EMCS Science Department

Chemistry AS Bridging Project

For Chemistry at A-Level we follow the specification OCR A.

General Resources:

1. OCR Website – the specification can be found here for AS and A Level Chemistry https://www.ocr.org.uk/qualifications/as-and-a-level/chemistry-a-h032-h432-from-2015/#as-level

2. Currently free on Amazon to download to a kindle or device that allows the kindle app:

   New Head Start to A-level Chemistry (CGP A-Level Chemistry) Kindle Edition https://www.amazon.co.uk/Head-Start-level-Chemistry-Level-ebook/dp/B00VE2NIGG/ref=sr_1_1?crid=260VRHZM6KDQU&dchild=1&keywords=new+head+start+to+a-level+chemistry&qid=1587498213&s=digital-text&sprefix=new+head+sta%2Cdigital-text%2C138&sr=1-1

3. Physics and Maths Tutor:

   https://www.physicsandmathstutor.com/chemistry-revision/a-level-ocr-a/

4. Transition from GCSE to A Level. You will be using this for some of your tasks.

   http://fdslive.oup.com/www.oup.com/oxed/secondary/science/Science_A_Level_Transition_Pack_Chemistry.pdf

Section 1: Atomic and Electronic Structure

The first part of AS Chemistry looks at the structure of atoms in more detail than you have learnt already. It will feel like you are bombarded with new models, so use this time to recap what you have learnt at GCSE and familiarise yourself with some new terms! Using your GCSE knowledge as a baseline, before completing further tasks.

Tasks:

1. Draw a typical Bohr's model of an atom and label the parts.

2. Draw the plum pudding model and nuclear model of the atom, and label them.

3. Draw a table to compare and contrast all three models (considering the similarities and differences).
4. What are the relative masses, charges and locations of all the subatomic particles? Make a table to display this.

The rest of the tasks will involve research, reading and watching videos and completing tasks on what you have read/watched/researched. Building on GCSE Chemistry, these tasks will give a more in-depth view of the structure of the atom.

5. Try this GCSE quiz about atomic structure:
   https://www.bbc.co.uk/bitesize/guides/z3sg2nb/test

6. Make a timeline of events in the history of the discovery of the structure of the atom. Research further information of some of the key scientists and add this to your timeline. You should include images to make your timeline interesting.

7. Watch this video tutorial about atoms and isotopes from Free Science Lessons:
   https://www.youtube.com/watch?v=MGLrYaI_UfE

8. Read these notes on Atomic and Electronic Structure:
   - https://pmt.physicsandmathstutor.com/download/Chemistry/A-level/Notes/OCR-A/2-Foundations-in-Chemistry/Summary%20Notes%20-%20Module%202%20OCR%20(A)%20Chemistry%20A-level.pdf
   - https://www.physicsandmathstutor.com/chemistry-revision/a-level-ocr-a/module-2/atomic-structure-isotopes-compounds-formulae-equations-flashcards/
   - https://www.s-cool.co.uk/a-level/chemistry/atomic-structure/revise-it/the-structure-of-the-atom

9. Try the simulation on the following webpage to help you to build atoms according to the model you learned at GCSE.
   http://jiscscience.weebly.com/task-1.html

10. In a blog post, discuss the model we have for the structure of the atom (as you understand it). Explain how electrons are arranged in shells according to the model you learned in GCSE. If you do not have a blog yet you will have to set one up. You might like to try Wordpress or Blogger or you could word process or handwrite it. The model you learned at GCSE will change at AS level and this can be confusing for some students. You might like to read ahead using this page on the website: http://www.jiscscience.weebly.com/orbitals and then put a comment on your blog post about how this model is different to the one you learned at GCSE.

11. Write the definitions of:

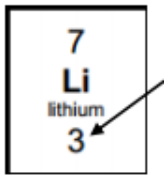
a) Atomic number b) Mass number c) Complete the missing data in the table below:

Use the example given, and your understanding of atomic structure and how atoms become ions.

Atom	Metal or non-metal atom	Atomic No.	Electron Configuration of Atom	Gains /loses e-	No. of e- gained /lost	Ion formula produced	Electronic configuration of Ion
Li	Metal	3	2,1	loses	1e-	Li^+	$[2]^+$
Na							
Mg							
Al							
F							
O							
S							

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 structure 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.

