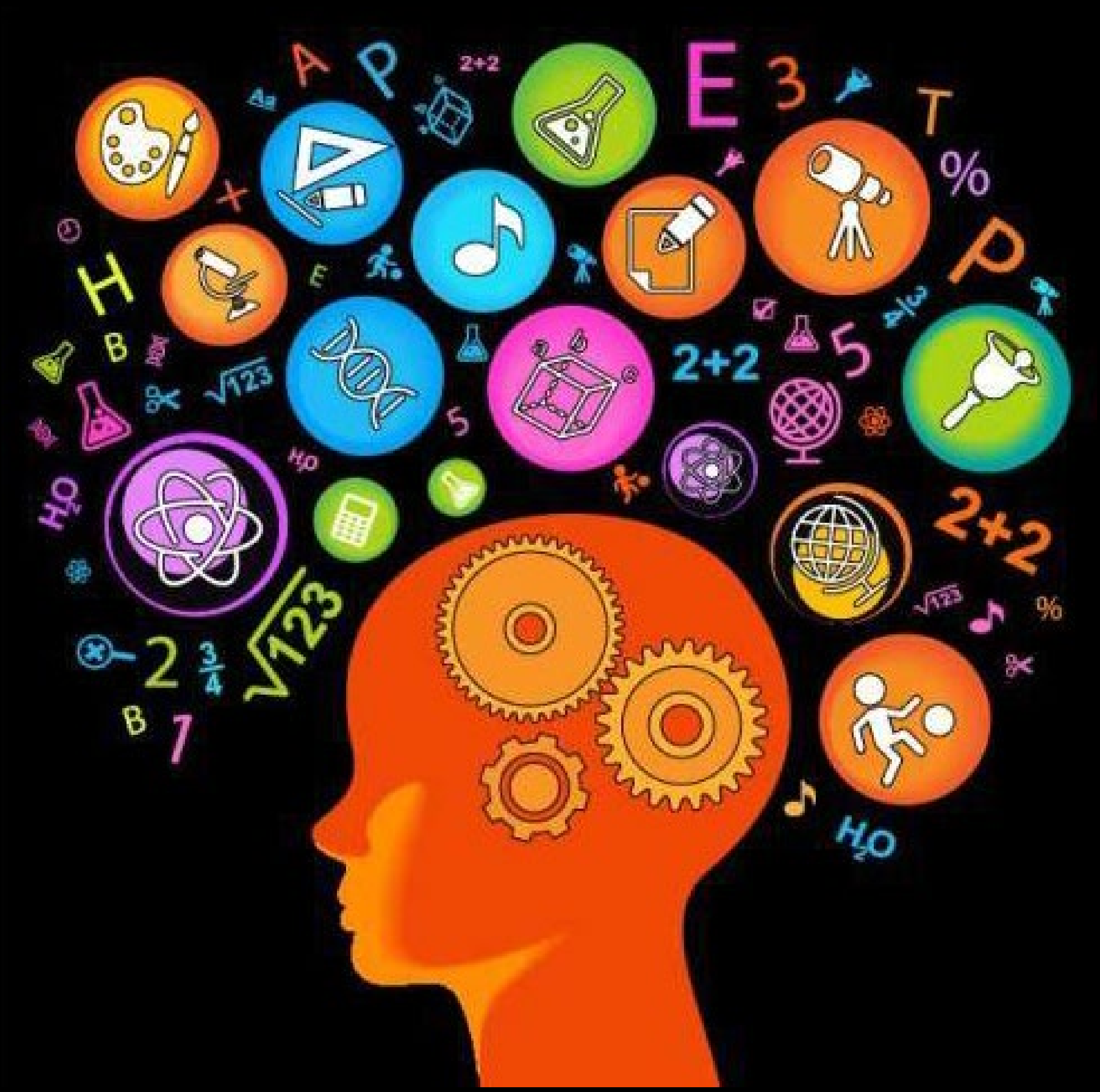

# CHEMISTRY

## Science Department

ST PETER'S SCHOOL

LEARN, ASPIRE, EXCEED

# Activities

## Activity 1: Balancing equations

## Activity 2: Writing the formulae of ionic compounds

## Activity 3: Research the structure of the atom

### Activity 1: Balancing equations

Chemical equations in A level do not come already balanced. It is expected that all equations are balanced when written. Making sure equations are balanced must be done before the equation can be used in any chemically meaningful way.

A balanced equation has equal numbers of each type of atom on each side of the equation.

The Law of Conservation of Mass is the rationale for balancing a chemical equation. "Matter is neither created nor destroyed."

Therefore, we must finish our chemical reaction with as many atoms of each element as when we started.

**Worked example**:

$$H_2 + O_2 \rightarrow H_2O$$

It is an unbalanced equation. This means that there are UNEQUAL numbers at least one atom on each side of the arrow.

In the above equation, there are two atoms of hydrogen on each side, BUT there are two atoms of oxygen on the left side and only one on the right side.

Step one put a 2 front of the water on the right.

$$H_2 + O_2 \rightarrow 2H_2O$$

Now there are 2 oxygen atoms on the left and 2 oxygen atoms on the right

But there are 2 hydrogen atoms on the left and 4 hydrogen atoms on the right

Step two put a 2 in front of the hydrogens on the left.

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

Now the equation is balanced there are equal number of atoms on each side of the equation.

