Adapted by C Francis April 2020

Countesthorpe Leysland Community College

Transition Pack for A Level Chemistry

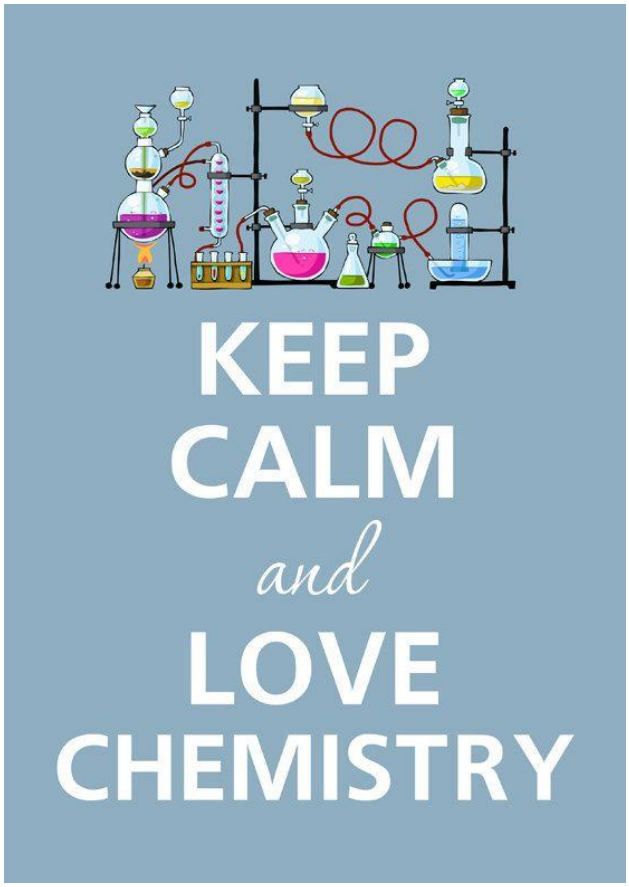
Get ready for A-level!

A guide to help you get ready for A-level Chemistry, including everything from topic guides to interesting reads and online learning courses.

Commissioned by The PiXL Club Ltd. February 2016

Please note: these resources are non-board specific. Please direct your students to the specifics of where this knowledge and skills most apply.

So you have chosen to study A Level Chemistry?



This pack contains a programme of activities and resources to prepare you to start an A level in Chemistry in September. It is designed for you to complete throughout the remainder of the summer term to help you prepare for your course in September.

Deadline 22nd June 2020.

So what's it like to study A level Chemistry at CLCC?

Your teachers:

- Dr Francis (Head of Chemistry) cfrancis@clcc.college
- Mr Carr (Teaches Year 12 and 13) pcarr@clcc.college

Your course:

- Following OCR A (from 2015) exam board
- All students are expected to complete the full A level course, we do not sit AS level exams.

  To find out more about the course or view the specification use this link:

  https://www.ocr.org.uk/qualifications/as-and-a-level/chemistry-a-h032-h432-from-2015/specification-at-a-glance/

The course content is split into six teaching modules:

- Module 1 – Development of practical skills in chemistry- this is taught throughout the course, not as an individual unit and involves completing a series of assessed practicals during the course alongside other practicals used for skill development and understanding concepts.
- Module 2 – Foundations in chemistry- This is a bridging unit between GCSE and AS and makes sure you understand the key concepts that underpin chemistry such as formulae and equations, moles, concentrations, oxidation and reduction, titration, electronic structure, bonding and shapes of molecules.
- Module 3 – Periodic table and energy – This looks in detail at trends in the periodic table, introduces you to the idea of ionisation energy, looks at understanding in more detail and being able to calculate energy changes in reactions, further ideas into rates of reaction and equilibrium.
- Module 4 – Core organic chemistry- Beginning with familiar ideas about alkanes and alkenes from GCSE we build on knowledge of naming organic compounds, introducing branching, isomerism and new functional groups such as haloalkanes, aldehydes and ketones. We also develop ideas about reaction mechanisms and synthesis and analysis of organic compounds.
- Module 5 – Physical chemistry and transition elements- taught in year 13 develops ideas from AS and GCSE on Equilibria, rates of reaction, Redox, enthalpy and entropy, transition metals and pH, preparing students for further study at university.
- Module 6 – Organic chemistry and analysis- Taught in year 13 this builds on ideas learned in AS and GCSE about organic compounds, learning about aromatic ring structures as well as further functional groups and more complex mechanism, isomers and synthesis of new compounds. We also put together a variety of analytical techniques to identify unknown organic compounds.

