# Queens School

## A-level Chemistry

New to year 12 Chemistry

Introductory Assessment

Due: 14 September 2018

Name:_____

Group:_____

Welcome to A-level Chemistry.

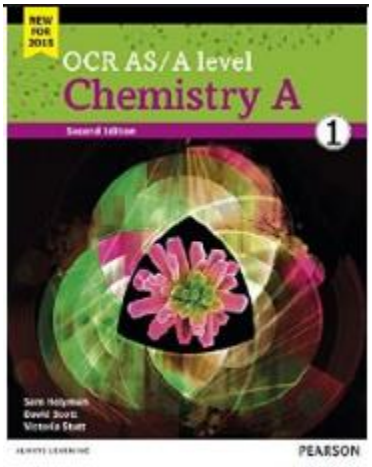
An A-level in Chemistry is a challenging task to take on. It is assumed by the examiners that you will still remember **everything** from the GCSE so that you can build on this; you will be expected to link ideas together much more than you have done in the past.

You will need to demonstrate the skills you have learned previously to a higher level and you are expected to read beyond the set text for the course to develop a breadth of knowledge. If you do not start the course with an organised and dedicated approach you will find that even after just a few months it will be almost impossible to catch up.

So to start you off correctly, you need to complete this introductory assessment by the **Friday 14th of September** and give it to your chemistry teacher. This will allow us to get a good idea of what you need to work on in the early months to make sure you are able to keep up with the demands of one of the most difficult subjects.

Complete all sections, show working out where necessary (it helps us follow your thoughts and help you better when you are stuck) and come for help if you are stuck either in person or via email during the holidays.

The text book we use in school is by Pearson, students are expected to have a copy of this. There are also other really useful books from other publishers and I have copies of most if you wish to have a look before you buy.




Miss L Shirion

Head of Chemistry

## Balance these equations

1) _____ $Al(NO_3)_3$ + _____ $(NH_4)_3PO_4$ → _____ $AlPO_4$ + _____ $NH_4NO_3$

2) _____ $AgF$ + _____ $CaCl_2$ → _____ $AgCl$ + _____ $CaF_2$

3) _____ $ZnBr_2$ + _____ $Pb(NO_2)_2$ → _____ $Zn(NO_2)_2$ + _____ $PbBr_2$

4) _____ $C_2H_4O_2$ + _____ $O_2$ → _____ $CO_2$ + _____ $H_2O$

5) _____ $Ca$ + _____ $CuF_2$ → _____ $CaF_2$ + _____ $Cu$

6) _____ $H_2SO_4$ + _____ $B(OH)_3$ → _____ $B_2(SO_4)_3$ + _____ $H_2O$

7) _____ $S_8$ + _____ $O_2$ → _____ $SO_2$

8) _____ $H_2O_2$ → _____ $O_2$ + _____ $H_2O$

9) _____ $K$ + _____ $F_2$ → _____ $KF$

10) _____ $AgNO_3$ + _____ $Ga$ → _____ $Ag$ + _____ $Ga(NO_3)_3$

11) _____ $N_2$ + _____ $H_2$ → _____ $NH_3$

12) _____ $NaCl$ + _____ $H_2SO_4$ → _____ $NaHSO_4$ + _____ $HCl$

13) _____ $KMnO_4$ → _____ $K_2MnO_4$ + _____ $MnO_2$ + _____ $O_2$

14) _____ $Fe$ + _____ $AgNO_3$ → _____ $Fe(NO_3)_2$ + _____ $Ag$

15) _____ $Li_2SO_4$ + _____ $K_3PO_4$ → _____ $Li_3PO_4$ + _____ $K_2SO_4$

→

## Calculating Theoretical Yield

Step 1: Balance the equation

Step 2: Work out the RFM of the species involved

Step 3: Multiply the RFM by the balancing number for the species involved. This gives you the ratio of the reactants to the products

