Chemistry

Subject	Chemistry
Exam Board	AQA
Head of Department	Ms Clarke

Assessment

Unit 1: Physical Chemistry		**Unit 2: Inorganic Chemistry**		**Unit 3: Organic Chemistry**	
33.3%	Written Exam, 2 hours	33.3%	Written Exam, 2 hours	33.3%	Written Exam, 2 hours

Welcome to Chemistry,

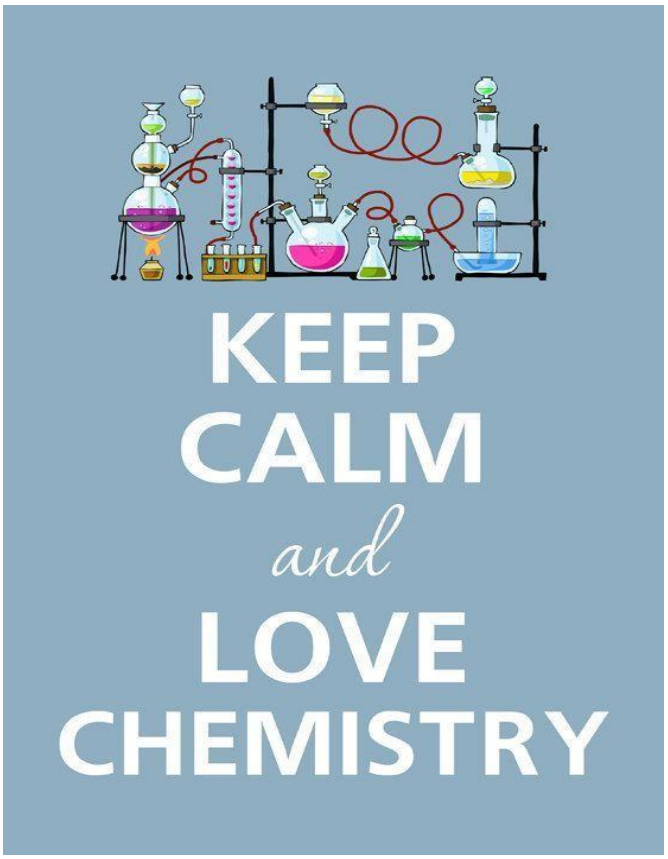
This transition pack will provide you with a brief outline of the course structure and a reading list of sources and videos. You may wish to use these sources before and throughout the course to improve your wider understanding. This pack also contains some interesting and fun activities to get you ready for the first few weeks of the course. Please submit your work by the set **due dates** to sixthform@sta.islington.sch.uk for the attention of Ms Yepifanova.

Curriculum Map (Term 1)

September - October 2020	**November - December 2020**
Physical Chemistry Amount of substance Bonding	Energetics Kinetics Equilibria Oxidation, reduction, and redox reactions

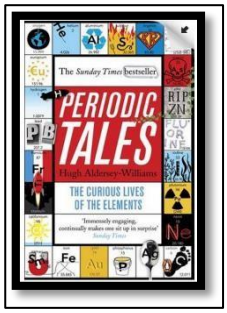
Subject Specific Reading List:	1. **Periodic Tales: The Curious Lives of the Elements** (Paperback) Hugh Aldersey-Williams ISBN-10: 0141041455 **http://bit.ly/pixlchembook1** 2. **Calculations in AS/A Level Chemistry** (Paperback) Jim Clark ISBN-10: 0582411270 **http://bit.ly/pixlchembook4**
Useful Websites:	https://filestore.aqa.org.uk/resources/chemistry/AQA-7404-7405-TG.PDF http://www.rsc.org/Learn-Chemistry http://www.rsc.org/learn-chemistry/collections/experimentation

So you are considering 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 aimed to be used after you complete your GCSE, throughout the remainder of the summer term and over the Summer Holidays to ensure you are ready to start your course in September.

Book Recommendations



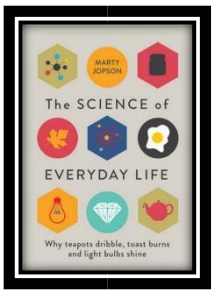
Periodic Tales: The Curious Lives of the Elements (Paperback) Hugh Aldersey-Williams

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!

Videos to watch online

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/pixlchemvid1ahttp://www.dailymotion.com/playlist/x2igjq_Rough-Science_rough-science-full-series/1#video=xxw6pr or

http://bit.ly/pixlchemvid1bhttps://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/pixlchemvid3https://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-

Transition activities submission dates:

1. **All research activities (page 5) should be submitted by Friday the 29th of May**
2. **Chemistry topics from 1 to 6 (pages 6-10) by Friday the 26th of June**
3. **Chemistry topics from 7 to 11 (pages 11-16) by September 2020 (first week back)**

Due: Friday 29th May 2020

Email: sixthform@sta.islington.sch.uk

Research activities

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:** 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?

