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**GCSE Combined Science**

**Student Revision Booklet**

**Quantitative Chemistry**

**Contents:**

1. Student checklist and RAG sheet
2. Pre-revision Multiple Choice Quiz
3. Key Questions, 5 sentences, 5 words
4. Exam Question Practice
5. Progress checkpoint - Post-revision Multiple Choice Quiz
6. Student checklist and RAG sheet

**Student Checklist and RAG Sheet**

**Quantitative Chemistry**

**Read each statement below and colour the box that best describes your current understanding.**

**(R – red: low understanding, A – amber: some understanding, G - green: good understanding)**

**GCSE Combined Science**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **AQA TRILOGY Chemistry (8464) from 2016 Topics T5.3 Quantitative chemistry** | | | | |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **5.3.1 Chemical measurements, conservation of mass and the quantitative interpretation** | State that mass is conserved and explain why, including describing balanced equations in terms of conservation of mass |  |  |  |
| Explain the use of the multipliers in equations in normal script before a formula and in subscript within a formula |  |  |  |
| Describe what the relative formula mass (Mr) of a compound is and calculate the relative formula mass of a compound, given its formula |  |  |  |
| Calculate the relative formula masses of reactants and products to prove that mass is conserved in a balanced chemical equation |  |  |  |
| Explain observed changes of mass during chemical reactions in non-enclosed systems using the particle model when given the balanced symbol equation |  |  |  |
| Explain why whenever a measurement is made there is always some uncertainty about the result obtained |  |  |  |
| **5.3.2 Use of amount of substance in relation to masses of pure substances** | **HT ONLY: State that chemical amounts are measured in moles (mol) and explain what a mol is with reference to relative formula mass and Avogadro's constant** |  |  |  |
| **HT ONLY: Use the relative formula mass of a substance to calculate the number of moles in a given mass of the substance** |  |  |  |
| **HT ONLY: Calculate the masses of reactants and products when given a balanced symbol equation** |  |  |  |
| **HT ONLY: Use moles to write a balanced equation when given the masses of reactants and products (inc changing the subject of the equation)** |  |  |  |
| **HT ONLY: Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams** |  |  |  |
| Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution |  |  |  |
| **HT ONLY: Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution** |  |  |  |

**Pre-Revision Multiple Choice Questions**

**GCSE Combined Science**

**Quantitative Chemistry**

**INSTRUCTIONS Score: /20**

* **Read the question carefully.**
* **Circle the correct letter.**
* **Answer all questions**

|  |  |  |
| --- | --- | --- |
| 1. | In a reaction, the mass of reactants is: | |
|  | a. | Equal to the mass of the products |
|  | b. | Smaller than the mass of the products |
|  | c. | Larger than the mass of the products |
|  | d. | Dependent on the reactants |
| 2. | The “2” in 2HCl means: | |
|  | a. | There are two hydrogen atoms |
|  | b. | There are two chlorine atoms |
|  | c. | There are two molecules of hydrogen chloride |
|  | d. | There are two atoms of hydrogen chloride |
| 3. | The “2” in H2O means: | |
|  | a. | There are two hydrogen atoms |
|  | b. | There are two oxygen atoms |
|  | c. | There are two molecules of water |
|  | d. | There are two atoms of water |
| 4. | The relative formula mass of a compound is: | |
|  | a. | The combined relative atomic masses of metal atoms |
|  | b. | The combined relative atomic masses of non-metal atoms |
|  | c. | The combined relative atomic masses of all atoms in the compound |
|  | d. | The combined relative atomic masses of all hydrogen atoms |
| 5. | The formula CaCO3 means the compound contains: | |
|  | a. | 1 calcium atom, 1 carbon atom and 1 oxygen atom |
|  | b. | 1 calcium atom and 3 carbon oxide atoms |
|  | c. | 3 calcium atoms, 3 carbon atoms and 3 oxygen atoms |
|  | d. | 1 calcium atom, 1 carbon atom and 3 oxygen atoms |
| 6. | The relative formula mass of CaCO3 is: | |
|  | a. | 40 |
|  | b. | 110 |
|  | c. | 100 |
|  | d. | 48 |
| 7. | When magnesium reacts with hydrochloric acid in an open beaker on a top pan balance, the mass: | |
|  | a. | Increases |
|  | b. | Decreases |
|  | c. | Stays the same |
|  | d. | Depends on the mass of magnesium used |
| 8. | Uncertainty in measurements is: | |
|  | a. | Half the range of a set of values when calculating the mean |
|  | b. | Half the smallest scale division on a measuring instrument |
|  | c.  d. | Half the last figure shown on a digital instrument  All of the above |
| 9. | A mole is: | |
|  | a. | The mass in grams of a substance |
|  | b. | The mass in milligrams of a substance |
|  | c. | The mass in kilograms of a substance |
|  | d. | A small nocturnal animal |
| 10. | The mass of one mole of carbon is: | |
|  | a. | 1.2g |
|  | b. | 120g |
|  | c. | 12kg |
|  | d. | 12g |
| 11. | The mass of 2 moles of CuCO3 is: | |
|  | a. | 247g |
|  | b. | 123.5g |
|  | c. | 63.5g |
|  | d. | 120g |
| 12. | Avagadros’s constant is represented as: | |
|  | a. | 6.02 x 10 23 per mol |
|  | b. | 6.02 x 10 23 per gram |
|  | c. | 6.02 x 10 2 per mol |
|  | d. | 6.02 x 10 3 per mol |
| 13. | Avagadros’s constant is: | |
|  | a. | The number of atoms in a mole of any substance |
|  | b. | The number of molecules in a mole of any substance |
|  | c. | The number of ions in a mole of any substance |
|  | d. | The number of atoms, molecules or ions in a mole of any substance |
| 14. | The calculation to find the number of moles of a substance is: | |
|  | a. | Mass ÷ Relative formula mass (*Mr*) |
|  | b. | Mass x Relative formula mass (*Mr*) |
|  | c. | Mass + Relative formula mass (*Mr*) |
|  | d. | Mass - Relative formula mass (*Mr*) |
| 15. | The calculation to find the mass of a substance is: | |
|  | a. | Number of moles ÷ Relative formula mass (*Mr*) |
|  | b. | Number of moles x Relative formula mass (*Mr*) |
|  | c. | Number of moles + Relative formula mass (*Mr*) |
|  | d. | Number of moles - Relative formula mass (*Mr*) |