Step 4: Compare the amount you have been given to the ratio to work out the scale up/down value for the reactants. Then scale up the products to match

http://www.docbrown.info/page04/4_73calcs14other2a.htm

Example:

You are given 240 tonnes of NaOH, what is the theoretical yield of $Na_2SO_4$

Step 1:

$$H_2SO_4 + \underline{2}NaOH \rightarrow Na_2SO_4 + \underline{2}H_2O$$

Step 2:

NaOH = 23 + 16 + 1 = 40

$Na_2SO_4$ = (23 x 2) + 32 + (16 x 4) = 142

Step 3:

NaOH = 40 x 2 = 80

$Na_2SO_4$ = 142 x 1 = 142

**NaOH : $Na_2SO_4$**

**80 : 142**

This gives us the amount of reactant/product for the "standard recipe"

Step 4

**NaOH : $Na_2SO_4$**

**80 : 142**

**240 : ?**

The **240** is the amount you are told you will use **from the question**. Work out how many times bigger/smaller this is than the value for the "standard recipe"

This is 3 times more reagent which means you should get 3 times more products. Therefore….. multiply the expected yield from the "standard recipe" by 3 also.

Expected yield of sodium sulphate = 142 x 3 = 426 tonnes

Calculate the theoretical yield of all products if:

1) _____ $Al(NO_3)_3$ + _____ $(NH_4)_3PO_4 \rightarrow$ _____ $AlPO_4$ + _____ $NH_4NO_3$

106.5 g of aluminium nitrate is used and ammonium phosphate is in excess

2) _____ $AgF$ + _____ $CaCl_2$ → _____ $AgCl$ + _____ $CaF_2$

507.6g of silver fluoride is used and calcium chloride is in excess

3) _____ $ZnBr_2$ + _____ $Pb(NO_2)_2$ → _____ $Zn(NO_2)_2$ + _____ $PbBr_2$

2,093 tonnes of lead nitrite is used and zinc bromide is in excess

4) _____ $C_2H_4O_2$ + _____ $O_2$ → _____ $CO_2$ + _____ $H_2O$

20 g of ethanoic acid is used and excess oxygen

5) _____ $Ca$ + _____ $CuF_2$ → _____ $CaF_2$ + _____ $Cu$

50g of Calcium is used with excess copper fluoride

**Atom Economy**

Atom economy is the amount of useful products expressed as a percentage of the total products. To calculate divide the mass of useful products by the mass of total product and then multiply by 100.

1. Iron is extracted from its ore using carbon:

$$2\ Fe_2O_3 + 3\ C \rightarrow 4\ Fe + 3\ CO_2$$

What is the atom economy of this reaction?

2. Titanium can be extracted from its ore by two different methods. One uses a more reactive metal to displace the titanium:

$$TiO_2 + 2\ Mg \rightarrow Ti + 2\ MgO$$

The second method is electrolysis of the ore. The overall reaction for this method is:

$$TiO_2 \rightarrow Ti + O_2$$

Calculate the atom economy for each reaction.

Oxygen is a useful product and can be sold. What is the atom economy of the electrolysis if the oxygen is collected and sold?

**Structure and Bonding:**

Draw labelled diagrams to show the structure and bonding in:

a) Sodium

b) Sodium Chloride

c) Chlorine

d) Diamond

e) State and explain the conductivity of each of the above
f) State and explain the melting point of each of the above

**Organic Chemistry**

Draw the first 10 alkanes and name them.

Find out the name of the first 5 alkyl substituents as well as the following functional groups:

OH

Cl

Br

I

COOH

C=O

**Atomic Structure:**

Find out the difference between a shell, sub-shell and an orbital.

Sketch the s, p and d orbitals

Write the electron configuration for Fluorine, Magnesium, Phosphorus and Potassium

Calculate the number of mass of NaOH in a 25 $cm^3$ portion that is neutralised by titration by 20 $cm^3$ of 0.5 mol $dm^{-3}$ HCl