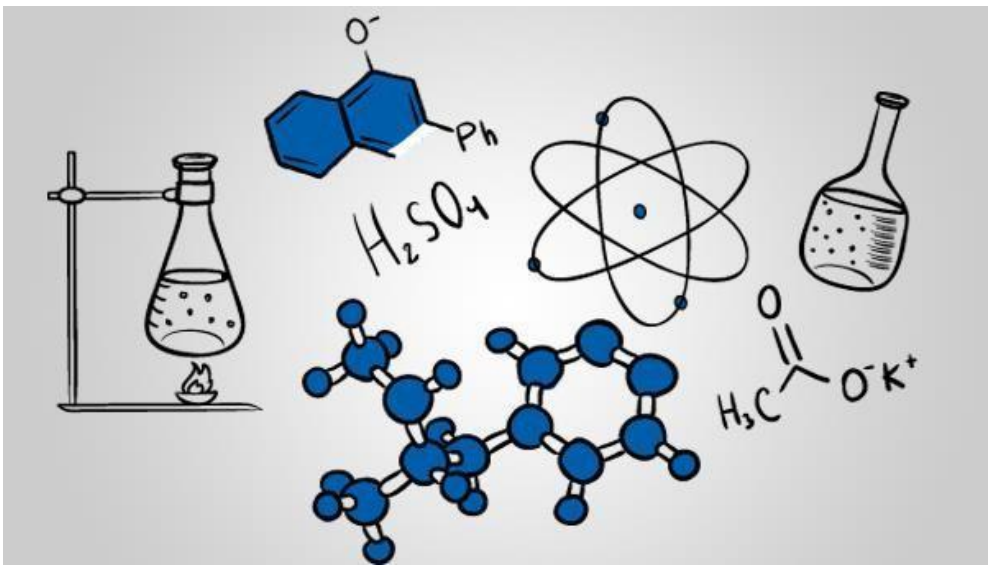
Transition Pack for A Level Chemistry

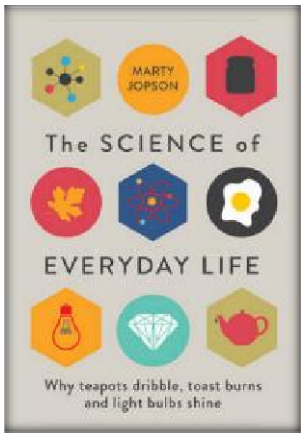
Get ready for A-level!

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

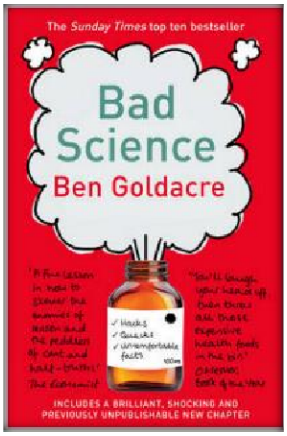


Book Recommendations

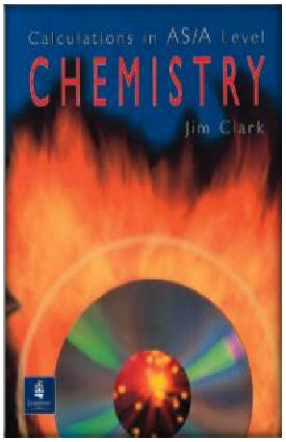
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of chemistry



The Science of Everyday Life: Why Teapots Dribble, Toast Burns and Light Bulbs Shine
The title says it all really, lots of interesting stuff about the things around your home!



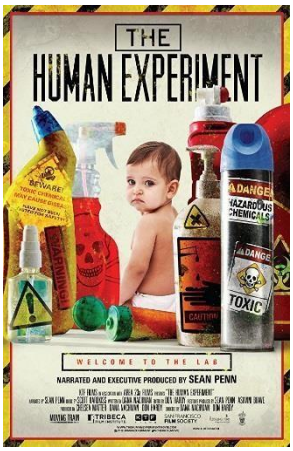
Bad Science
Here Ben Goldacre takes apart anyone who published bad / misleading or dodgy science – this book will make you think about everything the advertising industry tries to sell you by making it sound 'sciencey'.



Calculations in AS/A Level Chemistry
If you struggle with the mathematical side of chemistry then this is the book for you. It 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.

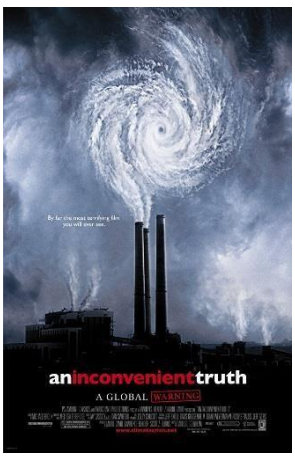
Movie Recommendations

Everyone loves a good story and everyone loves some great science. Here are some of the picks of the best films based on real life scientists and discoveries. You wont find Jurassic Park on this list! We've looked back over the last 50 years to give you our top 5 films you might not have seen before. Great watching for a rainy day.