**Key questions, 5 sentences, 5 words**

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| --- |
| **INSTRUCTIONS** |

* **For each statement, use either the suggested website or your own text book to write a 5-point summary. In examinations, answers frequently require more than 1 key word for the mark, so aim to include a few key words.**
* **It is important to stick to 5 sentences. It is the process of selecting the most relevant information and summarising it that will help you remember it.**
* **Write concisely and do not elaborate unnecessarily, it is harder to remember and revise facts from a big long paragraph.**
* **Finally, identify 5 key words that you may have difficulty remembering and include a brief definition. You might like to include a picture to help you remember it.**

**Example:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **QUESTION:** | **Describe and explain the conservation of mass.** | | | |
| **Sources:** | **Website –**   1. <http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel/materials_from_earth/conservation_of_massrev1.shtml> 2. <https://www.youtube.com/watch?v=hVVpSx7hA1Q> | | | |
| 1. **All substances are made of atoms.** 2. **All atoms are made of protons, neutrons and electrons, of which protons and neutrons make up the mass of the atom.** 3. **Atoms rearrange themselves during a chemical reaction.** 4. **Reactants are made into products.** 5. **The mass of the reactants is equal to the mass of the products.**     **16g + 64g 🡪 44g + 36g** | | | | |
| **reactant** | **mass** | **product** | **equal** |  |

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| **QUESTION 1:** | **Describe the meaning of the formula H2SO4.** | | | | |
| **Sources:** | **Website –**   1. <http://www.elementalmatter.info/chemical-formula-and-equations.htm> 2. <http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_pre_2011/periodic_table/chemicalequationsrev1.shtml> | | | | |
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| --- | --- | --- | --- | --- | --- |
| **QUESTION 2:** | **Describe and calculate the relative formula mass of H2SO4.** | | | | |
| **Sources:** | **Website –**   1. <http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway_pre_2011/chemical/reactingmassesrev1.shtml> 2. <https://www.youtube.com/watch?v=q49NwIrjaFw> | | | | |
|  | | | | | |
|  | |  |  |  |  |
| **QUESTION 3:** | **Define a mole and give examples with calculations for a range of elements and compounds for whole and part moles of that substance.** | | | | |
| **Sources:** | **Website –**   1. <http://www.bbc.co.uk/schools/gcsebitesize/science/triple_ocr_gateway/how_much/moles_molecular_mass/revision/1/> 2. <https://www.youtube.com/watch?v=-_-fNVmDwJk> | | | | |
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| **QUESTION 4:** | **Demonstrate how to calculate the masses of reactants and products when given a balanced symbol equation:**  **How much MgCl2 is made when 1.2g of magnesium completely reacts with Hydrochloric acid?**  **Balanced equation: Mg(s) + 2HCl(aq) 🡪 MgCl2(aq)  + H2(g)** | | | | |
| **Sources:** | **Website –**   1. <http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/chemical_economics/reactingmassesrev3.shtml> 2. [https://www.youtube.com/watch?v=TV6n5MFH6IU](https:/www.youtube.com/watch?v=TV6n5MFH6IU) 3. <https://www.youtube.com/watch?v=5zOpoeN0dV0> | | | | |
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| **QUESTION 5:** | **Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams.** | | | | |
| **Sources:** | **Website –**   1. <http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/chemical_economics/reaction1rev3.shtml> 2. [https://www.youtube.com/watch?v=MuzOmFhiE8o](https://www.youtube.com/watch?v=MuzOmFhiE8o%20)   **Oxford AQA text**:  Page | | | | |
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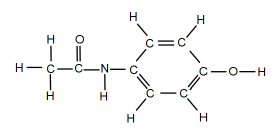
**Quantitative Chemistry**

