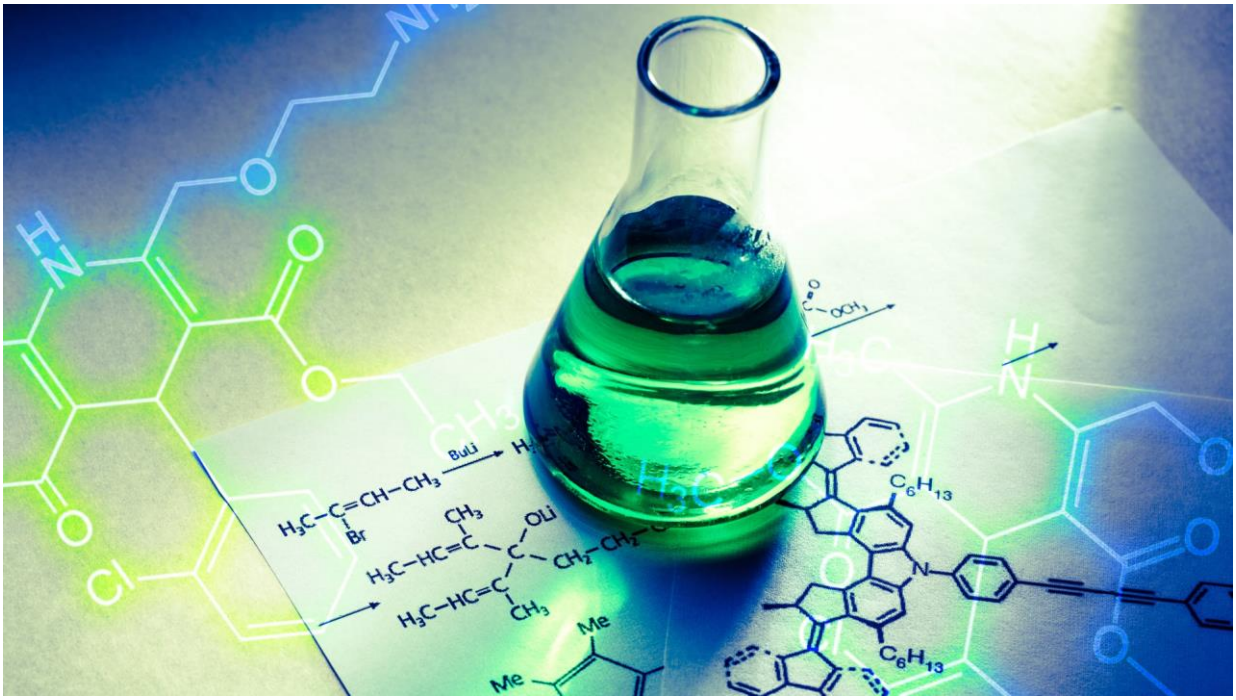
A-level Chemistry

at The Blue Coat Sixth Form

Part of the Science Department



Welcome to A-level Chemistry! You have chosen a subject that will be challenging, yet fascinating. You will deepen your knowledge about the building blocks of matter, and how interactions on a molecular level influence every aspect of the world around you.

This bridging unit is aimed at getting you ready to succeed at A-level, by consolidating your GCSE knowledge and introducing some of the key skills you will need, including the ability to be self-reflective, and to use mistakes as learning opportunities.

A lot of people have misconceptions about how to make progress at A-level, thinking that their notes have to be perfect first time, or that it is better to not write anything down until you know it is right. If you have found yourself falling into this habit in the past, please try and overcome that during this task. Whether you get questions right first time is not what matters – it is the work you do after getting things wrong.

Successful A-level chemists have good time management and organisation skills. As you are completing this assignment, please plan your time. This is designed as a Summer Task, so you have six weeks over which to spread the work. If you struggle with any of the topics, leave it for a couple of days and then go back and do it again. Self-mark honestly and make sure you correct anything you got wrong. Your work toward this part of the bridging material will be assessed in September. Please put your best into this and make a strong start to the A-level. We look forward to seeing you!

