MEGA LECTURE

AQA (GCSE Notes)

Chapter 3: Quantitative Chemistry

Q1. State the law of conservation of mass in simple terms.

Q2. Why does the total mass of reactants equal the total mass of products in a chemical reaction?

Q3. Explain how a balanced symbol equation supports the law of conservation of mass.

Q4. Why is it important to balance chemical equations?

Q5. Describe what is meant by a balanced chemical equation.

Q6. What does a subscript number in a chemical formula show?

Q7. What does a number in front of a chemical formula in an equation mean?

Q8. In the equation $2H_2 + O_2 \rightarrow 2H_2O$, explain the role of the number 2 in front of H_2 and H_2O.

Q9. What would happen if you did not balance the number of atoms on both sides of an equation?

Q10. Give an example of a chemical equation where the number of atoms of each element is the same on both sides.

Q11. How can a balanced equation help us calculate the mass of products formed?

Q12. What do you understand by the term 'relative formula mass' (Mr)?

Q13. How is relative formula mass calculated from a chemical formula?

Q14. What is the Mr of H_2O?

Q15. Why do we use relative atomic masses when calculating Mr?

Q16. In the formula NaCl, what is the total Mr?

Q17. How can you check that the total Mr of the products equals the total Mr of the reactants?

Q18. In a balanced chemical equation, what must be equal on both sides?

Q19. How can you calculate the percentage by mass of an element in a compound?

Q20. Calculate the percentage by mass of carbon in CO_2.

Q21. Why might the mass appear to increase when a metal reacts with oxygen in open air?

Q22. What happens to the mass during the thermal decomposition of a metal carbonate?

Q23. Why does the mass seem to decrease in some reactions that produce a gas?

Q24. Explain why a change in mass might be observed in an open system.

Q25. How does the particle model help explain mass changes in chemical reactions?

Q26. What is an open system in terms of chemical reactions?

Q27. What is a closed system in chemical reactions?

Q28. Explain how the mass of magnesium increases after burning in air.

Q29. Why does mass stay constant in a sealed container during a reaction?

Q30. Why might the total mass of products be less than expected if gas escapes?

Q31. Describe what is observed when calcium carbonate is heated strongly.

Q32. What gas is released during the decomposition of metal carbonates?

Q33. Why should gas be included when calculating total mass change?

Q34. How can you confirm the conservation of mass in a reaction that involves gases?

Q35. Suggest an experiment to show that mass is conserved during a chemical reaction.

Q36. What equipment could you use to measure mass changes during a reaction?

Q37. Why is it important to use a sealed container in mass change experiments?

Q38. What error might occur in mass change experiments done in an open beaker?

Q39. What would you observe if you heated zinc carbonate strongly?

Q40. Give a reason why the mass of a solid product might be more than the metal it came from.

Q41. What is thermal decomposition? Give one example.

Q42. How does mass change when a metal carbonate decomposes?

Q43. What role does oxygen play in increasing the mass of a metal after reaction?

Q44. Why do symbol equations need to show correct chemical formulas?

Q45. Why is it incorrect to write H2O as HO2 in a balanced equation?

Q46. What safety precautions are needed when investigating mass change in reactions involving heat?

Q47. Why is weighing before and after a reaction useful in experiments?

Q48. How can a reaction be designed to prove that no atoms are lost?

Q49. What does WS 1.2 focus on when interpreting chemical equations?

Q50. Why is understanding mass changes in chemical reactions important in real-life applications?

Q51. What does the term "uncertainty" mean in the context of a scientific measurement?

Q52. How can the range of a set of results be used to estimate uncertainty?

Q53. Why do repeated measurements help reduce uncertainty?

Q54. How can a graph be used to show the distribution of results from repeated measurements?

Q55. What is meant by the mean of a set of measurements?

Q56. Describe how to calculate the uncertainty in a measured value.

Q57. Why should scientists report uncertainty when presenting results?

Q58. How can a single outlier affect the mean and uncertainty of a data set?

Q59. What is the standard way to express uncertainty in a measurement?

Q60. Give an example of how to estimate uncertainty using the range of repeated measurements.

Q61. Define the term mole in chemistry.

Q62. What is the unit used to measure chemical amount?

Q63. How is the relative formula mass related to the mass of one mole?

Q64. What does the Avogadro constant represent?

Q65. State the value of the Avogadro constant.

Q66. Why does one mole of any substance contain the same number of particles?