**Exam Practice**

**Question 1:**

 The main ingredient in Aqamed is a painkiller called paracetamol.

The figure below represents a molecule of paracetamol.



 Give the molecular formula of paracetamol.

Calculate its relative formula mass (*M*r).

Relative atomic masses (*A*r): H = 1; C = 12; N = 14; O = 16

Molecular formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Relative formula mass \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

­­­­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*M*r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2)

(d)     Aspirin is a medicine for use by adults.

An aspirin tablet contains 300 mg of acetylsalicylic acid.

Calculate the number of moles of acetylsalicylic acid in one aspirin tablet.

Give your answer in standard form to three significant figures.

Relative formula mass (*M*r) of aspirin = 180

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Number of moles = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **(4)**

**Question 2:**

(i)      The formula of sodium chloride is NaCl

Calculate the relative formula mass of sodium chloride.

Relative atomic masses: Na = 23; Cl = 35.5

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Relative formula mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Draw a ring around the correct answer to complete each sentence.

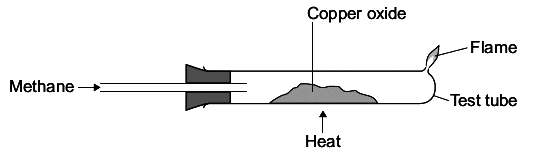
The relative formula mass of a substance, in grams,

|  |  |  |
| --- | --- | --- |
|  | ion |  |
| is one | isotope | of the substance. |
|  | mole |  |

**(1)**

**Question 3:**

An experiment was done on the reaction of copper oxide (CuO) with methane (CH4).



(a)     The equation for this reaction is shown below.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4CuO(s) | + | CH4(g) | → | 4Cu(s) | + | 2H2O(g) | + | CO2(g) |

The water and carbon dioxide produced escapes from the test tube.

Use information from the equation to explain why.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     (i)      Calculate the relative formula mass (*M*r) of copper oxide (CuO).

Relative atomic masses (*A*r): O = 16; Cu = 64.

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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Relative formula mass (*M*r) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(ii)     Calculate the percentage of copper in copper oxide.

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Percentage of copper = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ %

**(2)**

(iii)    Calculate the mass of copper that could be made from 4.0 g of copper oxide.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mass of copper = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(1)**

**Question 4:**

Formulae and equations are used to describe chemical reactions.

(a)     Aluminium reacts with sulfuric acid (H2SO4) to produce aluminium sulfate, Al2(SO4)3 and hydrogen (H2).

Complete and balance the equation for this reaction.

\_\_\_\_Al     +   \_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_  +  \_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(b)     Calcium carbonate reacts with nitric acid to produce calcium nitrate.

Calculate the relative formula mass (*M*r) of calcium nitrate, Ca(NO3)2

Relative atomic masses (*Ar*): N = 14; O = 16; Ca = 40

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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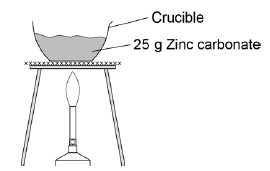
Relative formula mass (*M*r) =   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(c)     Zinc carbonate decomposes when heated.

A student heated 25 g zinc carbonate (ZnCO3).

The figure below shows how he set up the apparatus.



The balanced chemical equation for the decomposition reaction is:

ZnCO3 (s)          ZnO (s)   +   CO2 (g)

The student measured the mass of solid product after heating until there was no further change in mass.