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1.0 H hydrogen 1										4.0 He helium 2
6.9 Li lithium 3	9.0 Be beryllium 4											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											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	95.9 Mo molybdenum 42	[98] 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	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

140.1 Ce cerium 58	140.9 Pr praseodymium 59	144.2 Nd neodymium 60	144.9 Pm promethium 61	150.4 Sm samarium 62	152.0 Eu europium 63	157.2 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
232.0 Th thorium 90	[231] Pa protactinium 91	238.1 U uranium 92	[237] Np neptunium 93	[242] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[245] Bk berkelium 97	[251] Cf californium 98	[254] Es einsteinium 99	[253] Fm fermium 100	[256] Md mendelevium 101	[254] No nobelium 102	[257] Lr lawrencium 103

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

GCE Chemistry A (Yellow)

Task and instructions

There are three sections of the Chemistry Bridging Material.

Section 1: Using online platforms to support study and revision

Section 2: Practising independent study skills in Chemistry

Section 3: Consolidating mathematical skills

Your *assessment* for this bridging material will take place in the first month of the course, in the form of:

a) an online test on the material in Section 2, in the second week of the course
b) a paper-based test on the material in Section 3, in the fourth week of the course

Your performance on these assessments will help form the first element of your Year 12 progress report.

Section 1: Using online platforms to support study

For Section 1, we are going to use an online learning platform: Seneca Learning. This is valuable for two reasons; firstly it will familiarise you with one of the platforms you will be using next year, and secondly it gives feedback which allows both you and the subject lead to see how you cope with some introductory A-level work.

A lot of people have misconceptions about online learning, thinking that they need to complete it as quickly as possible and/or only complete it once. As you are completing the assignments, please take your time. Make notes as you are going through, as these will be helpful when completing the assignments but also will be useful next year. File them in your notes folder if you have set one up already. If you struggle with any of the assignments, leave it for a couple of days and then go back and do it again. Your subject lead can see your first score and your best score. They will be looking for evidence of students that grasped it first time, and of those who kept trying until they did grasp it. The most successful A-level students have resilience, so keep revisiting the trickier sections until you can get 100%.

You may have already used Seneca to support your learning, in which case, you just need to log in with your existing account and join the class using the class code below.

If you have never used Seneca before you will need to create an account. To do this you just need an email address and to create a password. Please give your correct first name and last name when setting up the account so we can match you to our class lists. When you have created an account, you can join the class using the class code below.

Web address: https://senecalearning.com/en-GB/ Class code: **z5iicp59jv**

Once you have joined the class, you should be able to access the assignment we have set. Please work through the assignment, completing the transition course by September 1st.

If you are using this document electronically, please click here to join our course and access the assignment directly:

Bridging Material Section 1 Seneca Assignment

Section 2: Practising independent study skills in Chemistry

Section 2 will offer the opportunity to practise your skills from GCSE, and make sure that you are confident with the key basic concepts that you have learnt so far.

These basic chemical concepts are:

Atomic and electronic structure

Ionic and covalent bonding

Relative formula mass and related calculations

Mole calculations

Mathematics is also a key part of the Chemistry course, and therefore will be assessed too. More information about Mathematics in Chemistry is available in Section 3 of this assignment.

The key concepts in Mathematics that are included in Section 2 of this assignment are:

Significant figures

Standard form

Rearranging and solving equations

Instructions

You should work through this document, then use the mark scheme at the end of this document to assess your work. You should do your self-marking in a different colour pen. This will then allow you to polish up on the bits you are less confident with.

You will need to know all of the material in this document, as it will be in the follow-up assessment.

You should prepare to hand in your completed version in your first lesson of the AS Chemistry course. Your follow-up assessment will be an online quiz, which will be taken in the second week. The pass mark will be 75%.

Throughout this document, you will be referred to ChemGuide. This is an online resource which is written for A-level students, and covers the basics of GCSE right through to the hardest A-level material. You should get used to using it, as you will likely need it throughout your course. Get yourself to www.chemguide.co.uk .

Atomic and electronic structure

You need to know the meanings of these terms:

Atomic number.....

Atomic mass.....

You need to be able to use the periodic table to work out the number of electrons in an atom's outer shell, and then what charge an ion would have.

If you need a brief recap, check out ChemGuide (the atomic structure and bonding section).

There are five molecular ions that you need to know of, and <u>remember</u>:

Hydroxide – OH^-

Carbonate – CO_3^{2-}

Sulfate – SO_4^{2-}

Nitrate – NO_3^-

Ammonium – NH_4^+

You will need to be able to use these to work out the formula of compounds, for example:

Sodium chloride: Sodium has a 1+ charge, chlorine has a 1- charge. Therefore, to make a neutral ionic compound, these charges must balance out. So, there must be one chlorine ion for every sodium ion, giving a formula of NaCl.