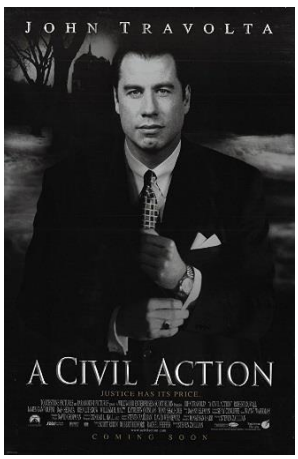


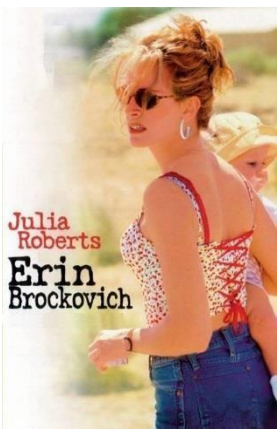
The Human Experiment (2013)
A documentary that explores chemicals found in everyday household products.

An Inconvenient Truth (2006)
Al Gore, former presidential candidate campaigns to raise public awareness of the dangers of global warming and calls for immediate action to curb its destructive effects on the environment.
(See also: An Inconvenient Sequel, 2017)



A Civil Action (1998)
A tenacious lawyer takes on a case involving a major company responsible for causing several people to be diagnosed with leukemia due to the town's water supply being contaminated, at the risk of bankrupting his firm and career.





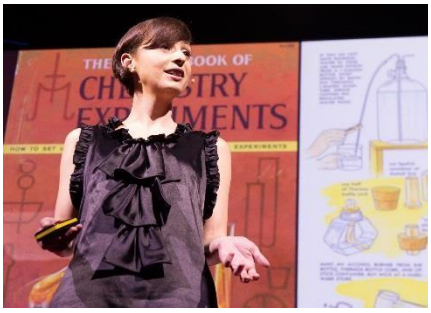
Erin Brokovich (2000) Based on a true story. An unemployed single mother becomes a legal assistant and almost single-handedly brings down a California power company accused of polluting a city's water supply.

The Insider (1999)
A research chemist comes under personal and professional attack when he decides to appear in a "60 Minutes" expose on Big Tobacco.

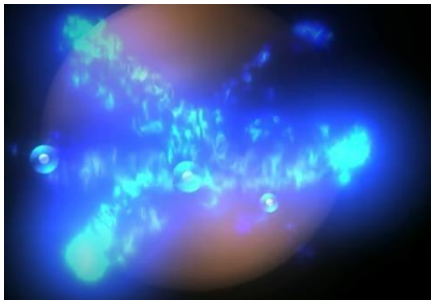
Movie Recommendations

If you have 30 minutes to spare, here are some great presentations (and free!) from world leading scientists and researchers on a variety of topics. They provide some interesting answers and ask some thought-provoking questions. Use the link or scan the QR code to view:

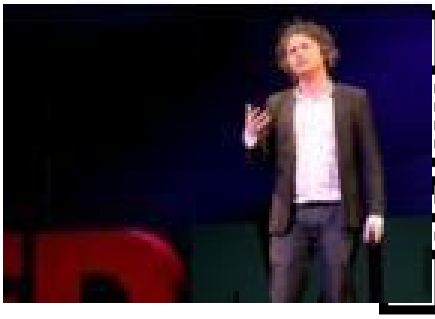
Play with Smart Materials
Available at :
https://www.ted.com/talks/catarina_mota_play_with_smart_materials Ink that conducts electricity; a window that turns from clear to opaque at the flip of a switch; a jelly that makes music. All this stuff exists, it's time to play with it. A tour of surprising and cool new materials.



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.



Battling Bad Science
Available at :
https://www.ted.com/talks/ben_goldacre_battling_bad_science#t-44279
Every day there are news reports of new health advice, but how can you know if they're right? Doctor and epidemiologist Ben Goldacre shows us, at high speed, the ways evidence can be distorted, from the blindingly obvious nutrition claims to the very subtle tricks of the pharmaceutical industry.



How Spectroscopy Could Reveal Alien Life Available at :
https://www.ted.com/talks/garik_israelian_what_s_inside_a_star
Israelian is a spectroscopist, studying the

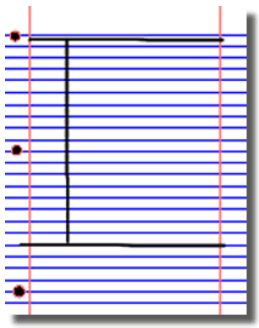
Movie Recommendations

spectrum emitted by a star to figure out what it's made of and how it might behave. It's a rare and accessible look at this discipline, which may be coming close to finding a planet friendly to life.

Research Activities

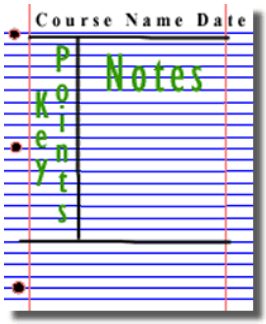
Research, reading and note making are essential skills for A level chemistry study. For the following task you are going to produce 'Cornell Notes' to summarise your reading.