Q67. How many atoms are there in one mole of hydrogen?

Q68. Explain how to calculate the number of moles in a given mass of substance.

Q69. How can you find the mass of a substance if you know the number of moles and the relative formula mass?

Q70. What is the formula for calculating moles from mass and relative formula mass?

Q71. Describe how to use standard form when working with the Avogadro constant.

Q72. Why must we use significant figures when recording chemical measurements?

Q73. Give an example of changing the subject of a moles equation to calculate mass.

Q74. What is the relationship between mass, moles, and Mr?

Q75. In terms of moles, how are atoms and molecules treated similarly?

Q76. How many molecules are in 2 moles of water?

Q77. Why is it useful to express very large numbers like the Avogadro constant in standard form?

Q78. Calculate the number of particles in 0.5 moles of a substance.

Q79. Explain the steps to convert grams to moles using relative formula mass.

Q80. Why is it important to know the Mr of a compound when calculating moles?

Q81. What mathematical skills are needed to work with mole calculations?

Q82. Why does one mole of CO_2 contain the same number of molecules as one mole of O_2?

Q83. What is the difference between atoms and molecules in the context of moles?

Q84. If you have 6.02×10^{23} ions of sodium, how many moles is that?

Q85. How can you use a balanced equation to find the mole ratio of reactants and products?

Q86. What is meant by the term “formula unit” in mole calculations?

Q87. How can you calculate the Mr of a compound from its formula?

Q88. Why is understanding decimal and standard form important in mole calculations?

Q89. What is the mole of electrons and how is it different from the mole of atoms?

Q90. How would you convert moles to number of particles?

Q91. Explain the link between moles and balanced equations.

Q92. What are the steps for calculating the number of moles in a known mass of NaCl?

Q93. Why do chemists use the mole rather than individual particle counts?

Q94. How does using the mole simplify calculations in chemical reactions?

Q95. What is meant by “amount of substance”?

Q96. Why is it incorrect to compare the mass of 1 mole of hydrogen with 1 mole of carbon directly?

Q97. How many atoms are there in 3 moles of magnesium?

Q98. Why is the concept of a mole essential in chemical formulas?

Q99. Describe the difference between molar mass and relative atomic mass.

Q100. What is the significance of using 3 significant figures in mole calculations?

Q101. What does a balanced chemical equation show about the number of moles of each substance?

Q102. How can you use a balanced symbol equation to calculate the mass of a product?

Q103. In a reaction where 2 moles of hydrogen react with 1 mole of oxygen, how many moles of water are formed?

Q104. Describe the steps to calculate the mass of a product using moles and relative formula mass.

Q105. How would you calculate the mass of a reactant needed to produce a given mass of product?

Q106. If 1 mole of magnesium reacts with 2 moles of HCl, how much magnesium is needed to react with 73 g of HCl?

Q107. Explain how to convert mass in grams to moles using relative formula mass.

Q108. How can you calculate the mass of excess reactant remaining after a chemical reaction?

Q109. What is the importance of using the correct mole ratio in chemical calculations?

Q110. How can a balanced symbol equation help you calculate the amount of gas produced in a reaction?

Q111. A reaction uses 0.5 moles of oxygen. How can you calculate the mass of oxygen used?

Q112. If you know the mass of a product, how can you work backwards to find the mass of a reactant?

Q113. Why is it important to use the relative formula mass in mole calculations?

Q114. In the equation: $Ca + 2HCl \rightarrow CaCl_2 + H_2$, what is the mole ratio between HCl and $CaCl_2$?

Q115. How do you convert the number of moles into mass using an equation?

Q116. If 2.4 g of magnesium reacts, how many grams of hydrogen gas will be produced?

Q117. Explain why balancing a chemical equation is important for mass calculations.

Q118. What are the steps to follow when calculating mass from a balanced chemical equation?

Q119. How can you calculate the limiting reactant in a chemical reaction?

Q120. If a reaction forms 88 g of CO_2, how can you find the amount of oxygen used?

Q121. In the reaction: $2Mg + O_2 \rightarrow 2MgO$, what mass of MgO is made from 12 g of Mg?

Q122. How do you calculate the amount of product formed in a reaction with two reactants?

Q123. What is the formula for converting between moles and mass?

Q124. How do you identify which reactant is in excess during a chemical reaction?

Q125. If 6 g of carbon reacts with oxygen, what is the maximum mass of CO_2 that can be formed?