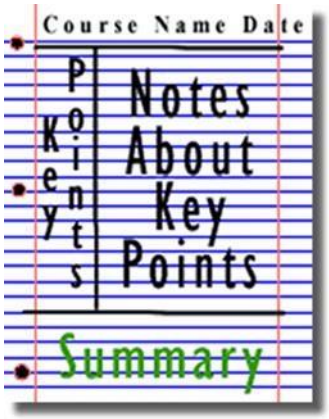


Figure 1: http://coe.jmu.edu/learningtoolbox/images/noteb4.gif

Due: Friday 26th June 2020

Email: sixthform@sta.islington.sch.uk

Pre-Knowledge Topics

Chemistry topic 1 – Conversion of units

Q.1.1 Mass

Convert the following into grams:

a) 0.25 kg
b) 15 kg
c) 100 tonnes
d) 2 tonnes

Q.1.2 Volume

a) 100 cm^3
b) 25 cm^3
c) 50 m^3
d) 50000 cm^3

Tip – always use standard form for very large and very small numbers!

Chemistry topic 2 – The history of The Periodic Table

The Periodic Table is one of the most important tools every chemist has. It is important to know the history of the development of periodic table.

You can use the links to find the information you need and to refresh your knowledge about periodic table development.

https://www.savemyexams.co.uk/gcse-chemistry-aqa-new/revision-notes/atomic-structure-the-periodic-table/the-periodic-table/history-of-the-periodic-table/

Q.2 Complete the table to summarise some similarities and differences between Newland' table and Mendeleev's table below.

Newlands	Mendeleev

Due: Friday 26th June 2020

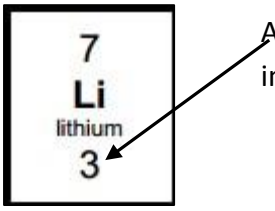
Email: sixthform@sta.islington.sch.uk

Chemistry topic 3 – 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/pixlchem1http://www.chemguide.co.uk/atoms/properties/atomorbs.html#tp

Q.3 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

Chemistry topic 4 – Oxidation and reduction

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!

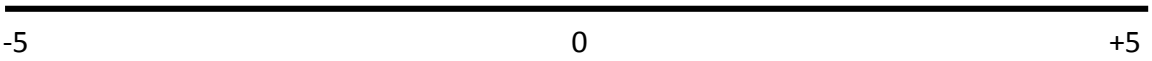
You know that the metals in group 1 react to form ions that are +1, i.e. Na^+ and that group 7, the halogens, form -1 ions, i.e. Br-.

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.



You can read about the rules for assigning oxidation numbers here:

http://www.dummies.com/how-to/content/rules-forassigningoxidation-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: 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 (except in peroxide -1)

Hydrogen has an oxidation state of +1 (except metal hydrides)

The charges in a molecule must cancel.

Examples: Sodium nitrate, $NaNO_3$ We need to find the oxidation state of N

nitrate ion, NO^-_3

sodium ion, Na^{+1} $3x\ O^{2-}$

+1 -6

To cancel: N = +5

Q.4 Work out the oxidation state of the *underlined* atom in the following:

a) $Mg\underline{C}O_3$ b) $\underline{S}O_3$ c) $NaClO_3$ 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) $\underline{Cl}_2O_4$

Due: Friday 26th June 2020

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Chemistry topic 5 – Isotopes and mass

You will remember that an isotopes are elements that have differing numbers of neutrons. Hydrogen has 3 isotopes; $H_1^1 H_1^2$ H_1^3

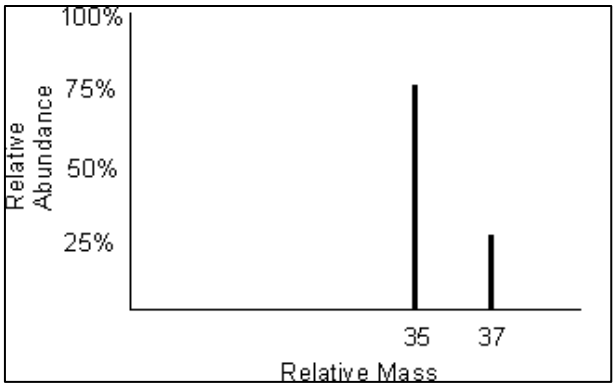
Isotopes occur naturally, so in a sample of an element you will have a mixture of these isotopes. We can accurately measure the amount of an isotope using a **mass spectrometer**. You will need to understand what a mass spectrometer is and how it works at A level. You can read about a mass spectrometer here:

http://bit.ly/pixlchem3http://www.kore.co.uk/tutorial.htm
http://bit.ly/pixlchem4
http://filestore.aqa.org.uk/resources/chemistry/AQA-74047405-TN-MASS-SPECTROMETRY.PDF

Q5.1 What must happen to the atoms before they are accelerated in the mass spectrometer?