1. Divide your page into three sections like this



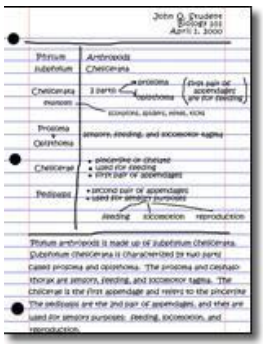
2. Write the name, date and topic at the top of the page

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

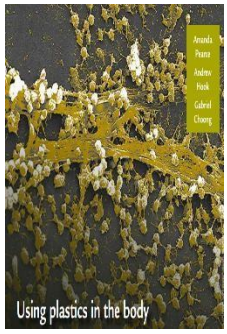


Images taken from http://coe.jmu.edu/learningtoolbox/cornellnotes.html

Research Activities

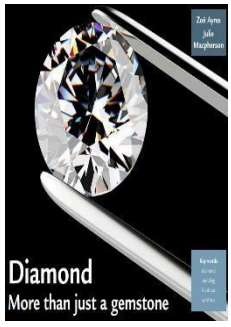
Aimed at students aged 14-19, Catalyst magazine is packed with interesting articles on cutting-edge science, interviews and new research written by leading academics. It also includes a booklet of teacher's notes, full of ideas and lesson plans to bring the articles to life in the classroom.
For each of the following topics you are going to use the resources to produce one page of Cornell style notes.
Use the links of scan the QR code to take you to the resources.

Topic 1: Using Plastics in the Body
Available at:
https://www.stem.org.uk/resources/elibrary/resource/382317/using-plastics-body
This Catalyst article looks at how scientists are learning to use polymers for many medical applications, including implants, bone repairs and reduction in infections.

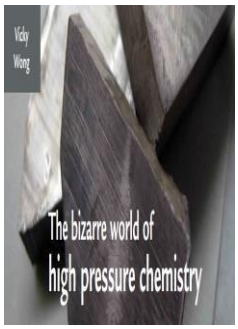


Topic 2: Catching a Cheat
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2017/03/Catching%20a%20cheat.pdf
This Catalyst article looks at analytical chemists who are involved in many kinds of testing, including drug testing to catch cheats in sport.

Topic 3: Diamond: More than just a gemstone
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2017/02/Diamond%20more%20than%20just%20a%20gemstone.pdf
This Catalyst article looks at diamond and graphite which are allotropes of carbon. Their properties, which depend on the bonding between the carbon atoms, are also examined.



Topic 4: The Bizarre World of High Pressure Chemistry
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2016/11/Catalyst27_1_the_bizarre_world_of_high_pressure_chemistry.pdf
This Catalyst article investigates high pressure chemistry and discovers that, when put under extreme pressure, the properties of a material may change dramatically.



Topic 5: Microplastics and the Oceans
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2016/11/Catalyst27_1_microplastics_%20and_the_oceans.pdf
This Catalyst article looks at microplastics. Microplastics are tiny particles of polymer used in many products. They have been found to be an environmental pollutant especially in oceans.

Pre-Knowledge Topics

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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:

Chemistry Topic 1 – Electronic structure, how electrons are arranged around the nucleus

A periodic table can give you the proton / atomic number of an element, this 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 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.

You can read about orbitals here:

http://bit.ly/pixlchem1

http://www.chemguide.co.uk/atoms/properties/atomorbs.html#top

Now that you are familiar with s, p and d orbitals try these problems. 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 k)

As 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+}

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: 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.
Oxygen is 'king', it always has an oxidation state of -2.
Hydrogen has an oxidation state of +1 (except metal hydrides). The charges in a molecule must cancel.

Examples: Sodium nitrate, $NaNO_3$

Na	N	3x O^{2-}
+1		- 8
+1	N	-6
To cancel	= +5	

sulfate ion, SO_4^{2-} $4xO^{2-}$ and 2- charges - 'showing'

	S
	= +6

Q2. Work out the oxidation state of the **underlined** atom in the following:

a) $\underline{Mg}CO_3$ b) $\underline{S}O_4^{2-}$ c) $Na\underline{Cl}O_3$ d) $\underline{Mn}O_2$ e) $\underline{Fe}_2O_3$ f) $\underline{V}_2O_5$

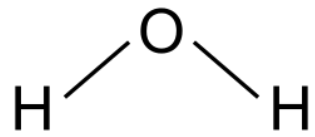
g) $K\underline{Mn}O_4$ h) $\underline{Cr}_2O_7^{2-}$ i) $\underline{Cl}_2O_4$

Given the percentage of each isotope you can calculate the mean mass which is the accurate atomic mass for that element.

Q3. Use the percentages of each isotope to calculate the accurate atomic mass of the following elements.

- Antimony has 2 isotopes: Sb-121 57.25% and Sb-123 42.75%
- Gallium has 2 isotopes: Ga-69 60.2% and Ga-71 39.8%
- Silver has 2 isotopes: Ag-107 51.35% and Ag-109 48.65%
- 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%



Chemistry Topic 4 – The shapes of molecules and bonding

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:

http://bit.ly/pixlchem5
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. You can read about shapes of molecules here:

http://bit.ly/pixlchem6
http://www.chemguide.co.uk/atoms/bonding/shapes.html#top

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 and the bond angles in a molecule of methane (CH_4)?

Chemistry Topic 5 – 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.