Section title:

Key ideas identified:

Key word definitions:

What previous topics does this link to?

Where can this topic be found in your textbook?

Useful diagrams/tables etc..

Questions I need to ask in the lesson

Pre-Knowledge Topics- All must be completed

You have come across most of these concepts to some degree at GCSE but it is really important you understand them as they are fundamental ideas in Chemistry. Take the time to make sure you can complete these tasks fully- use the links for help and guidance. You could always email myself or Mr Carr if you get really stuck! Use the flipped learning sheet on the previous page to help you lay out your notes, we use it for pre-reading tasks at A level so you can get some practise at using it as you work through the tasks. If you can't print it out at home, you can just copy out the format onto your paper.

Chemistry topic 1 – 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 chemical, don't worry about that, the key idea is to get balancing right.

http://bit.ly/pixlchem7

http://www.chemteam.info/Equations/Balance-Equation.html

This website has a download; it is safe to do so:

http://bit.ly/pixlchem8

https://phet.colorado.edu/en/simulation/balancing-chemical-equations

Q5.1 Balance the following equations

a. $H_2 + 0_2 \rightarrow H_20$

b. $S_8 + 02 \rightarrow SO_3$

c. $HgO \rightarrow Hg + 0_2$

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

e. $Na + H_20 \rightarrow NaOH + H_2$

f. $C_{10}H_{16} + Cl_2 \rightarrow C + HCl$

g. $Fe + 0_2 \rightarrow Fe_20_3$

h. $C_6H_{12}O_6 + 0_2 \rightarrow C0_2 + H_20$

i. $Fe_20_3 + H_2 \rightarrow Fe + H_20$

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

Chemistry topic 2 – Measuring chemicals – the mole

From this point on you need to be using an A level periodic table, not a GCSE one you can view one here:

http://bit.ly/pixlpertab

https://secondaryscience4all.files.wordpress.com/2014/08/filestore_aqa_org_uk_subjects_aqa-2420-w-trb-ptds_pdf.png

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 → 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 (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.

Here is a comprehensive page on measuring moles, there are a number of descriptions, videos and practice problems.

You will find the first 6 tutorials of most use here, and problem sets 1 to 3.

http://bit.ly/pixlchem9

http://www.chemteam.info/Mole/Mole.html

Q6.1 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 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 g of oxygen(O_2) will I need to react completely with the magnesium? $2Mg + O_2 \rightarrow MgO$

Chemistry topic 3 – Solutions and concentrations

In chemistry a lot of the reactions we carry out involve mixing solutions rather than solids, gases or liquids.

You will have used bottles of acids in science that have labels saying 'Hydrochloric acid 1M', this is a solution of hydrochloric acid where 1 mole of HCl, hydrogen chloride (a gas) has been dissolved in 1dm^3 of water.