Q5.2 Explain why the different isotopes travel at different speeds in a mass spectrometer.

A mass spectrum for the element chlorine will give a spectrum like this:



75% of the sample consist of chlorine-35, and 25% of the sample is chlorine-37.

Given a sample of naturally occurring chlorine ¾ of it will be Cl-35 and ¼ of it is Cl-37. We can calculate what the **mean** mass of the sample will be:

Mean mass = $\frac{75}{100} \times 35 + \frac{25}{100} \times 37 = 35.5$

If you look at a periodic table this is why chlorine has an atomic mass of 35.5.

http://www.avogadro.co.uk/definitions/ar.htm

An A level periodic table has the masses of elements recorded much more accurately than at GCSE. Most elements have isotopes and these have been recorded using mass spectrometers.

Due: Friday 26th June 2020

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GCSE

11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9
27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17

A level

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
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

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

Q5.3 Use the percentages of each isotope to calculate the accurate atomic mass of the following elements.

a) Antimony has 2 isotopes: Sb-121 57.25% and Sb-123 42.75%

b) Gallium has 2 isotopes: Ga-69 60.2% and Ga-71 39.8%

c) Silver has 2 isotopes: Ag-107 51.35% and Ag-109 48.65%

d) 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 6 – Working with significant fugures

At A level you are expected to know how to give your answer to a required number of significant figures

Q.6.1 Complete the following calculations, giving your answers to three significant figures.

a) 32420 + 762891 b) 12000 ÷ 1000 c) 0.06438 + 0.0004378 d) 180 ÷ 90 **(4)**

Q.6.2 The following results are accurately measured values from experiments. Complete the sum and give the answer to the most number of significant figures that you think gives an answer that is trustworthy.

a) 1.4567 + 2.3 b) 10.5 - 0.145 c)3.000 - 0.056 d) 8693.457 + 1.2367 **(4)**

Due: September 2020
Bring to first lesson

Chemistry topic 7 – 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/pixlchem7http://www.chemteam.info/Equations/Balance-Equation.html

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

http://bit.ly/pixlchem8https://phet.colorado.edu/en/simulation/balancing-chemical-equations

Q 7.1 Balance the following equations

a. $H_2 + O_2 \rightarrow H_20$

b. $S_8 + O_2 \rightarrow S O_3$

c. $HgO \rightarrow Hg + O_2$

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

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

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

g. $Fe + O_2 \rightarrow Fe_2 O_3$

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

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

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

Chemistry topic 8 – 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-trbptds_pdf.png

Due: September 2020

Bring to first lesson

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

$$Mg + S \rightarrow MgS$$

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.

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/pixlchem9http://www.chemteam.info/Mole/Mole.html

Q8.1 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? $2Mg + O_2 \rightarrow MgO$

Due: September 2020

Bring to first lesson

Chemistry topic 9 – 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/pixlchem10http://www.docbrown.info/page04/4_73calcs11msc.htm

Q8.1

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?

Due: September 2020

Bring to first lesson

Chemistry topic 9 – 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/revisio n/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/pixlchem12http://www.docbrown.info/page06/Mtestsnotes/ExtraVolCalcs1.ztm

Use the steps on the previous page to help you

Due: September 2020
Bring to first lesson

Q9.1 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 0.25moldm^{-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 10 – Rearranging of equations

At GCSE you would have come across many opportunities for rearranging equations. Practicing rearranging equations will no doubt increase your confidence in tackling some very challenging questions.

Rearrange the following equations to give the letter shown as the subject.

a) What does **c** equal if q = mcT ?

b) What does **T** equal if G = H - TS

c) What does **q** equal if E = 3pq/2r

d) What does **n** equal if PV = nRT ?

e) What does **c** equal if 2a = 3(b – 2c)

f) What does **T** equal if F = mc + Rk/T

(6)

Due: September 2020
Bring to first lesson

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/pixlchem15http://www.chemguide.co.uk/physical/acidbaseeqia/theories.html#top

Q11.1 What is your new definition of what an acid is?

Q11.2 How does ammonia (NH_3) act as a base?

http://bit.ly/pixlchem16http://www.chemguide.co.uk/physical/acidbaseeqia/acids.html#tp

Q11.3 Ethanoic acid (vinegar) is a weak acid, what does this mean?

Q11.4 What is the pH of a solution of 0.01 $moldm^{-3}$ of the strong acid, hydrochloric acid?