Sodium sulphate: Sodium has a 1+ charge, the carbonate ion has a 2- charge. To make the charges balance out, there must be two sodium ions for every carbonate ion. So, the formula must be Na_2CO_3.

Magnesium hydroxide: Magnesium ion = 2+, hydroxide ion = 1-. Two hydroxides for every magnesium = $Mg(OH)_2$.

You will also need to be able to recognise when compounds are ionic or covalent, by looking at the components of the compound, and be able to draw dot-cross diagrams of both ionic and covalent compounds. Again, check ChemGuide if not sure.

Atomic and electronic structure practice.

Complete the following questions, self-mark them in a different colour pen, and learn from any mistakes.

1. How many protons are there in:

(a) $^{56}_{26}\mathrm{Fe}$ (b) $^{23}_{11}\mathrm{Na}$ (c) $^{184}_{74}\mathrm{W}$ (d) $^{132}_{54}\mathrm{Xe}$

2. How many neutrons are there in:

(a) $^{19}_{9}\mathrm{F}$ (b) $^{28}_{14}\mathrm{Si}$ (c) $^{79}_{34}\mathrm{Se}$ (d) $^{208}_{82}\mathrm{Pb}$

3. What is the charge on these ions?

(a) $Br^{\cdots\cdots}$ (b) $K^{\cdots\cdots}$ (c) $S^{\cdots\cdots}$ (d) $CO_3^{\cdots\cdots}$ (e) $NH_4^{\cdots\cdots}$

4. Draw dot-cross diagrams for the following molecules.

(a) HBr (b) H_2O

(c) O_2 (d) CO_2

5. What is the formula of these compounds?

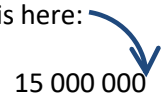
(a) magnesium chloride (b) sodium oxide

(c) potassium hydroxide (d) magnesium nitrate

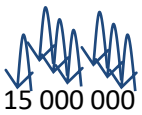
(e) aluminium oxide (f) ammonium carbonate

Mathematics for Chemists

There are some basic maths skills that every chemist needs to have a grasp on. Firstly, the usage of *standard form*. This means when you give a value to a power of 10, for example 15,000,000 would become 1.5 x 10^7. The cheat's way of looking at it (not the mathematical way) is to count how many places the decimal point has moved. If you imagine the above number, then the decimal point is here:



Then, moving it:



The decimal point has moved 7 places to the left, so the number becomes 1.5 x 10^7.

If the decimal point moves to the right, then the power is negative. For example:

0.000231 becomes 2.31 x10^{-4}, as the decimal point has moved four places to the right.

For more info, go to http://www.bbc.co.uk/schools/gcsebitesize/maths/number/powersrootshirev1.shtml

Next, *significant figures*. This shows you the accuracy of a measurement, and a lot of questions in AS Chemistry ask you for the answer to a calculation to be given to a certain number of significant figures. It is crucial that you know how to do this.

For example, if you were to give the number 123,456 to 3 significant figures, it would be 123,000 (select the first three numbers and make sure that the last one is rounded correctly).

Similarly for 4sf, you take the first four numbers and round the last one correctly. This would then make 123,500 (the number after the 4 is a 5, which means you round up).

It's a bit different if you are working with decimals that are less than 1, as "leading" zeroes don't count as significant figures. So, if you had the number 0.00021098, then, to 2sf, it would be 0.00021 (the three zeroes immediately after the decimal point don't count) ; to 3sf, it would be 0.000211, and to 4sf, it would be 0.0002110.

If you need a recap or more information about significant figures, then there are plenty of internet tutorials out there. Here is one: http://www.youtube.com/watch?v=Q8-iBZAir-s

You will also need to be able to *rearrange simple equations*, as you will have a bank of equations to use and you will have to work out how to use them.

If you struggle with this, check out the BBC Bitesize pages on rearranging equations:

http://www.bbc.co.uk/schools/gcsebitesize/maths/algebra/formulaerev3.shtml

http://www.bbc.co.uk/schools/gcsebitesize/maths/algebra/formulaehirev1.shtml

Mathematics for Chemists practice.

Complete the following questions, self-mark them in a different colour pen, and learn from any mistakes.