The dm^3 is a cubic decimetre, it is actually 1 litre, but from this point on as an A level chemist you will use the dm^3 as your volume measurement.

http://bit.ly/pixlchem10

http://www.docbrown.info/page04/4_73calcs11msc.htm

Q7.1

a) What is the concentration (in mol dm^{-3}) of 9.53g of magnesium chloride ($MgCl_2$) dissolved in 100cm^3 of water?
b) What is the concentration (in mol dm^{-3}) of 13.248g of lead nitrate ($Pb(NO_3)_2$) dissolved in 2dm^3 of water?
c) If I add 100cm^3 of 1.00 mol dm^3 HCl to 1.9dm^3 of water, what is the molarity of the new solution?
d) What mass of silver is present in 100cm^3 of 1moldm^{-3} silver nitrate ($AgNO_3$)?
e) The Dead Sea, between Jordan and Israel, contains 0.0526 moldm^{-3} of Bromide ions (Br^-), what mass of bromine is in 1dm^3 of Dead Sea water?

Chemistry topic 4 – Titrations

One key skill in A level chemistry is the ability to carry out accurate titrations, you may well have carried out a titration at GCSE, at A level you will have to carry them out very precisely **and** be able to describe in detail how to carry out a titration - there will be questions on the exam paper about how to carry out practical procedures.

You can read about how to carry out a titration here, the next page in the series (page 5) describes how to work out the concentration of the unknown.

http://bit.ly/pixlchem11

http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/further_analysis/analysing_substances/revision/4/

Remember for any titration calculation you need to have a balanced symbol equation; this will tell you the ratio in which the chemicals react.

E.g. a titration of an unknown sample of sulfuric acid with sodium hydroxide.

A 25.00cm^3 sample of the unknown sulfuric acid was titrated with 0.100$moldm^{-3}$ sodium hydroxide and required exactly 27.40cm^3 for neutralisation. What is the concentration of the sulfuric acid?

Step 1: the equation $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

Step 2; the ratios 2 : 1

Step 3: how many moles of sodium hydroxide $27.40cm^3 = 0.0274dm^3$

number of moles = c x v = 0.100 x 0.0274 = 0.00274 moles

step 4: Using the ratio, how many moles of sulfuric acid

for every 2 NaOH there are 1 H_2SO_4 so, we must have 0.00274/2 =0.00137 moles of H_2SO_4

Step 5: Calculate concentration. concentration = moles/volume ←in dm^3 = 0.00137/0.025 = ***0.0548 moldm^{-3}***

Here are some additional problems, which are harder, ignore the questions about colour changes of indicators.

http://bit.ly/pixlchem12

http://www.docbrown.info/page06/Mtestsnotes/ExtraVolCalcs1.htm

Use the steps on the last page to help you

Q8.1 A solution of barium nitrate will react with a solution of sodium sulfate to produce a precipitate of barium sulfate.

$Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$

What volume of 0.25$moldm^{-3}$sodium sulfate solution would be needed to precipitate all of the barium from 12.5cm^3 of 0.15 $moldm^{-3}$ barium nitrate?

Chemistry topic 5 – Organic chemistry – functional groups

At GCSE you would have come across **hydrocarbons** such as alkanes (ethane etc) and alkenes (ethene etc). You may have come across molecules such as alcohols and carboxylic acids. At A level you will learn about a wide range of molecules that have had atoms added to the carbon chain. These are called functional groups, they give the molecule certain physical and chemical properties that can make them incredibly useful to us.

Here you are going to meet a selection of the functional groups, learn a little about their properties and how we give them logical names.

You will find a menu for organic compounds here:

http://bit.ly/pixlchem13

http://www.chemguide.co.uk/orgpropsmenu.html#top

And how to name organic compounds here:

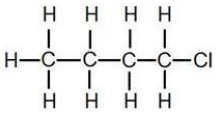
http://bit.ly/pixlchem14

http://www.chemguide.co.uk/basicorg/conventions/names.html#top

Using the two links see if you can answer the following questions:

Q9.1 Halogenoalkanes

What is the name of this halogenoalkane?



How could you make it from butan-1-ol?

Q9.2 Alcohols

How could you make ethanol from ethene?

How does ethanol react with sodium, in what ways is this a) similar to the reaction with water, b) different to the reaction with water?