Q126. Describe the method for balancing an equation using mole calculations from given masses.

Q127. How can you find the simplest whole number ratio of moles in a chemical reaction?

Q128. Why must the number of atoms be balanced on both sides of a chemical equation?

Q129. In a reaction between 3 moles of A and 2 moles of B, what is the mole ratio?

Q130. How do you use algebraic equations to find unknown masses in a reaction?

Q131. What units are typically used for mass in chemical calculations?

Q132. How do you substitute known values into the equation: moles = mass ÷ Mr?

Q133. If the mass of one product is known, how do you find the mass of the other product?

Q134. What information is needed to calculate the mass of a substance from a balanced equation?

Q135. How would you calculate the theoretical yield of a chemical reaction?

Q136. What is the difference between actual yield and theoretical yield?

Q137. If 2.5 moles of a compound are produced, what mass is this if the Mr is 40?

Q138. How can you calculate the percentage yield of a reaction?

Q139. What is meant by the term “stoichiometry”?

Q140. Why do we need to calculate masses in reactions before carrying out practical experiments?

Q141. How do you use mole ratios to determine which substance limits the amount of product formed?

Q142. If a reaction is given in grams, how can you convert it to moles to balance the equation?

Q143. Explain how to calculate the mass of water formed when hydrogen reacts with oxygen.

Q144. In the reaction: $N_2 + 3H_2 \rightarrow 2NH_3$, how many moles of NH_3 are formed from 9 g of H_2?

Q145. Why is it necessary to change the subject of an equation in mass calculations?

Q146. How do you apply ratios and fractions in solving chemical mass problems?

Q147. What does the coefficient in front of a substance in a balanced equation tell you?

Q148. If the mass of the reactants is known, how can you calculate the mass of the products?

Q149. What is the process to calculate the balanced equation from experimental mass data?

Q150. How can comparing mole ratios help verify the correctness of a balanced equation?

Q151. What is meant by the term 'limiting reactant' in a chemical reaction?

Q152. How does the limiting reactant affect the amount of product formed in a reaction?

Q153. Describe how to identify the limiting reactant when given the masses of two reactants.

Q154. What happens to the excess reactant after a reaction is complete?

Q155. Why is it useful to use an excess of one reactant in a chemical reaction?

Q156. If one reactant is in excess, how can you determine the maximum amount of product formed?

Q157. In a reaction, 5 g of A reacts with 10 g of B. How can you tell which is the limiting reactant?

Q158. How can you calculate the mass of product formed when the limiting reactant is known?

Q159. What is the relationship between moles of limiting reactant and moles of product formed?

Q160. Why is the limiting reactant important when planning a chemical reaction in industry?

Q161. How can you use mole ratios to determine the limiting reactant in a reaction?

Q162. What is the first step in finding the limiting reactant in a reaction?

Q163. In a reaction between magnesium and hydrochloric acid, how do you determine which is limiting?

Q164. A reaction produces less product than expected. What could this indicate about the reactants used?

Q165. How can you calculate the amount of excess reactant left after a reaction?

Q166. What is meant by concentration of a solution?

Q167. What unit is commonly used to measure concentration in chemistry?

Q168. How is concentration related to the mass of solute and the volume of solution?

Q169. If you know the concentration and volume of a solution, how can you calculate the mass of solute?

Q170. Write the formula that links mass, volume, and concentration of a solution.

Q171. A solution has a concentration of 20 g/dm³ and a volume of 0.5 dm³. How much solute is in it?

Q172. How do you change the subject of the formula concentration = mass ÷ volume to find mass?

Q173. What is the concentration if 10 g of solute is dissolved in 250 cm³ of solution?

Q174. How would increasing the mass of solute in a solution affect its concentration?

Q175. How would increasing the volume of solvent in a solution affect its concentration?

Q176. How can you convert a volume in cm³ to dm³ when calculating concentration?

Q177. A solution contains 5 g of solute in 200 cm³. What is its concentration in g/dm³?

Q178. If you dilute a solution, what happens to its concentration?

Q179. A solution has a volume of 1.5 dm³ and contains 12 g of solute. What is its concentration?

Q180. Explain the effect of doubling the volume of a solution while keeping the solute mass constant.

Q181. A student prepares a solution with 6 g of salt in 0.3 dm^3 of water. What is the concentration?

Q182. How do you calculate the new concentration after dilution?