The student did the experiment four times. The table below shows the results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Experiment** | 1 | 2 | 3 | 4 |
| **Mass of solid product in g** | 17.4 | 19.7 | 17.6 | 16.9 |

Calculate the mean mass of the solid product.

Do **not** use any anomalous results in your calculation.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mean mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

**(2)**

**(Total 6 marks)**

**Post-Revision Multiple Choice Questions**

**GCSE Combined Science**

**Quantitative Chemistry**

**INSTRUCTIONS Score: /20**

* **Read the question carefully.**
* **Circle the correct letter.**
* **Answer all questions**

|  |  |  |
| --- | --- | --- |
| 1. | In a reaction, the mass of reactants is: | |
|  | a. | Equal to the mass of the products |
|  | b. | Smaller than the mass of the products |
|  | c. | Larger than the mass of the products |
|  | d. | Dependent on the reactants |
| 2. | The “2” in 2HCl means: | |
|  | a. | There are two hydrogen atoms |
|  | b. | There are two chlorine atoms |
|  | c. | There are two molecules of hydrogen chloride |
|  | d. | There are two atoms of hydrogen chloride |
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|  | b. | There are two oxygen atoms |
|  | c. | There are two molecules of water |
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| 4. | The relative formula mass of a compound is: | |
|  | a. | The combined relative atomic masses of metal atoms |
|  | b. | The combined relative atomic masses of non-metal atoms |
|  | c. | The combined relative atomic masses of all atoms in the compound |
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| 5. | The formula CaCO3 means the compound contains: | |
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|  | b. | 1 calcium atom and 3 carbon oxide atoms |
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| 6. | The relative formula mass of CaCO3 is: | |
|  | a. | 40 |
|  | b. | 110 |
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|  | d. | 48 |
| 7. | When magnesium reacts with hydrochloric acid in an open beaker on a top pan balance, the mass: | |
|  | a. | Increases |
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|  | d. | A small nocturnal animal |
| 10. | The mass of one mole of carbon is: | |
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|  | c. | The number of ions in a mole of any substance |
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|  | a. | Mass ÷ Relative formula mass (*Mr*) |
|  | b. | Mass x Relative formula mass (*Mr*) |
|  | c. | Mass + Relative formula mass (*Mr*) |
|  | d. | Mass - Relative formula mass (*Mr*) |
| 15. | The calculation to find the mass of a substance is: | |
|  | a. | Number of moles ÷ Relative formula mass (*Mr*) |
|  | b. | Number of moles x Relative formula mass (*Mr*) |
|  | c. | Number of moles + Relative formula mass (*Mr*) |
|  | d. | Number of moles - Relative formula mass (*Mr*) |

**Student Checklist and RAG Sheet**

**Quantitative Chemistry**

**Read each statement below and colour the box that best describes your current understanding.**

**(R – red: low understanding, A – amber: some understanding, G - green: good understanding)**

**GCSE Combined Science**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **AQA TRILOGY Chemistry (8464) from 2016 Topics T5.3 Quantitative chemistry** | | | | |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **5.3.1 Chemical measurements, conservation of mass and the quantitative interpretation** | State that mass is conserved and explain why, including describing balanced equations in terms of conservation of mass |  |  |  |
| Explain the use of the multipliers in equations in normal script before a formula and in subscript within a formula |  |  |  |
| Describe what the relative formula mass (Mr) of a compound is and calculate the relative formula mass of a compound, given its formula |  |  |  |
| Calculate the relative formula masses of reactants and products to prove that mass is conserved in a balanced chemical equation |  |  |  |
| Explain observed changes of mass during chemical reactions in non-enclosed systems using the particle model when given the balanced symbol equation |  |  |  |
| Explain why whenever a measurement is made there is always some uncertainty about the result obtained |  |  |  |
| **5.3.2 Use of amount of substance in relation to masses of pure substances** | **HT ONLY: State that chemical amounts are measured in moles (mol) and explain what a mol is with reference to relative formula mass and Avogadro's constant** |  |  |  |
| **HT ONLY: Use the relative formula mass of a substance to calculate the number of moles in a given mass of the substance** |  |  |  |
| **HT ONLY: Calculate the masses of reactants and products when given a balanced symbol equation** |  |  |  |
| **HT ONLY: Use moles to write a balanced equation when given the masses of reactants and products (inc changing the subject of the equation)** |  |  |  |
| **HT ONLY: Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams** |  |  |  |
| Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution |  |  |  |
| **HT ONLY: Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution** |  |  |  |