Q9.3 Aldehydes and ketones

Draw the structures of a) propanal b) propanone

How are these two functional groups different?

Careers- Complete all tasks

You may already have an idea about what you want to do beyond GCSE and A levels or you may have chosen your A level courses based on the topics you enjoy either way investigating the types of careers that a Chemistry course can lead you into might surprise you and inspire you.

Visit the following websites: -

https://edu.rsc.org/future-in-chemistry?_ga

https://www.prospects.ac.uk/careers-advice/what-can-i-do-with-my-degree/chemistry

1) Create a wordle of the jobs titles that you come across, try to get a good range of different job types.

2) Pick two of the jobs that you find most interesting and write a job description for each in the style of a job advert you might see online or in a newspaper. Include salary, qualifications and skills needed and what the job entails in terms of day to day tasks and activities (see example below). Note: -If you are doing more than one Science topic and these jobs overlap e.g. Pharmacist (involves Chemistry and biology) you need not do this task twice! Submit the same advert to both your teachers.

3) Write down your current thoughts on what **you** might like to do beyond A levels (it doesn't have to be one of the jobs you have researched), has it changed in light of your research?

Specialist Quality Assurance Technician

Bradford Teaching Hospitals NHS
NHS Foundation Trust

Job Reference: 389-A-20-38489
Department: Pharmacy

Location: Bradford Royal Infirmary

Salary: Band 6 - £31,365 - £37,890 per annum

Hours:37.5 HOURS PER WEEK

Brief Description of the Role:

We are looking for a pro-active, self-motivated individual with strong problem solving skills who shows a passion for improving and developing services to work in our small, dedicated team in pharmacy QA.

This established role will suit an individual with good critical thinking skills, who has a background in the life sciences, microbiology, chemistry, pharmacy or engineering. The role is open to pharmacy technicians, however, this is not a pre-requisite, and individuals with relevant qualifications outside of pharmacy are also invited to apply.

The role involves providing a technical pharmacy service to both internal and external customers – primarily NHS Trusts. This will involve occasionally visiting other trusts (sometimes staying overnight) and undertaking physical and environmental monitoring tasks in pharmacy cleanrooms and radiopharmacies, therefore a good understanding of GMP and clean room behaviours is required. This role also involves a significant amount of manual handling.

On site, the role requires the management and processing of non-pathogenic microbiological samples, and therefore the individual will also need to demonstrate a clear understanding of GLP. This role also involves providing advice and support to customers, clinical hospital teams, and occasionally patients. The QA team advise on the use and safety of unlicensed medicines, the stability of medicines made in the licensed aseptic unit (and radiopharmacy), medicines defects, safe storage of medicines (GDP) and aspects of COSHH. The successful candidate will be expected to support all of these aspects as a primary part of their role. All necessary training will be provided. The post is also likely to include line management at a future stage.

The main purpose of all of the above is to ensure that across the Trusts we work with, high-risk, high-cost medicines are made at the highest quality possible for our most vulnerable patients in the most appropriate and safest environment at all times. While often considered to be a non-patient-facing environment, it can be determined from this that the safety of all of our patients is at the forefront of everything we do, and the successful applicant will be expected to demonstrate a strong patient-focus at all times.

You must be an excellent communicator with outstanding interpersonal and relationship building skills, including management experience. You will need to be forward thinking and enthusiastic, with a commitment to continuing professional development. The team is small, and the volume and variety of work undertaken is large, there is no denying that we work very hard. Therefore the ideal candidate will also need to be dedicated and hard working, and have a willingness to be flexible when necessary.