12. Read about orbitals here: http://bit.ly/pixlchem1 and http://www.chemguide.co.uk/atoms/properties/atomorbs.html#top

13. Now that you are familiar with s, p and d orbitals try these problems, write your answer in the format: $1s^2$, $2s^2$, $2p^6$ etc. 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 k) As

14. 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+}

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Section 2: Chemical Calculations

Many students find the manipulation of, understanding and substituting values into, mathematical equations challenging. This task builds on and extends the chemical calculations that you will have encountered at GCSE.

Tasks:

1. Watch this video to remind you how to complete a % by mass question: https://www.youtube.com/watch?v=ZAxl502Yl9g

2. Download and complete the "% by mass" worked example task on this webpage: http://jiscscience.weebly.com/task-2.html

3. Refresh your memory of other calculation questions by trying some of the questions from this website: http://www.gcsescience.com/m31.htm

   Note: You do not have to complete all of these questions! Read through the list quickly then select some to try. If you cannot decide, I suggest you complete **1, 3, 5, 7, 17, 20, 21, 24, 33, 38, 40, 45, 46, 60** and **63**. You can check your answers by clicking the **Answer** link next to each question.

4. Write a blog post, explaining how to calculate the following:

   a) A relative formula mass from atomic masses;
   b) An empirical formula from % composition data,
   c) The % yield of a product when given the actual yield and reaction equation.

5. When GCSE Chemistry students are required to complete calculations, the most common error highlighted in examiners reports is an inability to produce a ratio. If you need help doing this, then read through http://www.shodor.org/unchem/math/r_p/ first. End your blog post with a comment about any differences you could see between your answer and the model answer on this webpage http://jiscscience.weebly.com/model-answers.html. You may also like to look at the other model answers for the explanations of the other calculations. Perhaps you learned something from doing this? If so, comment about what you have learned, on your blog post.

From this point on you need to be using an A level periodic table, not a GCSE one you can view one here: https://www.ocr.org.uk/Images/363792-unit-h032-and-h432-data-sheet.pdf

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 chemist's

equivalent of a dozen, atoms are so small that we cannot count them out individually, we weigh out chemicals.

Remember "Mass over Mr Moles"

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 (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.

6. Read through these comprehensive pages 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 and http://www.chemteam.info/Mole/Mole.html

7. 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 attached, so these have to be counted in as part of the molecule's mass.

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

   e) If I have 2.4g of magnesium, what mass of oxygen (O_2) will I need to react completely with the magnesium? $2Mg + O_2 \rightarrow MgO$

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

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 or 1 litre, but from this point on as an A level Chemist you will use the dm^3 as your volume measurement. Remember 1 mole of gas at r.t.p. takes up $24dm^3$ of volume.

8. Read through these webpages: http://bit.ly/pixlchem10 and http://www.docbrown.info/page04/4_73calcs11msc.htm

9. Answer these questions:

   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 concentration 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?

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.

10. 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/

11. 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. for 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 $0.100moldm^{-3}$ sodium hydroxide and required exactly $27.40cm^3$ for neutralisation. What is the concentration of the sulfuric acid?

12. Read through these additional problems, which are harder; ignore the questions about colour changes of indicators. http://bit.ly/pixlchem12 and http://www.docbrown.info/page06/Mtestsnotes/ExtraVolCalcs1.htm

13. Use the steps on the last page to help you answer this: A solution of barium nitrate will react with a solution of sodium sulfate to produce a precipitate of barium sulfate.

$$Ba(NO_3)_{2(aq)} + Na_2SO_{4(aq)} \rightarrow BaSO_{4(aq)} + 2NaNO_{3(aq)}$$

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

Section 3: Structure and Bonding

This activity builds on the knowledge and understanding of bonding you learned at GCSE level.

Tasks:

1. Try these quick quizzes about covalent and ionic bonding:

- https://www.bbc.co.uk/bitesize/guides/zcvy6yc/test
- https://www.bbc.co.uk/bitesize/guides/ztc6w6f/test

2. Download and read through the "intermolecular forces blog task" on this webpage: then answer the final question in a blog post: http://jiscscience.weebly.com/task-3.html

3. Download and complete the "bonding quiz" on this webpage: http://jiscscience.weebly.com/task-3.html

4. Run the simulation about shapes of molecules on the webpage http://jiscscience.weebly.com/task-3.html

5. When you have completed these tasks, write three key facts you have learned about shapes of molecules. Alternatively, write a tweet of your three key facts using #bridgingscience.

