C4 – Quantitative Chemistry

Lessons TBAT	Key Knowledge	Practical	Assessment
TBAT: Calculate Ar an Mr. TBAT: Calculate moles (HT). TBAT: Balance equations to demonstrate the conservation of mass (HT). TBAT: Calculate masses of reactants and products from balanced equations (HT).	5.3.1.1 Conservation of mass and balanced chemical equations The law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants. This means that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation. Students should understand the use of the multipliers in equations in normal script before a formula and in subscript within a formula. 5.3.1.2 Relative formula mass The relative formula mass (Mr) of a compound is the sum of the relative atomic masses of the atoms in the numbers shown in the formula. In a balanced chemical equation, the sum of the relative formula masses of the reactants in the quantities shown equals the sum of the relative formula masses of the products in the quantities shown. Students should be able to calculate the	Serial dilutions	End of unit assessment Maths focus Quantitative chemistry throughout the unit. Apply equations when throughout.

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TBAT: Explain mass changes in reactions TBAT: Construct a balanced equation given the masses of reactants and products (HT). TBAT: Calculate the concentration of a solution.	percentage by mass in a compound given the relative formula mass and the relative atomic masses. 5.3.1.3 Mass changes when a reactant or product is a gas Some reactions may appear to involve a change in mass but this can usually be explained because a reactant or product is a gas and its mass has not been taken into account. For example: when a metal reacts with oxygen the mass of the oxide produced is greater than the mass of the metal or in thermal decompositions of metal carbonates carbon dioxide is produced and escapes into the atmosphere leaving the metal oxide as the only solid product. Students should be able to explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and explain these changes in terms of the particle model. 5.3.1.4 Chemical measurements Whenever a measurement is made there is always some uncertainty about the result obtained. Students should be able to: • represent the distribution of results and make estimations of uncertainty • use the range of a set of measurements about the mean as a measure of uncertainty 5.3.2.1 Moles (HT only) Chemical amounts are measured in moles. The symbol for the unit mole is mol. The mass of one mole of a substance in grams is numerically equal to its relative formula mass. One mole of a substance contains the same number of the stated particles, atoms, molecules or ions as one mole of any other substance. The	Key stage 3

	number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02 x 1023 per mole. Students should understand that the measurement of amounts in moles can apply to atoms, molecules, ions, electrons, formulae and equations, for example that in one mole of carbon (C) the number of atoms is the same as the number of molecules in one mole of carbon dioxide (CO2). Students should be able to use the relative formula mass of a substance to calculate the number of moles in a given mass of that substance and vice versa 5.3.2.2 Amounts of substances in equations (HT only) The masses of reactants and products can be calculated from balanced symbol equations. Chemical equations can be interpreted in terms of moles. For example: Mg + 2HCl MgCl2 + H2 shows that one mole of magnesium reacts with two moles of hydrochloric acid to produce one mole of magnesium chloride and one mole of hydrogen gas. Students should be able to: • calculate the masses of substances shown in a balanced symbol equation • calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product. 5.3.2.3 Using moles to balance equations (HT only) The balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers of moles to simple whole number ratios. Students should be able	

	to balance an equation given the masses of reactants and products. Students should be able to change the subject of a mathematical equation. 5.3.2.4 Limiting reactants (HT only) In a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used. The reactant that is completely used up is called the limiting reactant because it limits the amount of products. Students should be able to explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams. 5.3.2.5 Concentration of solutions Many chemical reactions take place in solutions. The concentration of a solution can be measured in mass per given volume of solution, eg grams per dm3 (g/dm3). Students should be able to: • 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.	

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