Summary of Qualifications and Skills required:

- NVQ3 in Pharmacy Services or BTEC equivalent level qualification or
- MSc in Clinical Pharmaceutical Sciences or A suitable degree in associated science disciplines of chemistry or biology
- Diploma in Pharmacy Technology and Quality Assurance would be desirable, if the candidate does not hold this qualification they would be expected to undertake it during the first three years of work
- Knowledge of Good Manufacturing Practice, Good Distribution Practice and Good Laboratory Practice, including clean room behaviour
- Knowledge and understanding of Pharmaceutical Quality Management
- Knowledge and understanding of pharmaceutical technical procedures specific to the area of work
- Good verbal and written command of English
- Ability to follow written and verbal instructions
- Ability to work effectively under pressure
- Good communication/interpersonal skills
- Ability to manage staff and team workload
- Demonstrates a caring, compassionate and empathetic approach to work
- Ability to plan own time, use own initiative and act independently within the bounds of existing knowledge and skills
- Capable of working within a multidisciplinary team
- Computer literate

Videos to watch online (Pick one topic that interests you)

Rough science – the Open University – 34 episodes available

Real scientists are 'stranded' on an island and are given scientific problems to solve using only what they can find on the island.

Great fun if you like to see how science is used in solving problems.

There are six series in total

http://bit.ly/pixlchemvid1a

http://www.dailymotion.com/playlist/x2igjq_Rough-Science_rough-science-full-series/1#video=xxw6pr

or

http://bit.ly/pixlchemvid1b

https://www.youtube.com/watch?v=lUoDWAt259I

A thread of quicksilver – The Open University

A brilliant history of the most mysterious of elements – mercury. This program shows you how a single substance led to empires and war, as well as showing you come of the cooler properties of mercury.

http://bit.ly/pixlchemvid2

https://www.youtube.com/watch?v=t46lvTxHHTA

10 weird and wonderful chemical reactions

10 good demonstration reactions, can you work out the chemistry of …. any… of them?

http://bit.ly/pixlchemvid3

https://www.youtube.com/watch?v=0Bt6RPP2ANI

Chemistry in the Movies

Dantes Peak 1997: Volcano disaster movie.

Use the link to look at the Science of acids and how this links to the movie.
http://www.open.edu/openlearn/science-maths-technology/science/chemistry/dantes-peak

http://www.flickclip.com/flicks/dantespeak1.html

http://www.flickclip.com/flicks/dantespeak5.html

Fantastic 4 2005 &2015: Superhero movie

Michio Kaku explains the "real" science behind fantastic four http://nerdist.com/michio-kaku-explains-the-real-science-behind-fantastic-four/

http://www.flickclip.com/flicks/fantastic4.html

Research activities (pick two)

Use your online searching abilities to see if you can find out as much about the topic as you can. Remember it you are a prospective A level chemist, you should aim to push **your** knowledge.

You can make a 1-page summary for each one you research using Cornell notes or use the flipped learning sheet again:

http://coe.jmu.edu/learningtoolbox/cornellnotes.html

Task 1: The chemistry of fireworks

What are the component parts of fireworks? What chemical compounds cause fireworks to explode? What chemical compounds are responsible for the colour of fireworks?

Task 2: Why is copper sulfate blue?

Copper compounds like many of the transition metal compounds have got vivid and distinctive colours – but why?

Task 3: Aspirin

What was the history of the discovery of aspirin, how do we manufacture aspirin in a modern chemical process?

Task 4: The hole in the ozone layer

Why did we get a hole in the ozone layer? What chemicals were responsible for it? Why were we producing so many of these chemicals? What is the chemistry behind the ozone destruction?

Task 5: ITO and the future of touch screen devices

ITO – indium tin oxide is the main component of touch screen in phones and tablets. The element indium is a rare element and we are rapidly running out of it. Chemists are desperately trying to find a more readily available replacement for it. What advances have chemists made in finding a replacement for it?

