InkChemistry

QUESTION WORKBOOK

Test-tube reactions for functional groups, and high-resolution mass spectrometry

Organic analysis · Unit C19

AQA 3.3.6.1, 3.3.6.2 · OCR A 4.2.4, 6.1.2, 6.3.1

18 questions · 58 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 TTR-Q1

State the reagent used to test for a C=C double bond, and the observation when an alkene is present. [2]

A2 TTR-Q6

Explain why a green colour when an unknown is warmed with acidified potassium dichromate(VI) does not show that the unknown is an alcohol. [2]

A3 TTR-Q12

Suggest why a student testing propanal with Tollens' reagent sees a grey-black precipitate rather than a silver mirror, and state whether the result is positive. [2]

A4 TTR-Q22

Explain how sodium hydroxide solution and sodium hydrogencarbonate together distinguish phenol from ethanoic acid. [2]

SECTION B · Standard, 3 to 5 marks

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B1 TTR-Q11

Explain how fragment peaks in their mass spectra distinguish pentan-2-one, $CH_3COCH_2CH_2CH_3$, from pentan-3-one, $CH_3CH_2COCH_2CH_3$, which both have a molecular ion at m/z 86. [4]

B2 TTR-Q13

Suggest how test-tube reactions could distinguish pentan-1-ol, pentan-2-ol and 2-methylbutan-2-ol. [4]

B3 TTR-Q15

Evaluate a student's conclusion that a liquid is propanone, drawn from a low-resolution mass spectrum showing a molecular ion at m/z 58. [4]

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B4 TTR-Q16 Outline a sequence of tests that would identify each of four unlabelled liquids: cyclohexene, propanal, propan-1-ol and ethanoic acid. [4]

B5 TTR-Q21 Explain why 1-chloropropane, C_3H_7Cl, gives molecular ion peaks at m/z 78 and 80 in the height ratio 3 : 1, and predict the molecular ion peaks of dichloromethane, CH_2Cl_2. [4]

B6 TTR-Q2 Give what is observed when solid sodium hydrogencarbonate is added to aqueous ethanoic acid, and an equation, with state symbols, for the reaction. [3]

B7 TTR-Q4 Describe how Tollens' reagent is prepared from silver nitrate solution, and the positive result it gives with an aldehyde. [3]

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B8 TTR-Q5 Explain why propanal gives a positive result with Fehling's solution and propanone does not. [3]

B9 TTR-Q7 Explain why high-resolution mass spectrometry can distinguish but-1-ene, C_4H_8, from propenal, C_3H_4O, although both give a molecular ion at m/z 56 on a low-resolution spectrum. [3]

B10 TTR-Q8 Calculate the precise relative molecular masses of C_4H_8O and C_5H_{12}, and identify which formula fits a molecular ion at m/z 72.0574. Use ^{1}H = 1.0078, ^{12}C = 12.0000 and ^{16}O = 15.9949. [3]

B11 TTR-Q14 Compare what is observed when propanal and propanone are each warmed with Tollens' reagent and with Fehling's solution. [3]

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B12 TTR-Q19 Suggest which of ethanol, ethanal, methanol, propan-2-ol and pentan-3-one give a pale yellow precipitate when warmed with iodine and aqueous sodium hydroxide, and why. [3]

B13 TTR-Q20 Calculate the number of carbon atoms in a molecule whose molecular ion peak has a relative abundance of 18.0 and whose M+1 peak has a relative abundance of 0.99. [3]

SECTION C · Long, 6 marks or more

C1 TTR-Q17 Describe how to carry out the Tollens' and the acidified dichromate tests on an unknown organic liquid safely, and how to interpret the results. [6]

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