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. Balance the following equations a. $H_2 + 0_2 \rightarrow H_20$
b. $S_8 + 02 \rightarrow S0_3$

- $HgO \rightarrow Hg + 0_2$
- $Zn + HCl \rightarrow ZnCl_2 + H_2$
- $Na + H_20 \rightarrow NaOH + H_2$
- $C_{10}H_{16} + Cl_2 \rightarrow C + HCl$

g. $Fe + 0_2 \rightarrow Fe_20_3$
h. $C_6H_{12}0_6 + 0_2 \rightarrow C0_2 + H_20$ i. $Fe_20_3 + H_2 \rightarrow Fe + H_20$
j. $Al + FeO \rightarrow Al_2O_3 + Fe$

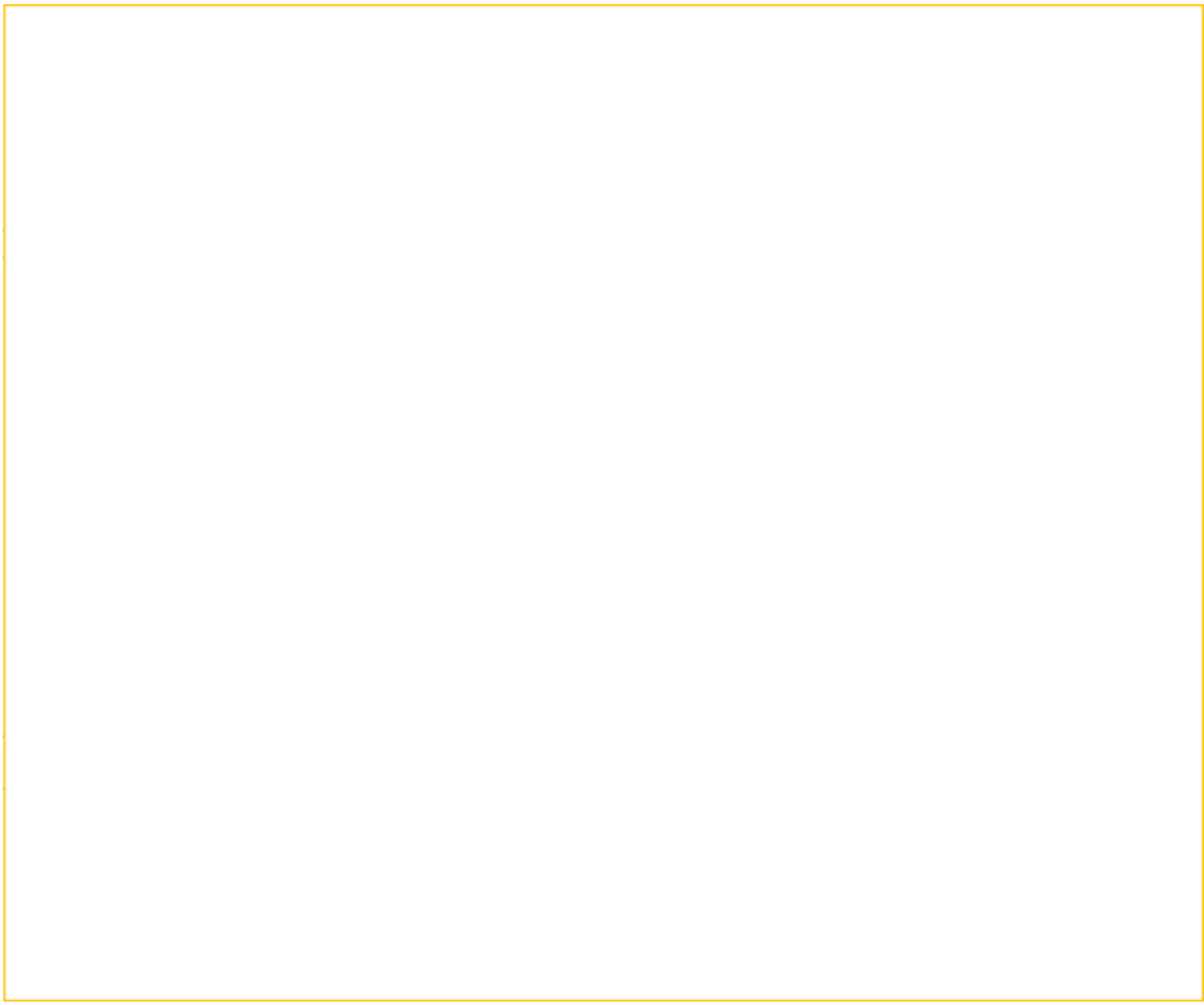
Chemistry Topic 7 – Solutions and concentrations

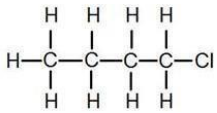
In chemistry a lot of the reactions we carry out involve mixing solutions rather than solids, gases or liquids. You will have used bottles of acids in science that have labels saying 'Hydrochloric acid 1M', this is a solution of hydrochloric acid where 1 mole of HCl, hydrogen chloride (a gas) has been 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

Q1.

- What is the concentration (in mol dm^{-3}) of 9.53g of magnesium chloride ($MgCl_2$) dissolved in $100cm^3$ of water?
- What is the concentration (in mol dm^{-3}) of 13.248g of lead nitrate ($Pb(NO_3)_2$) dissolved in $2dm^3$ of water?
- 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?
- What mass of silver is present in $100cm^3$ of $1moldm^{-3}$ silver nitrate ($AgNO_3$)?
- 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 10 – Acids, bases, pH

At GCSE you will know that an acid can dissolve in water to produce H^+ ions, at A level you will need a greater understanding of what an acid or a base is.
Read the following page and answer the questions

http://bit.ly/pixlchem15
http://www.chemguide.co.uk/physical/acidbaseeqia/theories.html#top

Q1. What is your new definition of what an acid is?
Q2. How does ammonia (NH_3) act as a base?

http://bit.ly/pixlchem16
http://www.chemguide.co.uk/physical/acidbaseeqia/acids.html#top

Q3 Ethanoic acid (vinegar) is a weak acid, what does this mean?
Q4 What is the pH of a solution of 0.01 $moldm^{-3}$ of the strong acid, hydrochloric acid?