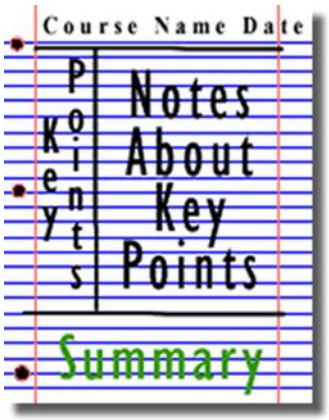
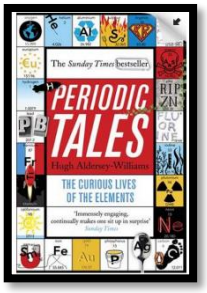


Figure 1: http://coe.jmu.edu/learningtoolbox/images/noteb4.gif

Book Recommendations (optional)

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

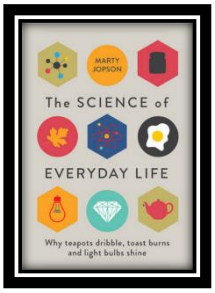


ISBN-10: 0141041455

http://bit.ly/pixlchembook1

This book covers the chemical elements, where they come from and how they are used. There are loads of fascinating insights into uses for chemicals you would have never even thought about.

The Science of Everyday Life: Why Teapots Dribble, Toast Burns and Light Bulbs Shine (Hardback) Marty Jopson

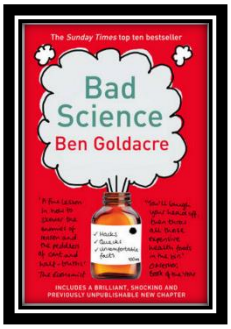


ISBN-10: 1782434186

http://bit.ly/pixlchembook2

The title says it all really, lots of interesting stuff about the things around you home!

Bad Science (Paperback) Ben Goldacre

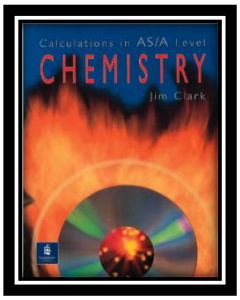


ISBN-10: 000728487X

http://bit.ly/pixlchembook3

Here Ben Goldacre takes apart anyone who published bad / misleading or dodgy science – this book will make you think about everything the advertising industry tries to sell you by making it sound 'sciency'.

Calculations in AS/A Level Chemistry (Paperback) Jim Clark



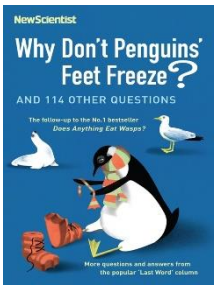
ISBN-10: 0582411270

http://bit.ly/pixlchembook4

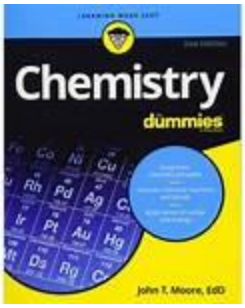
If you struggle with the calculations side of chemistry, this is the book for you. Covers all the possible calculations you are ever likely to come across. Brought to you by the same guy who wrote the excellent chemguide.co.uk website.

Salters' Advanced Chemistry: Chemical Storylines

Do not feel you need to buy the latest edition (unless you are doing Salters chemistry!) You can pick up an old edition for a few pounds on ebay, gives you a real insight into how chemistry is used to solve everyday problems from global pollution through feeding to world to making new medicines to treat disease.



New Scientist books such as 'why don't penguins feet freeze' or 'Does anything eat wasps'. These give interesting Scientific answers to life's everyday questions! And they are quite fun to read.



Mr Carr also recommends the Chemistry for Dummies books too.

Other Ideas (optional)

1. Go outdoors (in your local area!)
   Have you actually spent any time observing the geology of the area you live in? What rocks or minerals are found in your area? Does your area have a history of extracting minerals? If so what were they, what were they used for, how did they obtain them? Are there any working or remains of mineral extraction industries?

2. Try reading the New Scientist Magazine to find out about the latest research in all aspects of Science. https://www.newscientist.com/

3. Try finding some Chemistry related Ted Talks to watch, these are inspiring talks at the cutting edge of Chemistry related research. https://www.ted.com/topics/chemistry