InkChemistry

QUESTION WORKBOOK

Reacting masses, percentage yield and atom economy

Amount of substance · Unit C02

AQA 3.1.2.5, 3.3.14 · OCR A 2.1.3 (h), 2.1.3 (j)

17 questions · 51 marks

PRINT EDITION

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SECTION A · Short, 1 to 2 marks

A1 RMP-Q9 Explain why every addition reaction has an atom economy of 100%. [2]

A2 RMP-Q11 Explain why a chemist making an ester often uses an excess of the cheaper reactant. [2]

A3 RMP-Q12 Suggest two ways in which a company could reduce the waste from a process that has a low atom economy. [2]

A4 RMP-Q20 Suggest why the atom economy of a pharmaceutical synthesis can make it look much less wasteful than it is. [2]

A5 RMP-Q1 State what is meant by the limiting reagent in a reaction. [1]

SECTION B · Standard, 3 to 5 marks

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B1 RMP-Q4 Calculate the volume of hydrogen at room temperature and pressure formed when 0.486 g of magnesium is added to 20.0 cm^3 of 1.00 mol dm^{-3} hydrochloric acid: $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$. The molar gas volume is 24.0 $dm^3\ mol^{-1}$; Mg is 24.3. [4]

B2 RMP-Q15 Evaluate the claim that a process with a percentage yield of 95% must be more sustainable than one with a percentage yield of 70%. [4]

B3 RMP-Q18 Calculate the percentage yield when 4.60 g of sodium reacts with 5.68 g of chlorine and 8.42 g of sodium chloride is collected: $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$. Use Na 23.0, Cl 35.5. [4]

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B4 RMP-Q3 Calculate the maximum mass of iron that can be made from 500 g of iron(III) oxide: $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$. Use Fe 55.8, O 16.0. [3]

B5 RMP-Q6 Calculate the atom economy for iron in the reaction $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$. Use Fe 55.8, C 12.0, O 16.0. [3]

B6 RMP-Q8 Explain why the percentage yield of a preparation carried out in a school laboratory is less than 100%. [3]

B7 RMP-Q10 Explain how the hydration of ethene can have an atom economy of 100% while only about 5% of the ethene reacts on each pass over the catalyst. [3]

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B8 RMP-Q13 Suggest three reasons why a student who expects 8.80 g of ethyl ethanoate from a preparation collects only 5.94 g. [3]

B9 RMP-Q17 Calculate the atom economy for chloromethane in the reaction $CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$, and the mass of hydrogen chloride formed for each kilogram of chloromethane. Use C 12.0, H 1.0, Cl 35.5. [3]

B10 RMP-Q19 Explain why chemists designing a manufacturing process aim for one that needs no solvent. [3]

B11 RMP-Q21 Justify the use of an excess of magnesium carbonate, rather than an excess of sulfuric acid, when magnesium sulfate crystals are prepared from the two. [3]

SECTION C · Long, 6 marks or more

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C1 RMP-Q14 Compare the hydration of ethene with the fermentation of glucose as industrial methods of making ethanol. Consider atom economy, yield, raw materials, rate, energy and the purity of the product. [6]

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