Q183. Why is it important to measure solution concentration accurately in a chemical reaction?

Q184. Describe a method to prepare 250 cm^3 of a 4 g/dm^3 salt solution.

Q185. If the concentration of a solution is too high, how can it be adjusted?

Q186. How would you calculate the volume of solution needed to provide a certain mass of solute?

Q187. A solution contains 18 g of solute in 600 cm^3. How would you express the concentration in g/dm^3?

Q188. How can you use the concentration of an acid to calculate the amount needed for neutralisation?

Q189. A student adds more solute to a solution. What happens to the concentration?

Q190. What is the meaning of the term 'solute' in the context of a solution?

Q191. Why is volume measured in dm^3 when calculating concentration?

Q192. Describe how to prepare a solution of known concentration using a volumetric flask.

Q193. How can errors in measuring solution volumes affect calculated concentration?

Q194. How is percentage concentration different from g/dm^3 concentration?

Q195. What safety measures should be taken when preparing concentrated solutions?

Q196. Explain how inaccurate measurements of solute or solvent affect concentration calculations.

Q197. If two solutions have the same solute mass but different volumes, how do their concentrations compare?

Q198. A solution is made by dissolving 15 g of substance X in water to make 1 dm^3. What is its concentration?

Q199. How would you calculate the mass of solute required to make 500 cm^3 of a 10 g/dm^3 solution?

Q200. How can understanding concentration help in controlling the outcome of chemical reactions?

Q201. What is meant by the term percentage yield in a chemical reaction?

Q202. Why is the actual yield often less than the theoretical yield?

Q203. How can reversible reactions affect the yield of a product?

Q204. Give one reason why product may be lost when separated from a reaction mixture.

Q205. Explain how unexpected side reactions can reduce the yield of a reaction.

Q206. Write the formula used to calculate percentage yield.

Q207. A reaction produces 20 g of product, but the theoretical yield was 25 g. What is the percentage yield?

Q208. How can you calculate the theoretical yield from a balanced equation?

Q209. Why is percentage yield always less than or equal to 100%?

Q210. What does a percentage yield of 100% indicate?

Q211. A reaction has a percentage yield of 50%. What does this mean?

Q212. How does loss during purification affect percentage yield?

Q213. Describe one way to increase the yield of a reaction in the lab.

Q214. Why is percentage yield important in industrial chemical processes?

Q215. How does incomplete reaction of a limiting reactant affect yield?

Q216. A student calculates a percentage yield of 110%. What mistake might they have made?

Q217. What type of error in measurement could lead to an inaccurate yield?

Q218. Describe the difference between actual yield and theoretical yield.

Q219. In what situation would percentage yield be especially important in pharmaceuticals?

Q220. Why might a high yield not always be the main consideration when choosing a reaction pathway?

Q221. What is meant by the term atom economy?

Q222. Write the formula used to calculate atom economy.

Q223. Why is atom economy important in sustainable chemistry?

Q224. How does a higher atom economy benefit the environment?

Q225. What does an atom economy of 100% mean?

Q226. Why is atom economy usually less than 100% in many reactions?

Q227. How can atom economy be calculated using relative formula masses?

Q228. Why are reactions with low atom economy less efficient?

Q229. Give an example of a reason why a high atom economy reaction might still not be chosen.

Q230. What is the relationship between atom economy and waste products?

Q231. How is atom economy different from percentage yield?

Q232. A reaction produces two products, only one of which is useful. How does this affect atom economy?

Q233. Why is atom economy an important factor when designing new reactions?

Q234. A student calculates an atom economy of 85%. What does this mean?

Q235. How do side products affect the atom economy of a reaction?

Q236. Describe one way a reaction pathway can be improved to increase atom economy.

Q237. How can atom economy help in reducing costs in chemical manufacturing?

Q238. A reaction has high yield but low atom economy. What does this suggest?

Q239. In what situation would a company accept a low atom economy reaction?

Q240. How is atom economy useful for choosing between two different reaction routes?

Q241. What are the environmental advantages of a reaction with high atom economy?

Q242. Why should chemists aim for reactions with both high atom economy and high yield?

Q243. How does the balanced symbol equation help in calculating atom economy?

Q244. Explain why the relative formula mass of desired product is used in the atom economy formula.

Q245. What is meant by the ‘desired product’ in the context of atom economy?

Q246. A reaction with a 90% yield and 40% atom economy is carried out. What does this tell you?