6. If you are unsure about covalent bonding, read about it here: http://bit.ly/pixlchem5

   And http://www.chemguide.co.uk/atoms/bonding/covalent.html#top

At A Level you are also expected to know how molecules have certain shapes and why they are the shape they are.

7. Read about shapes of molecules here:http://bit.ly/pixlchem6

   And http://www.chemguide.co.uk/atoms/bonding/shapes.html#top

8. Draw a dot and cross diagram to show the bonding in a molecule of aluminium chloride ($AlCl_3$)

9. Draw a dot and cross diagram to show the bonding in a molecule of ammonia (NH_3)

10. What is the shape and what are the bond angles in a molecule of methane (CH_4)?

Section 4: Redox

At GCSE you know 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 learned that oxidation is removing electrons and reduction is adding 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.

Tasks:

1. Read about the rules for assigning oxidation numbers here:

   http://www.dummies.com/how-to/content/rules-for-assigning-oxidation-numbers-to-elements.html

Elements that you expect to have a specific oxidation state actually have different states, so for example you would expect chlorine to be -1, it can have many oxidation states e.g. in NaClO. In this compound it has an oxidation state of +1

There are a few simple rules to remember:

- Metals have a + oxidation state when they react.
- The more electronegative element has the negative oxidation state.
- Oxygen always has an oxidation state of -2 except in peroxides or compounds with fluorine.
- Hydrogen has an oxidation state of +1, except in metal hydrides.
- The oxidation states in a molecule must add up to the charge on the molecule.

2. 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) $\underline{Fe_2}O_3$ f) $\underline{V_2}O_5$ g) $K\underline{Mn}O_4$ h) $\underline{Cr_2}O_7^{2-}$ i) $\underline{Cl_2}O_4$

Section 5: Summary Activities

Tasks:

1. Download and complete the "summary activity" from the webpage: http://jiscscience.weebly.com/task-4.html

2. Write a blog post about the questions you cannot answer, find out the answers and let others know where you found the information.

3. Check your answers on the on the Answers page of this website: http://jiscscience.weebly.com/model-answers.html

4. At the end of this task, write a blog post or a tweet about how you found completing this set of Chemistry tasks. You might like to comment on what you have learned, how difficult you found the tasks and how long it took you to complete.

Section 5: Maths Skills

Tasks:

1. Download/View/Save using the link: The Transition from GCSE to A Level http://fdslive.oup.com/www.oup.com/oxed/secondary/science/Science_A_Level_Transition_Pack_Chemistry.pdf

2. Complete the questions on pages 4 and 5.

3. Complete the questions on pages 7 – 10.

4. Read through page 11 and complete the questions on page 12.

Section 6: Exam Questions

In this section, you will try to answer some AS exam questions, which link to the topics you have been studying. You should write your answers down and then mark them once you have completed them.

Electrons, Bonding and Structure 1 Questions:
https://pmt.physicsandmathstutor.com/download/Chemistry/A-level/Topic-Qs/OCR-A/2-Foundations-in-Chemistry/Set-F/Electrons,%20Bonding%20&%20Structure%201%20QP.pdf

Electrons, Bonding and Structure 1 Answers:
https://pmt.physicsandmathstutor.com/download/Chemistry/A-level/Topic-Qs/OCR-A/2-Foundations-in-Chemistry/Set-F/Electrons,%20Bonding%20&%20Structure%201%20MS.pdf

Particles, Amount of Substance, Equations and Reactions Questions:
https://pmt.physicsandmathstutor.com/download/Chemistry/A-level/Topic-Qs/OCR-A/2-Foundations-in-Chemistry/Set-F/Particles,%20Amount%20of%20Substance,%20Equations%20&%20Reactions%201%20QP.pdf

Particles, Amount of Substance, Equations and Reactions Answers:
https://pmt.physicsandmathstutor.com/download/Chemistry/A-level/Topic-Qs/OCR-A/2-Foundations-in-Chemistry/Set-F/Particles,%20Amount%20of%20Substance,%20Equations%20&%20Reactions%201%20MS.pdf