Balance the following equations:

1. __$FeCl_3$ + __$MgO$ → __$Fe_2O_3$ + __$MgCl_2$

2. __ $Li$ + __$H_3PO_4$ → __ $H_2$ + __$Li_3PO_4$

3. __ $ZnS$ + __$O_2$ → __$ZnO$ + __$SO_2$

4. ___$FeS_2$ + __$Cl_2$ → __$FeCl_3$ + __$S_2Cl_2$

5. __$HCl(aq)$ + __$MnO_2(s)$ → __$MnCl_2(aq)$ + __$Cl_2(g)$ + __$H_2O(\ell)$

6. __ $Fe_2O_3(s)$ + __$C(s)$ → __$Fe(s)$ + __$CO_2(g)$

7. __ $C_5H_{11}NH_2$ + __$O_2$ → __$CO_2$ + __$H_2O$ + __$NO_2$

8. __$NH_3$ + __$O_2$ → __$NO$ + __$H_2O$

9. __$NH_3$ + __$Cl_2$ → __ $N_2H_4$ + __$NH_4Cl$

10. __$NH_3$ + __$F_2$ → __$N_2F_4$ + __$HF$

11. __$NH_4NO_3(s)$ → __$N_2(g)$ + __$O_2(g)$ + __$H_2O(g)$

12. __$N_2O$ + __$CH_4$ → __$N_2$ + __$CO_2$ + __ $H_2O$

13. __$NO_2$ + __$O_2$ + __$H_2O$ → __$HNO_3$

14. __$NO_2$ + __ $H_2O$ → __$HNO_3$ + __$NO$

15. __$N_2(g)$ + __$O_2(g)$ + __$H_2O$ → __$HNO_3$

**Activity 2: Writing the formulae of ionic compounds**

In A level you need to know all the following ions and their charges and be able to calculate the formula of ionic compounds.

1. Identify the symbol of the positive metal ion (cation) first part of the name) and the negative non-metal ion (anion)
2. Identify the valence or charge of each symbol and place it in superscript just above the symbol

| Cations (Positive Ions) | Anions (Negative Ions) |
|---|---|
| All Group 1 elements in the Periodic Table are +1 in compounds.<br><br>All Group 2 elements in the Periodic Table are +2 in compounds.<br><br>Transition elements (have a few charges) will have a Roman Numeral to tell you what positive charge to use.<br><br>silver is 1+, Zinc is 2+ and Aluminum is 3+<br><br><u>Polyatomic Ions</u><br><br>Ammonium $NH_4{}^{1+}$ | Group 7 are 1- (will end with -ide)<br><br>Group 6 are 2- (will end with -ide)<br><br>Group 5 are 3- (will end with -ide)<br><br><u>Polyatomic Ions</u> –<br><br>Sulphate $SO_4{}^{2-}$<br><br>Carbonate $CO_3{}^{2-}$<br><br>Hydroxide $OH^{1-}$<br><br>Phosphate $PO_4{}^{3-}$<br><br>Cyanide $CN^{1-}$ |

3. Balance the total number of positive and negative charge on the cation and anion. The total positive and negative change must equal zero. To do this you may need to increase the number of cations or anions so the overall charge is 0.

4. Once you have determined the number of units of the cation and anion those become the subscripts which are placed right after the respective symbol. (Note if the ion is a polyatomic ion then the symbols need to be put in brackets.)

Worked example: Formula of copper (I) oxide

1. **Symbol** of cation: Copper = Cu, Symbol of anion: Oxide = O
2. **Identify the charge** Cu (I) = +1, O -2
3. **Balance the charges**. As each copper is 1+ and each oxide is 2- then it will take two Cu+ ions to balance one oxide with a -2

   So 2(+1) + (1)(2-) = 0
4. **Write the formula** $Cu_2O$

1. Sodium Sulphate Na__ ($SO_4$) __
2. Copper (II) Chloride Cu__Cl__
3. Barium Nitrate Ba__($NO_3$)__
4. Aluminium hydroxide Al__(OH)__
5. Mercury (II) Phosphate Hg__($PO_4$)__
6. Copper (II) Bromide Cu__Br__
7. Silver Cyanide Ag__CN__
8. Ammonium Oxide ($NH_4$)__ O__
9. Tin chloride Sn__Cl__
10. Iron Phosphate ________________
11. Barium Carbonate ________________
12. Potassium sulphate ________________
13. Aluminium Oxide ________________

## Activity 3: Research: The structure of the atom

Our knowledge of the structure of atoms has developed over approximately 2500 years. You should make a summary (not more than 2 sides of A4) showing how our present understanding has evolved. Use the headings below to help structure your summary. Do not copy and paste large chunks of information. You will learn much more if you put things in your own words. You can include images.

- The early Greeks were probably the first to talk about atoms. What were their ideas?
- Who was John Dalton and what was his contribution?
- J.J Thomson discovered the electron. How did he do this and what did he find out about electrons? What is meant by ‘plum pudding mode’ of atoms?
- Ernest Rutherford established a model that contained a nucleus. Describe his famous experiment and summarise what he thought atoms were like.
- Neils Bohr talked about energy levels. Summarise some of his key ideas.
- What did James Chadwick discover?
- How did Henry Moseley work out what the atomic number of an element was?

### Extension work

Our current ideas about atoms contain some very strange ideas. If you want to take this a little further find out a little bit about Louis de Broglie, Erwin Schrodinger and quarks

All transition work needs to be completed by the end of the 2nd week of lessons.

Please email:
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if you have any queries.

Thank you and see you in September,

Miss B Richardson

Head of KS5 Science