Q247. Give one industrial example where atom economy is a key consideration.

Q248. What factors other than atom economy might influence the choice of a reaction route?

Q249. How can atom economy support green chemistry principles?

Q250. Why might a reaction with high atom economy still create environmental concerns?

Q251. What does the unit mol/dm³ represent in terms of solution concentration?

Q252. How is concentration in mol/dm³ calculated using moles and volume?

Q253. Write the formula that links concentration, number of moles, and volume.

Q254. How can you calculate the number of moles of solute in a solution if concentration and volume are known?

Q255. What does it mean if a solution has a concentration of 2 mol/dm³?

Q256. Describe how the mass of solute can be calculated from concentration and volume.

Q257. How would you prepare 250 cm³ of a 1 mol/dm³ solution of sodium chloride?

Q258. Convert 0.5 dm³ to cm³.

Q259. Convert 300 cm³ to dm³.

Q260. If a solution has a concentration of 0.2 mol/dm³, how many moles are in 500 cm³?

Q261. What is the difference between concentration in mol/dm³ and g/dm³?

Q262. How can you convert concentration from mol/dm³ to g/dm³?

Q263. A 0.5 mol/dm³ solution contains 0.1 mol of solute. What is the volume?

Q264. What is the concentration if 0.05 mol of solute is dissolved in 100 cm³ of solution?

Q265. Describe how titration can be used to find the concentration of an acid.

Q266. If 25 cm³ of alkali reacts with 30 cm³ of acid, and the acid's concentration is known, how can you find the alkali's concentration?

Q267. Why is it important to measure solution volumes accurately in titration experiments?

Q268. Describe one source of error in measuring solution concentration using titration.

Q269. How can dilution affect the concentration of a solution?

Q270. A solution has 0.2 mol in 250 cm³. What is its concentration?

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Q271. Describe the steps to prepare 100 cm^3 of a 0.1 mol/dm^3 solution from a 1 mol/dm^3 solution.

Q272. What happens to concentration when a solution is diluted?

Q273. A solution of hydrochloric acid has a concentration of 1 mol/dm^3. What does this mean in terms of moles per litre?

Q274. Why is it important to use correct units when calculating concentration?

Q275. What volume of a 2 mol/dm^3 solution contains 0.4 mol of solute?

Q276. If a student doubles the volume of a solution but keeps the amount of solute the same, what happens to the concentration?

Q277. What is the volume of gas occupied by 2 moles of oxygen at room temperature and pressure?

Q278. State the volume of one mole of any gas at room temperature and pressure.

Q279. How can the volume of a gas be calculated from its mass and relative formula mass?

Q280. A gas has a mass of 44 g and an Mr of 44. What volume does it occupy at room temperature?

Q281. What is the formula used to calculate the volume of a gas at rtp from moles?

Q282. Calculate the number of moles of gas in 72 dm^3 at room temperature.

Q283. A chemical reaction produces 3 moles of nitrogen gas. What is the total volume of gas produced at room temperature?

Q284. How can you find the mass of a gas from its volume and relative formula mass?

Q285. How is the volume of a gas related to the number of moles?

Q286. Explain how the balanced symbol equation helps calculate gas volumes in a reaction.

Q287. If 1 mole of hydrogen reacts to produce 1 mole of a gas, what is the volume of the gas formed at rtp?

Q288. Describe the relationship between gas volumes and balanced equations.

Q289. What is the total volume of gases produced when 2 moles of methane combust completely?

Q290. How can changing temperature or pressure affect the volume of a gas?

Q291. A reaction produces 48 dm^3 of carbon dioxide. How many moles is this?

Q292. How many dm^3 will 0.25 mol of a gas occupy at room temperature?

Q293. Describe how to rearrange the equation to make number of moles the subject when calculating gas volumes.

Q294. A sample of nitrogen gas weighs 28 g. What volume does it occupy at room temperature?

Q295. Explain why equal moles of gases occupy equal volumes under the same conditions.

Q296. Calculate the volume of 0.1 mol of oxygen gas at rtp.

Q297. How can you calculate the amount in moles from gas volume?

Q298. A balanced equation shows that 2 moles of HCl react with 1 mole of Mg. If 48 dm^3 of HCl is used, how many dm^3 of H_2 gas will be produced?

Q299. What is the molar volume of a gas and how is it used in calculations?

Q300. How does using volume in gas calculations help in real-world chemical manufacturing?