https://www.chemguide.co.uk/atoms/bonding/shapes.html#top

Task: Complete the questions found on the following link: https://www.chemguide.co.uk/atoms/questions/q-shapes1.pdf

4. Introduction to organic chemistry

Carbon can form covalent bonds with itself and other elements to create a mind-boggling array of structures. In organic chemistry, we will learn about the reactions chemists use to synthesize crazy carbon based structures, as well as the analytical methods to characterize them. We will also think

about how those reactions are occurring on a molecular level with reaction mechanisms. Simply put, organic chemistry is like building with molecular Legos.

Read the information on these websites. Make a two-page summary on alkanes and alkenes. Include a table for naming alkanes and alkenes.

https://www.bbc.co.uk/bitesize/guides/zvvwxnb/revision/2

https://www.bbc.co.uk/bitesize/guides/zb6bcj6/revision/4

Complete the following quiz: https://www.bbc.co.uk/bitesize/guides/zb6bcj6/test

Watch the following video on naming hydrocarbons and make notes:
https://www.youtube.com/watch?v=0Zg8CLk_G6Y

Add to your notes using the following website:
https://www.chemguide.co.uk/basicorg/conventions/names.html

Practice and name the following hydrocarbons found on the following link:
https://www.saddleback.edu/faculty/jzoval/worksheets_tutorials/ch4worksheets/naming_hydrocarbons_worksheet1_key_12_26_08.pdf