Nat 5 : Unit 1 – Chemical Changes and Structure

Key area – Formula and Reacting Quantities

Lesson 13 – Gram Formula Mass and the Mole

Learning Outcomes

By the end of the lesson you should be able to …

1. State that the gram formula mass of any substance is known as one mole.
2. Explain that the mass can be calculated from the number of moles of a substance and vice versa.
3. Carry out calculations using the relationship between the mass and the number of moles of a substance.

Success Criteria

You will have been successful **this week** if you:

1. Are up to date will all the notes given so far,
2. Completed all the self-checks and uploaded the ones your class teacher has asked for.
3. **Completed Part 1 Formula Mass Quiz on forms by Friday 19th February.**
4. **Completed Part 2 Calculating Mass Quiz on forms by Friday 19th February.**
5. **Completed Part 3 Calculating the Number of Moles Quiz by Friday 19th February.**

If you have any questions about the content of this lesson, you should ask your **class teacher** either through your class MS team or via email. MS Teams will be monitored throughout the week by a chemistry teacher. If you need help or clarification with either the task or the content of the lesson, just ask.

Links to Prior Knowledge:

It is essential that you have completed lesson 12 and that you are confident about calculating formula. **If not contact your class teacher.**

You may wish to have a copy of the data booklet handy for this lesson. Download from the SQA website - ChemistryDataBookletSQPN5.pdf (sqa.org.uk)

What to do

- **Follow the instructions to complete the check points. Remember to watch the video links**

Click on the link below to access the RECORDED lesson on formula Mass

https://youtu.be/l0hm5OU3d5c

Remember to add to your notes by copying or printing out and sticking in.

Formula mass continued…

Sometimes the formula can be complicated and we need to make sure we count all the atoms

Example

Calculate the formula mass of aluminium sulphate

Step1 Work out the formula

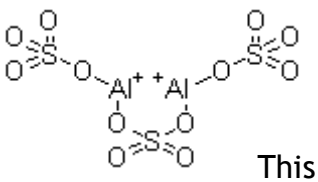
Using the valency method work out the correct formula:

Group ions have a valency equal to their charge
Ammonium, NH_4^+, has a valency of 1, and carbonate, CO_3^{2-}, has a valency of

Symbol Al SO_4

Valency 3 2

Swap Al_2 $(SO_4)_3$ because we have 3 group ions it has a bracket



This picture shows us what the ratio of atoms looks like and how many atoms of each type

This gives us: $Al_2(SO_4)_3$

Every atom inside the bracket is multiplied by 3

Step 2 Add the mass of all atoms present

$Al_2(SO_4)_3$

12 x 16 = 192

3 x 32 = 96

2 x 27 = 54

= 342

So the formula mass =342

Now try self-check Calculating Formula Mass

This is 10 questions on calculating formula mass. The same that you would get in a class room as a self-check. This allows you and your teacher to see your progress at each stage. DO NOT leave the 30 questions to do until Friday. The time has been added into the lesson so it should be part of your 50 minutes of chemistry and there is no additional homework this week.

https://forms.office.com/Pages/ResponsePage.aspx?id=oyzTzM4Wj0KVQTctawUZKV9pDH2i_JVJvH-NwfFQ2VJUQVE4WlRDQ1hXQTVIV05ERE1DMkxCTjg1Uy4u

The mole

The Relative Formula Mass has no units. In order to weigh out chemicals we need to know units. (To quantify and compare results). To solve this chemist, use a special term called **moles.** This effectively gives the units of grams to formula masses.

For example, the mass of one mole of calcium chloride is 111g and the mass of one mole of ammonium sulphate is 132 g.

One mole of any substance is equal to its formula mass in grams, in other words :

1 mol = gram formula mass (gfm)

Note: mole can be shortened to **mol**.

Example 1

Calculate the mass of 1 mole of carbon tetrachloride.

From page 11, the formula mass is : CCl_4

1 x 12	=	12
4 x 35.5	=	142
total		154

So the mass of 1 mole of CCl_4 = 154**g**

Example 2

Calculate the mass of 1 mole of ammonium carbonate.

From page 10, the formula mass is : $(NH_4)_2CO_3$

2 x 14	=	28
8 x 1	=	8
1 x 12	=	12
3 x 16	=	48
total		96

So the mass of 1 mole of $(NH_4)_2CO_3$ = 96**g**

Example 3

Calculate the mass of 1 mole of potassium nitrate (KNO_3).

Complete the following calculation: KNO_3

1	x	____	=	____
1	x	14	=	14
___	x	16	=	____
		total		____

So the mass of 1 mole of KNO_3 = _____**g**

Extension work

Self Check 8

1. Give the formula mass of each of the following compounds.

(a) H_2SO_4 (b) $MgCO_3$

(c) $NaNO_3$ (d) HNO_3

(e) MgO (f) $NaCl$

(g) H_2S (h) K_2SO_4

(i) Na_2SO_4 (j) $CaCO_3$

(k) Na_2CO_3 (l) $MgSO_4$

(m) KNO_3 (n) H_2CO_3

(o) $NaOH$ (p) KOH

(q) K_2CO_3 (r) $CaSO_4$

Self Check 9

1. Calculate the mass of 1 mole of the following compounds.

(a) $CuCO_3$ (b) $Fe(OH)_2$

(c) $Fe(NO_3)_2$ (d) $CuSO_4$

(e) $MgSO_3$ (f) $Mg(NO_3)_2$

(g) C_2H_6 (h) $Mg(OH)_2$

(i) $Ca(OH)_2$ (j) $Fe(NO_3)_3$

(k) $FeSO_4$ (l) $C_6H_{12}O_6$

(m) Cu_2CO_3 (o) K_2SO_3

Further reading

To learn more about atomic structure, try the following online resources:
Calculating relative formula masses - Formula mass and mole calculations - GCSE Chemistry (Single Science) Revision - Other - BBC Bitesize

Evans2 chem web: https://www.evans2chemweb.co.uk/login/index.php#
Username: snhs password: giffnock
Select any teacher ◊ revision material ◊ Nat5 chemistry◊ Unit 1: chemical changes and structure ◊ chemical formula Several online sections for you to expand your knowledge