6. Round these numbers to 3 significant figures:

a) 24530

b) 103.8

c) 25.88

d) 1.27385

e) 0.1999

f) 0.0065441

g) 0.08178

h) 0.020002

7. Convert these numbers to standard form (i.e. n x 10^y)

a) 2000

b) 56000

c) 9990000

d) 0.0005

e) 0.00234

f) 0.000000055

8. Convert these numbers from standard form

a) 2.5 x 10^4

b) 4.36 x10^6

c) 1.3 x 10^{-3}

d) 9.88 x 10^{-5}

9. Rearrange these equations to make x the subject

a) $y = x + b$

b) $z = xc$

c) $x^2 = ab$

d) $n = x^2 - 2g$

Chemical calculations

The basic calculation in chemistry is the *calculation of relative formula* mass (M_r). To do this, you need to add up the relative atomic masses of all of the atoms in the formula.

Make sure that you use the periodic table on Page 2 of this booklet to get your relative atomic masses.

ChemGuide doesn't have much in the way of help for calculations, as the guy who wrote it has a book on the subject. Better to use Bitesize: https://www.bbc.com/bitesize/guides/z934tyc/revision/1

Then, you can use your relative formula mass to find the *percentage composition* of each element in the formula.

Several GCSE boards cover this, but if you haven't you can use this formula.

$$\%\ composition = \frac{mass\ of\ element\ in\ 1\ mole\ of\ the\ compound}{mass\ of\ 1\ mole\ of\ compound}\ x\ 100$$

Again, check out the Bitesize page if you're struggling.

Calculations involving the mole will be used all the way through your A-level Chemistry course, and it is imperative that you can do them confidently. A mole is a certain amount of substance (actually 6.02 x 10^{23} atoms or formula units), and 1 mole of any substance is its relative formula mass in grams. For example, H_2O has a relative formula mass of 18, so 1 mole of H_2O has a mass of 18g.

The basic equation that you are familiar with so far is:

$$number\ of\ moles = \frac{mass\ of\ substance}{relative\ formula\ mass\ (M_r)}$$

Should you need help on this, the Bitesize pages above have plenty of info, and GCSE Science has some more: http://www.gcsescience.com/m.htm

You can use percentage compositions to find out the *empirical formula* of a compound. An empirical formula is the simplest whole number ratio of elements in a compound. For example, C_2H_4 and C_3H_6 both have a C:H ratio of 2:1, so the empirical formula for both of these compounds is CH_2.

To calculate the empirical formula, you need to do a step-wise approach. The Bitesize page is here: https://www.bbc.com/bitesize/guides/zgg7hyc/revision/4 , the GCSE Science page above has help, and there are plenty of internet tutorials, for example: http://www.youtube.com/watch?v=R-DgsodSxf0

Chemical calculations practice.

10. Calculate the relative formula mass (M_r) of these compounds.

a) C_3H_8 b) CO_2

c) $MgCO_3$ d) Na_2SO_4

e) $C_2H_2Cl_2$ f) $Na_2S_2O_3$

11. Calculate the percentages of the elements in these compounds, to **1 decimal place**:

a) What percentage by mass of C_3H_8 is carbon?

b) What percentage by mass of CO_2 is oxygen?

c) What percentage by mass of $MgCO_3$ is magnesium?

d) What percentage by mass of Fe_2O_3 is iron?

e) What percentage by mass of K_2SO_4 is potassium?

12. Calculate the answer to these mole calculations. Write your answer to **3 significant figures**:

a) How many moles are there in 27g of H_2O?

b) Work out the mass of 3 moles of sodium nitrate, $NaNO_3$.

c) How many moles are there in 500 g of iron oxide, Fe_2O_3?

d) Work out the mass of 5 moles of sodium hydroxide.

e) How many moles are there in 240 g of calcium sulfate?

Empirical formulae practice.

13. Calculate the empirical formulae of the compounds below, given the amounts of each element present, by mass, in the compound.

a) C 42.9%, O 57.1%

b) 70% Fe and 30% O

c) Na 29.1 %, S 40.5% and O 30.4%

d) C 7.5g, H 2.5g

e) Hg 7.37g, I 9.30g

f) 69.58% Ba, 6.10% C, 24.32% O

Before term starts....

You should have attempted all of the practice questions in this document. You should then have self-marked them, using a *different colour pen*, using the mark scheme at the end of this document, and made sure that you have addressed any issues. The pass mark for the assessment will be 75%, which reflects the fact that if you have made sure that you know everything in this document, then you will be able to score full marks in the assessment.

Your completed document must be available to hand in during your first Chemistry lesson.

Good luck. Section 3 of the assignment follows…

Section 3: Consolidating mathematical skills

In the A-level Chemistry course, 20% of the marks in the exams must be based on Mathematics. It is therefore crucial that Chemistry students have an awareness of which Maths skills they must possess.

