KNOLE
ACADEMY

Pre-IB Chemistry Transition
Assignment 3
Topics 6-10

WHAT DID THE THERMOMETER SAY TO THE GRADUATED CYLINDER?

"YOU MAY HAVE GRADUATED BUT I'VE GOT MANY DEGREES."

DIYLOL.COM
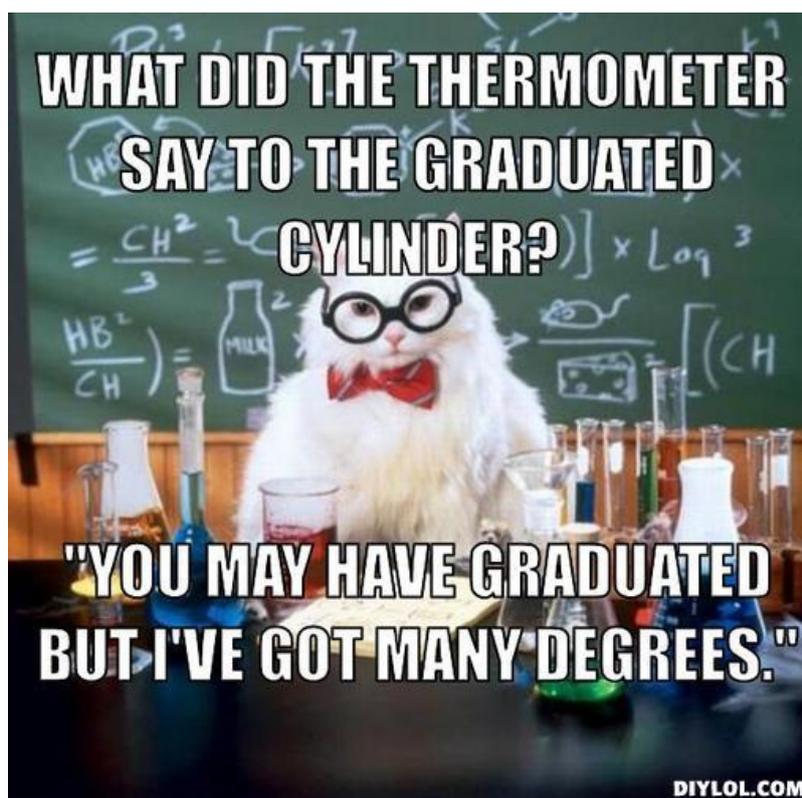
Instruction

Please complete the questions. Resources are included to remind/help you answer them.

Pre-Knowledge Topics

Chemistry topic 6 – Measuring chemicals – the mole

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

http://bit.ly/pixlpertab

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

Now that we have our chemical equations balanced, we need to be able to use them in order to work out masses of chemicals we need, or we can produce.

The **mole** is the chemists equivalent of a dozen, atoms are so small that we cannot count them out individually, we weigh out chemicals.

For example: magnesium + sulphur → magnesium sulphide

$$Mg \quad + \quad S \quad \rightarrow \quad MgS$$

We can see that one atom of magnesium will react with one atom of sulphur, 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 sulphur then I would have 1 mole of sulphur atoms.

So 24.3g of Mg will react precisely with 32.1g of sulphur, and will make 56.4g of magnesium sulphide.

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

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

http://bit.ly/pixlchem9

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

Q6.1 Answer the following questions on moles.

    a)   How many moles of phosphorus pentoxide (P_4O_{10}) are in 85.2g?

    b)   How many moles of potassium in 73.56g of potassium chlorate (V) ($KClO_3$)?

    c)   How many moles of water are in 249.6g of hydrated copper sulphate (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 sulphate ($SnSO_4$)?

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

Chemistry topic 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

Q7.1

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

Chemistry topic 8 – Titrations

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

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

http://bit.ly/pixlchem11

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

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

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

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

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

Step 2; the ratios   2 : 1

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

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

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

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

Step 5: Calculate concentration.   concentration = moles/volume ←in dm^3 = 0.00137/0.025 = **_0.0548 moldm^{-3}_**

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

http://bit.ly/pixlchem12

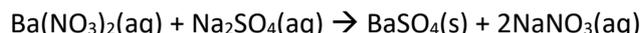http://www.docbrown.info/page06/Mtestsnotes/ExtraVolCalcs1.htm

Use the steps on the last page to help you

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

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

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

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

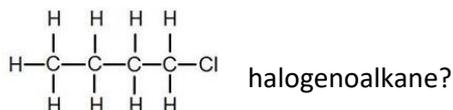http://www.chemguide.co.uk/basicorg/conventions/names.html#top

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

Q9.1 Halogenoalkanes

What is the name of this   halogenoalkane?

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

Q9.2 Alcohols

How could you make ethanol from ethene?

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

Q9.3 Aldehydes and ketones

Draw the structures of a) propanal b) propanone

How are these two functional groups different?

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

Q10.1 What is your new definition of what an acid is?

Q10.2 How does ammonia (NH_3) act as a base?

http://bit.ly/pixlchem16

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

Q10.3 Ethanoic acid (vinegar) is a weak acid, what does this mean?

Q10.4 What is the pH of a solution of 0.01 moldm^{-3} of the strong acid, hydrochloric acid?