Chemistry Topic 9 – 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:

Science on Social Media

Science communication is essential in the modern world and all the big scientific companies, researchers and institutions have their own social media accounts. Here are some of our top tips to keep up to date with developing news or interesting stories:

Follow on Twitter:
Satlers' Institute - Our activities include Festivals of Chemistry; Chemistry Camps; Curricula; Awards for Technicians, Graduates, A Level Students; and Seminars
@salters_inst

Daily A Level Chemistry Facts – Daily Chemistry Facts (Based on the A-Level AQA spec but most facts work with all)
@chemAlevels

Chemistry News –The latest chemistry news from only the best sources
@chemistrynews

Compound Interest– Graphics exploring everyday #chemistry. Winner of @absw 2018 science blog award
@compoundchem

Chemistry World – Chemistry magazine bringing you the latest chemistry news and research every day. Published by the Royal Society of Chemistry.
@ChemistryWorld

Royal Society of Chemistry - Promote, support and celebrate chemistry. Follow for updates on latest activities
@RoySocChem

Periodic Videos– Chemistry video series by @BradyHaran & profs at the Uni of Nottingham - also see @sixtysymbols & @numberphile
@periodicvideos

Find on Facebook:
Science Now - Science Now is a dedicated community that helps spread science news in all fields, from physics to biology, medicine to nanotechnology, space and beyond!

National Science Foundation – As an independent federal agency, NSF fund a significant proportion of basic research. For official source information about NSF, visit www.nsf.gov

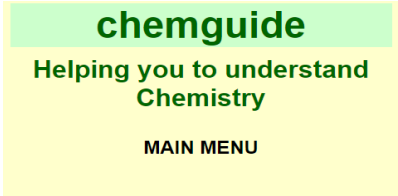
Science News Magazine - Science covers important and emerging research in all fields of science

BBC Science News - The latest BBC Science and Environment News: breaking news, analysis and debate on science and nature around the world

Scientific American - Scientific American is the authority on science and technology for a general audience, with coverage that explains how research changes our understanding of the world and shapes our lives.

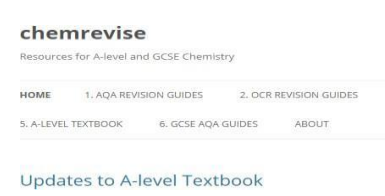
Science Websites

These websites all offer an amazing collection of resources that you should use again and again through out your course.



This website is very detailed and identifies other resources which are sharing incorrect or outdated information and suggests the correct materials to use. The site also contains links to the syllabuses of many exam boards which means it is accessible and useful to all students.
https://www.chemguide.co.u k/

Doc Brown is a website dedicated to all three science subjects; physics, chemistry and biology. It provides the user with summarised notes (useful for making flash cards) and practice questions to further their knowledge and understanding.
The site provides resources from a wide range of exam boards including AQA, Edexcel, Chemistry, CCEA, OCR, WJEC, CIE and Salters from GCSE level to A2.
http://www.docbrown.info/



The site was first made to host revision guides that are written for AQA A-level Chemistry. These revision guides have already been circulating on the internet for a couple of years on places like student room. This will be the place for the most up to date versions of them. The site has now extended to cover other exam boards. (OCR and Edexcel)
https://chemrevise.org/

The free revision website for students studying GCSE and A-levels. S-cool provides revision guides, question banks, revision timetable and more
https://www.s-cool.co.uk/a-level/chemistry

Tons of awesome courses in one awesome channel! Check out the playlists for past courses in physics, philosophy, games, economics, U.S. government and politics, astronomy, anatomy & physiology, world history, biology, literature, ecology, chemistry, psychology, and of course, chemistry!
https://www.youtube.com/user/crash course/featured

Science: Things to do!

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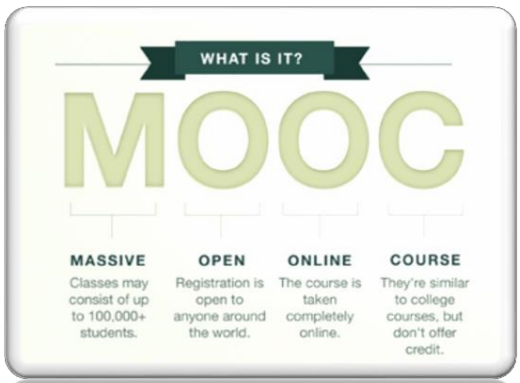
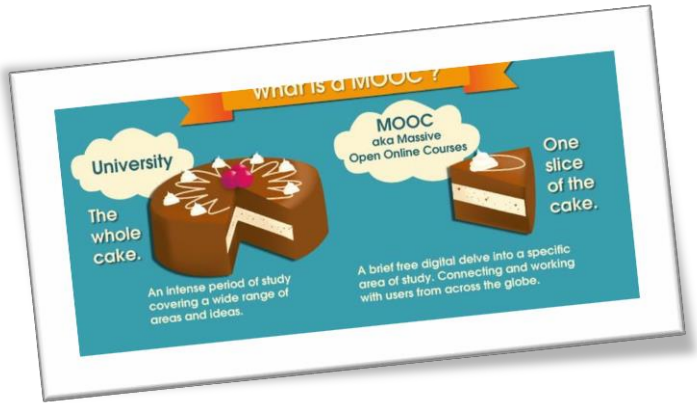
Day 4 of the holidays and boredom has set in?
There are loads of citizen science projects you can take part in either from the comfort of your bedroom, out and about, or when on holiday. Wikipedia does a comprehensive list of all the current projects taking place.