In order to assess students' mathematical skills, a *Maths assessment* will be carried out in the fourth week of the course. This will determine which students may need extra work in particular areas of Maths.

To prepare for this over the summer and the first three weeks of the course, you should consider your abilities in the areas of Maths listed in this section of the assignment and practise your skills in each of these topics. The table on the next page contains a list of Maths skills required, and links to websites that will help you practise these.

Instructions

On an electronic copy of this document, follow each of the links to assess whether you are comfortable with the skill required. If not, use the links and any other websites/text books you can find to practise the skill before the *Maths Assessment* in the fourth week of the course.

Remember that three key mathematical concepts will be assessed in Section 2 of this assignment (the first two weeks of the course), as well as Section 3. These concepts are:

Significant figures

Standard form

Rearranging and solving equations

Mastering all of the ideas across both parts of this Summer Task will give students the best possible start to A-level Chemistry, and allow them to access all of the new material from Day 1.

Students who achieve the top grades hit the ground running in September – be one of them.

Maths Skills required in Chemistry, and assessed in the September *Maths Assessment*.

	Mathematical Skill	Example of use from GCSE	Link
M0 – Arithmetic and numerical computation			
M0.0	Convert between appropriate units in calculations	Convert between units of cm^3 and dm^3, or between J and kJ.	Unit Conversion
M0.1	Use decimal places, significant figures and standard form	Retaining the same number of significant figures throughout a calculation. Round numbers correctly. Convert between standard and ordinary form.	Sig Figs Standard Form
M0.2	Use ratios, fractions and percentages	Calculate percentage yields Use ratios in equations to calculate expected product.	Fractions and Percentages
M0.3	Estimate results	Use mental estimation to judge whether calculated answers are appropriate.	
M0.4	Use calculators to find and use power functions	Carrying out calculations using standard form.	Calculators and Powers
M1 – Handling Data			
M1.1	Use appropriate numbers of significant figures	Using experimental results to perform calculations.	Calculating using Sig Figs
M1.2	Find arithmetic means	Selecting appropriate data from which to calculate a mean. Use of weighted means (frequency tables).	Frequency Tables
M1.3	Identify uncertainties in measurements and calculate percentage errors	Reading balances and burettes.	Uncertainty and Errors
M2 - Algebra			
M2.1	Understand and use the symbols: =, <, <<, >, >>, ∝, ~, ⇌	GCSE Maths	Maths Symbols
M2.2	Change the subject of an equation	GCSE Maths/Physics. Mole calculations.	Rearranging Equations
M2.3	Substitute numerical values into algebraic equations	Use of $q = mc\Delta T$ Mole calculations	See Section 1
M3 - Graphs			
3.1	Translate information between graphical and numerical forms	Interpreting experimental graphs.	Interpreting Graphs
3.2	Plot two variables from experimental data	GCSE Controlled Assessments	Drawing Graphs
3.5	Use of tangents to a curve to give rate of change	GCSE Maths	Tangents
M4 – Geometry and trigonometry			
4.1	Use angles and shapes in regular 2-D and 3-D structures	These skills have not been taught in Chemistry before, and will be taught throughout the Year 1 course.	These skills will not appear on the September *Maths Assessment*.
4.2	Visualise and represent 2-D and 3-D forms		
4.3	Understand the symmetry of 2-D and 3-D objects		

The mark scheme for Section 1 follows on the next page. Please use the mark schemes responsibly - the aim of this task is to improve your self-reflection, so please make sure you have made an attempt at questions before consulting the mark scheme.

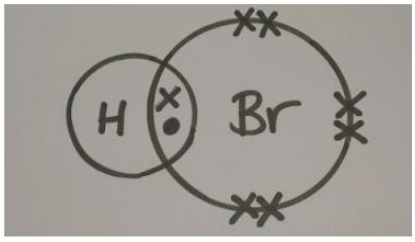
Mark scheme for Section 1

1 (a) 26 (b) 11 (c) 74 (d) 54

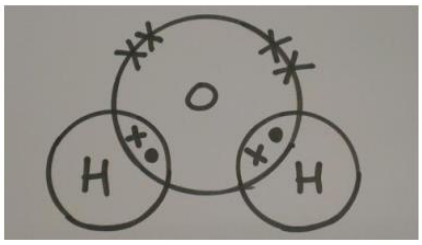
2 (a) 10 (b) 14 (c) 45 (d) 126

3 (a) Br^- (b) K^+ (c) S^{2-} (d) CO_3^{2-} (e) NH_4^+

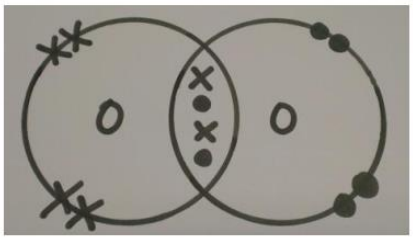
4 (a)



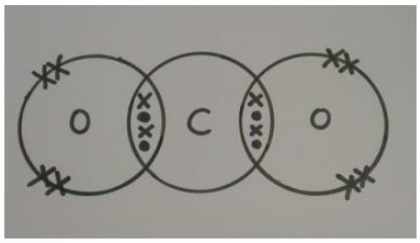
(b)



(c)



(d)



5 (a) $MgCl_2$ (b) Na_2O (c) KOH

(d) $Mg(NO_3)_2$ (e) Al_2O_3 (f) $(NH_4)_2CO_3$

6 (a) 24500 (b) 104 (c) 25.9 (d) 1.27

(e) 0.200 (f) 0.00654 (g) 0.0818 (h) 0.0200

7 (a) 2×10^3 (b) 5.6×10^4 (c) 9.99×10^6

(d) 5×10^{-4} (e) 2.34×10^{-3} (f) 5.5×10^{-8}

8 (a) 25000 (b) 4360000 (c) 0.0013 (d) 0.0000988

9 (a) $x = y - b$

(b) $x = \frac{z}{c}$

(c) $x = \sqrt{ab}$

(d) $x = \sqrt{n + 2g}$

10 (a) 44 (b) 44 (c) 84.3

(d) 142.1 (e) 97 (f) 158.2

11 (a) 81.8% (b) 72.7% (c) 28.8%

(d) 69.9% (e) 44.9%

12 (a) 1.50 moles (b) 255 g (c) 3.13 moles

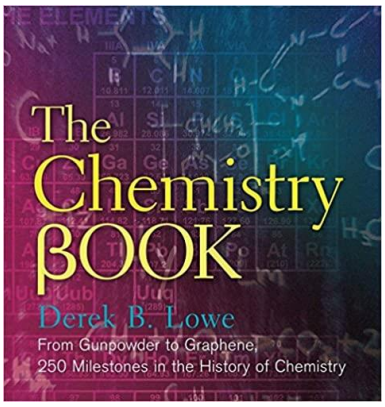
(d) 200 g (e) 1.76 moles

13 (a) CO (b) Fe_2O_3 (c) $Na_2S_2O_3$

(d) CH_4 (e) HgI_2 (f) $BaCO_3$

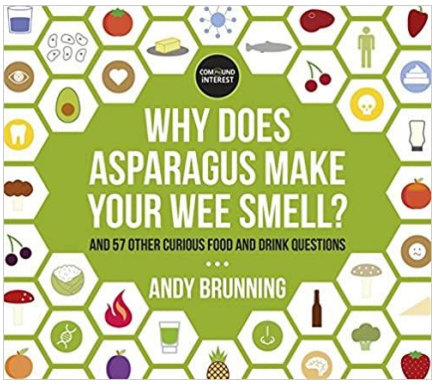
Reading List

If these tasks have whetted your appetite, here are some recommendations for background reading which will support your A-level learning:



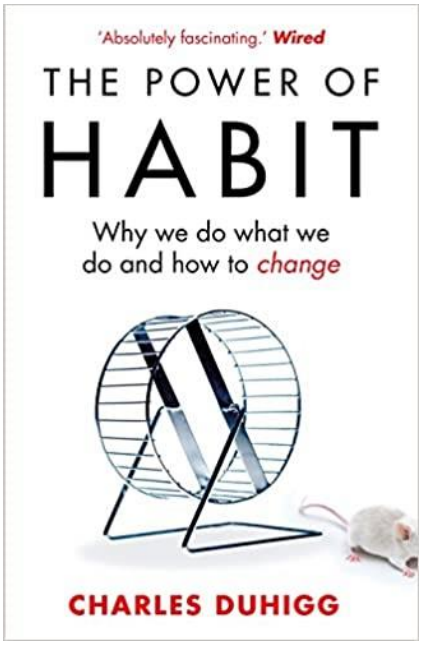
The Chemistry Book

Derek B Lowe



Why does asparagus make your wee smell?

Andy Brunning



The Power of Habit:
Why we do what we do, and how to change

Charles Duhigg