Want to stand above the rest when it comes to UCAS? Now is the time to act.
MOOCs are online courses run by nearly all universities. They are short FREE courses that you take part in. They are usually quite specialist, but aimed at the public, not the genius!
There are lots of websites that help you find a course, such as edX and Future learn.
You can take part in any course, but there are usually start and finish dates. They mostly involve taking part in web chats, watching videos and interactives.

Completing a MOOC will look great on your Personal statement and they are dead easy to take part in!





Science: Things to do!

A Level chemistry Transition Baseline Assessment

the PiXL club partners in excellence

The following 40 minute test is designed to test your recall, analysis and evaluative skills and knowledge.
Remember to use your exam technique: look at the command words and the number of marks each question is worth.
A suggested mark scheme is provided for you to check your answers.

All data is given on this paper, you will not need a periodic table

Answer all questions.

1. Here is part of a periodic table, use it to answer the following questions

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	20.2 Ne 10 neon
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	39.9 Ar 18 argon

a. Which is the correct electron configuration for a nitrogen atom, circle the correct answer [1]

$1s^2 2p^5$ $1s^1 2p^6$ $1s^2 2s^2 2p^3$ $1s^2 2s^5$ $1s^2 2s^2 2p^6 3s^2 3p^2$

b. Which is the correct electron configuration for a chlorine atom, circle the correct answer [1]

$1s^2 2s^8 2p^7$ $1s^2 2s^2 2p^8 2d^5$ $1s^2 2s^2 2p^6 3d^7$ $1s^2 2s^2 2p^6 3p^7$ $1s^2 2s^2 2p^6 3s^2 3p^5$

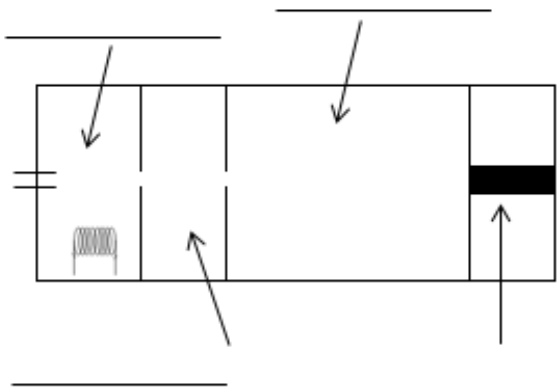
c. Which is the correct electron configuration for an aluminium **ion**, Al^{3+}? Circle the correct answer [1]

$1s^2 2s^2 2p^6$ $1s^2 2s^2 2p^6 3s^2 3p^3$ $1s^2 2s^2 2p^6 3s^2$ $1s^2 2s^2 2p^6 2d^1$

2. Draw a dot and cross diagram to show the bonding in a molecule of water, H_2O. [2]
Atomic numbers: H =1, O =8

3. A time of flight mass spectrometer has 4 main stages put the correct stage in the diagram below:

Drift region **Ionisation** **Detector** **Acceleration**



[4]

4. A mass spectrometer was used to analyse a sample of chlorine; the results of the analysis are as follows:

isotope mass	% of sample
Cl-35	75.53
Cl-37	24.47

Calculate the accurate atomic mass of chlorine. Give your answer to **3 decimal places**. [3]

mass: _____

5. Give the oxidation state of the underlined atom in the following chemicals.
Useful information: H = +1, K = +1, Na = +1, Mg = +2, O = -2, Cl = -1 [7]

a) $\underline{C}O_2$ b) $\underline{S}O_3$ c) $H_2\underline{S}O_4$ d) $\underline{Al}Cl_3$

e) $\underline{Cr}_2O_3$ f) $NaNO_3$ g) $\underline{V}Cl_4$

6. Balance the following chemical equations:

a) C_3H_8 + ___ O_2 → ___ CO_2 + ___ H_2O [3]

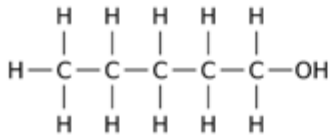
b) ___ HCl + $Mg(OH)_2$ → $MgCl_2$ + ___ H_2O [2]

c) Na_2CO_3 + ___ HCl → ___ NaCl + ___ H_2O + CO_2 [3]

7. Calculate the relative formula masses of the following:
Atomic masses: H = 1, O = 16, S = 32.1, C = 12, Ca = 40.1, Na = 23, Cl = 35.5, Zn = 65.4

a) $CaCl_2$ b) H_2CO_3 c) Na_2SO_4 d) C_3H_7OH e) $Zn(NO_3)_2$ [5]

8. A student carried out a reaction with this molecule:



a. What is the name of this molecule? _____ [2]

9. Vinegar is a solution of ethanoic acid (CH_3COOH) in water. A student carried out a titration of a sample of vinegar.
He used a pipette to measure exactly 25.0cm^3 of vinegar into a flask, added an indicator and titrated it with a 1.00 mol dm^{-3} solution of sodium hydroxide (NaOH).
The reaction is:

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

The student found that his average titration was 27.50cm^3

c = n/v c = concentration (mol dm^{-3}), n = number of moles, v = volume (dm^3)

n = m/Rfm n = number of moles, m = mass in grams, Rfm = formula mass

1dm^3 = 1000 cm^3

a. Using the chemical equation, how many moles of sodium hydroxide will react with 1 mole of ethanoic acid?

_____moles [1]

b. How many moles of sodium hydroxide are in 27.50cm^3 of 1.00 moldm^{-3} sodium hydroxide?

_____moles [2]

c. How many moles of ethanoic acid are in 25.0cm^3 of the vinegar sample?

_____moles [1]

d. How many moles of ethanoic acid are in 1dm^3 of vinegar?

_____moles [1]

e. Ethanoic acid has a formula mass of 48. What mass of ethanoic acid is present in 1dm^3 of vinegar?

_____g [2]

Pre-Knowledge Topics Answers to problems

Q1.

a) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6 4s^2$ b) $1s^2\ 2s^2\ 2p^6 3s^2 3p^1$ c) $1s^2\ 2s^2\ 2p^6 3s^2 3p^4$

d) $1s^2\ 2s^2\ 2p^6 3s^2 3p^5$ e) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ f) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^6 4s^2$

g) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^3 4s^2$ h) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^8 4s^2$ i) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^{10}\ 4s^1$

j) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^{10}\ 4s^2$ k) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^3$

Q2

a) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ b) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ c) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^{10}$

d) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ e) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^7$

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Q1

a) +4 b) +6 c) +5 d) +4 e) +3 f) +5 g) +7 h) +6 i) +4

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Q1 They must be ionised / turned into ions

Q2 The ions are all given the same amount of kinetic energy, as KE = ½ mv^2 the lighter ions will have greater speed / heavier ions will have less speed.

Q3 a) 121.855 b) 67.796 c) 107.973 d) 204.41 e) 87.710 / 87.7102

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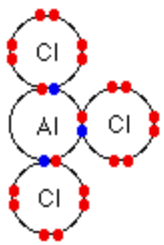
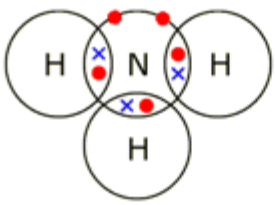
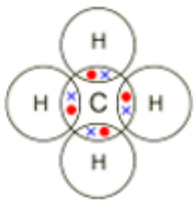
Q1



a) 120°



b) 107°



c) 109.5°

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Q1

a. $2H_2 + O_2 \rightarrow 2H_2O$

b. $S_8 + 12O2 \rightarrow 8SO_3$

c. $2HgO \rightarrow 2Hg + O_2$

d. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

e. $2Na + 2H_2O \rightarrow 2NaOH + H_2$

f. $C_{10}H_{16} + 8Cl_2 \rightarrow 10C + 16HCl$

g. $2Fe + 3O_2 \rightarrow 2Fe_2O_3$

h. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

i. $Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$

j. $2Al + 3FeO \rightarrow Al_2O_3 + 3Fe$

==========

Q1

a) 85.2/284 = 0.3 moles b) 73.56/122.6 = 0.6 moles c) 249.5/249.5 = 1.0 moles

d) 0.125 x 212.8 = 26.6g

e) 2Mg : 2O or 1:1 ratio 2.4g of Mg = 0.1moles so we need 0.1 moles of oxygen (O_2): 0.1 x 32 = 3.2g

==========

Q1

a) 9.53g/95.3 = 0.1 moles, in $100cm^3$ or $0.1dm^3$ in $1dm^3$ 0.1moles/$0.1dm^3$ = 1.0 mol dm^{-3}

b) 13.284g/331.2 = 0.04 moles, in $2dm^3$ in $1dm^3$ 0.04moles /$2dm^3$ = 0.02 mol dm^{-3}

c) $100cm^3$ of 0.1 mol dm^{-3} = 0.01 moles added to a total volume of 2 dm^3 = 0.01moles/$2dm^3$ = 0.005 mol dm^{-3}

d) in $1dm^3$ of 1 mol dm^{-3} silver nitrate, 1 mole of Ag = 107.9g in $0.1dm^3$ = 107.9 x 0.1 = 10.79g

e) 0.0526 x 79.7 = 42.0274g

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Q1

$Ba(NO_3)_2 : Na_2SO_4$

1 : 1 ratio

$12.5cm^3$ of $Ba(NO_3)_2$ = $0.0125dm^3$

0.15 $moldm^{-3}$ x $0.0125dm^3$ = 0.001875 moles

same number of moles of sodium sulfate needed, which has a concentration of 0.25 mol dm^{-3}

0.001875 moles / 0.25 mol dm^{-3} = 0.0075 dm^3 or $7.5cm^3$

==========

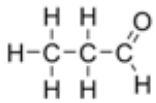
Q1 1-chlorobutane

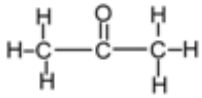
Add butan-1-ol to concentrated HCl and shake

Q2 React ethene with hydrogen gas at high temperature and pressure with a nickel catalyst

The reaction is similar in that it releases hydrogen but different as it proceeds much slower than in water

Q3 propanal propanone





The carbon atom joined to oxygen in propanal has a hydrogen attached to it, it does not in propanone.

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10.1 An acid is a proton donor

10.2 Ammonia can accept a proton, to become NH_4^+

10.3 ethanoic acid has not fully dissociated, it has not released all of its hydrogen ions into the solution.

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$
Mostly this Very few of these

10.4 pH = -log [0.01] = 2 The pH = 2

Suggested Mark Scheme:

Chemistry A level transition - baseline assessment. - Answers

1. .

   a. Which is the correct electron configuration for a nitrogen atom, circle the correct answer [1]

   $1s^2 2p^5$ $1s^1 2p^6$ $1s^2 2s^2 2p^3$ $1s^2 2s^5$ $1s^2 2s^2 2p^6 3s^2 3p^2$

   b. Which is the correct electron configuration for a chlorine atom, circle the correct answer [1]

   $1s^2 2s^8 2p^7$ $1s^2 2s^2 2p^8 2d^5$ $1s^2 2s^2 2p^6 3d^7$ $1s^2 2s^2 2p^6 3p^7$ $1s^2 2s^2 2p^6 3s^2 3p^5$

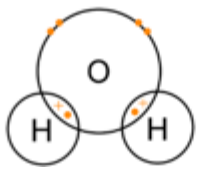
   c. Which is the correct electron configuration for an aluminium **ion**, Al^{3+}? Circle the correct answer [1]

   $1s^2 2s^2 2p^6$ $1s^2 2s^2 2p^6 3s^2 3p^3$ $1s^2 2s^2 2p^6 3s^2$ $1s^2 2s^2 2p^6 2d^1$

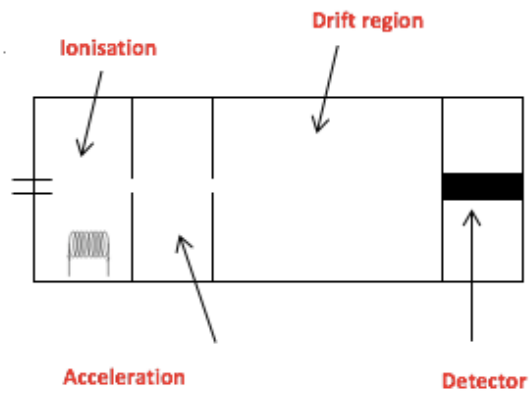
2. Draw a dot and cross diagram to show the bonding in a molecule of water, H_2O. [2]
   Atomic numbers: H =1, O =8

1 mark for 2 x shared electrons

1 mark for lone pairs



3. A time of flight mass spectrometer has 4 main stages put the correct stage in the diagram below:



[4]

4. A mass spectrometer was used to analyse a sample of chlorine, the results of the analysis are as follows:

isotope mass	% of sample
Cl-35	75.53
Cl-37	24.47

(35x75.53) + (37x24.47)/100 [1]

= 35.4894 [1]

To 3dp = 35.489 [1] [2 marks if above line is missing]

[3]

5. Give the oxidation state of the underlined atom in the following chemicals.
Useful information: H = +1, K = +1, Na = +1, Mg = +2, O = -2, Cl = -1 [7]

a) $\underline{C}O_2$ +4 b) $\underline{S}O_3$ +6 c) $H_2\underline{S}O_4$ +6 d) $\underline{Al}Cl_3$ +3

e) $\underline{Cr}_2O_3$ +3 f) $Na\underline{N}O_3$ +5 g) $\underline{V}Cl_4$ +4

6. Balance the following chemical equations:

a) C_3H_8 + _5_ O_2 → _3_ CO_2 + _4_ H_2O [3]

b) _2_ HCl + $Mg(OH)_2$ → $MgCl_2$ + _2_ H_2O [2]

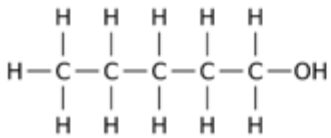
c) Na_2CO_3 + _2_ HCl → _2_ NaCl + _1_ H_2O + CO_2 [3]

7. Calculate the relative formula masses of the following:
Atomic masses: H = 1, O = 16, S = 32.1, C = 12, Ca = 40.1, Na = 23, Cl = 35.5

a) $CaCl_2$ b) H_2CO_3 c) Na_2SO_4 d) C_3H_7OH e) $Zn(NO_3)_2$ [5]

111.1 62 142.3 60 189.4

8. A student carried out a reaction with this molecule:



a. What is the name of this molecule? pentan-1-ol [2]

Pentanol = 1 mark pentan-1-ol = 2 marks

9.

a. Using the chemical equation, how many moles of sodium hydroxide will react with 1 mole of ethanoic acid?

_____1_____moles [1]

b. How many moles of sodium hydroxide are in 27.50cm^3 of 1.00 $moldm^{-3}$ sodium hydroxide?

27.5/1000 [1] x 1.00 = 0.0275 [1]

0.0275 [2] moles [2]

c. How many moles of ethanoic acid are in 25.0cm^3 of the vinegar sample?

___0.0275 __moles [1]

d. How many moles of ethanoic acid are in $1dm^3$ of vinegar?

0.0275 x 1000/25 = 1.10

___1.10____moles [1]

e. Ethanoic acid has a formula mass of 48. What mass of ethanoic acid is present in $1dm^3$ of vinegar?

1.1 x 48 = 52.8g

___52.8g ___g [1]