



# **GCE A LEVEL CHEMISTRY**

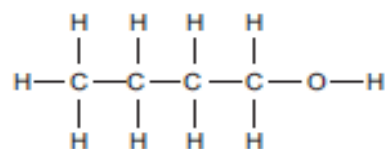
S21-A410

## **Assessment Resource B**

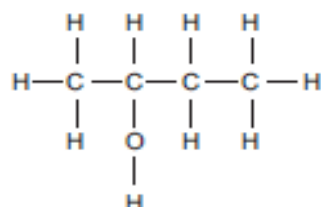
Chemistry in Practice

1. A, B, C and D are the four isomeric alcohols of formula  $C_4H_{10}O$ .

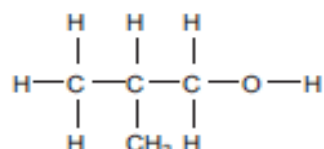
The structural formulae and systematic names of A, B and C are shown below.



A  
butan-1-ol



B  
butan-2-ol



C  
methylpropan-1-ol

(a) Give the structural formula and systematic name of alcohol D.

[2]

.....

(b) Describe a test that would give a positive result for butan-2-ol (alcohol B) but not for alcohols A, C and D. Give the name of the reagent(s) used and the observation(s) made.

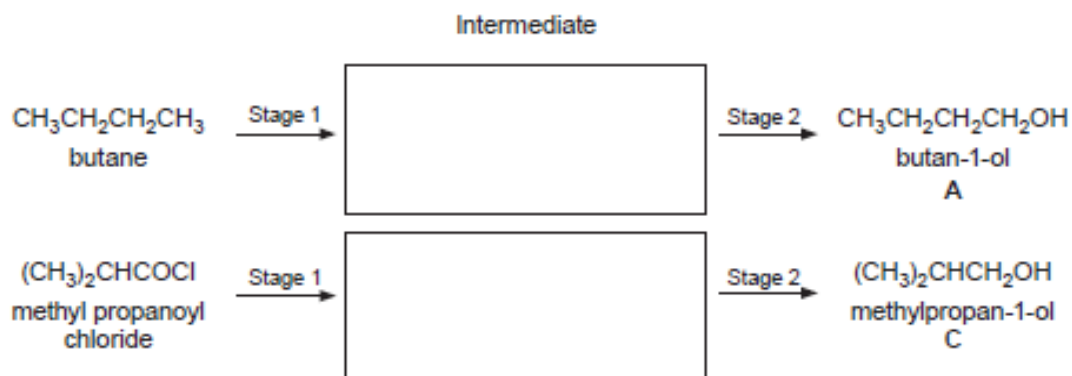
[2]

Reagent(s) .....

Observation(s) .....

- (c) Two-stage processes for the preparation of alcohols A and C are shown below. In each case the intermediate compound has been omitted.

Complete the schemes by inserting the shortened structural formula of the intermediate compounds in the spaces provided. [2]



- (d) Butan-1-ol can also be prepared directly from 1-aminobutane by reaction with nitric(III) acid ( $\text{HNO}_2$ ). Butan-1-ol is only one of many organic products formed, including butan-2-ol and but-1-ene.

Nitrogen gas, however, is given off in quantities exactly as shown in the equation below. Thus, by measuring the volume of nitrogen gas produced, the exact amount of amine present in the solution can be found.



Calculate the volume in  $\text{cm}^3$  of liquid 1-aminobutane used if  $6.60 \text{ dm}^3$  of nitrogen gas are produced. Assume that all gas volumes are measured at 298 K and 1 atm pressure. [3]

(density of 1-aminobutane =  $0.740 \text{ g cm}^{-3}$  at 298 K)

Volume = .....  $\text{cm}^3$

- (e) Benzenediazonium chloride,  $C_6H_5N_2Cl$ , also forms nitrogen gas on decomposition. The reaction is first order with respect to benzenediazonium chloride.

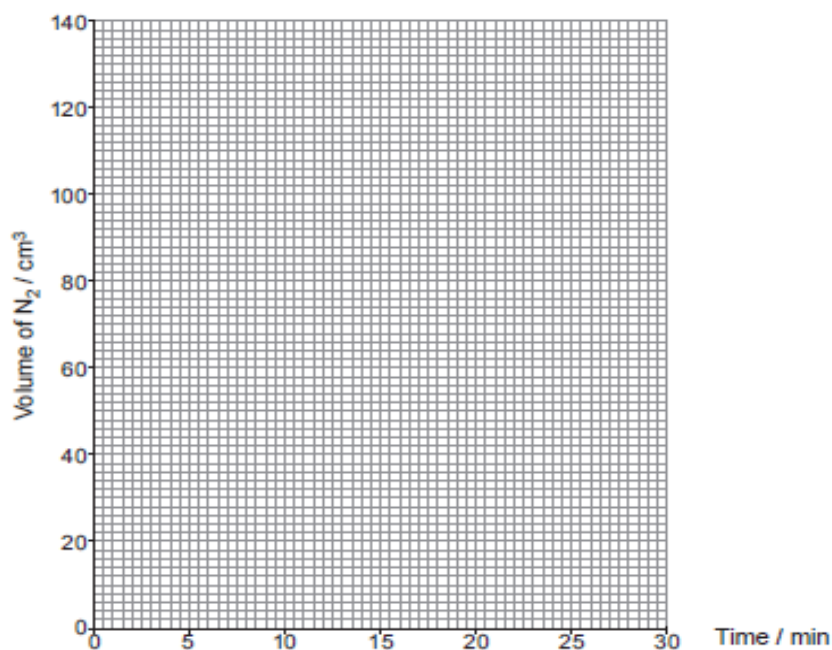


The following table gives the volume of nitrogen gas collected over time in the decomposition of  $50\text{ cm}^3$  of a  $0.110\text{ mol dm}^{-3}$  solution of benzenediazonium chloride at  $20^\circ\text{C}$ .

Time / min	0	2.0	4.0	6.0	9.0	12.0	16.0	22.0	28.0
Volume of $N_2$ / $\text{cm}^3$	0	17	34	49	66	81	95	112	122

- (i) Draw a labelled diagram of the apparatus that could be used to follow this reaction. [2]

- (ii) Plot the volume of nitrogen gas collected against time on the graph below. [2]



- (iii) Assuming the decomposition of the benzenediazonium chloride is complete, calculate the total volume of nitrogen gas that would be formed at the end of the reaction at 1 atm and 20 °C. [3]

Volume = ..... cm<sup>3</sup>

- (iv) I. Use the graph to determine the initial rate of formation of nitrogen gas in  $\text{dm}^3 \text{min}^{-1}$ . Give your answer in standard form. [3]

Initial rate = .....  $\text{dm}^3 \text{min}^{-1}$

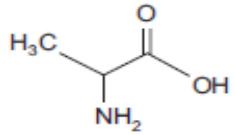
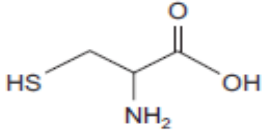
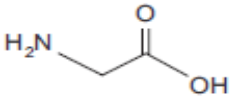
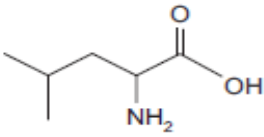
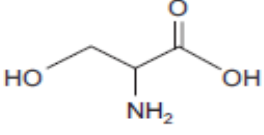
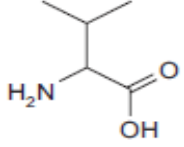
- II. Calculate the rate constant for this reaction giving the unit. [2]

Rate constant = .....

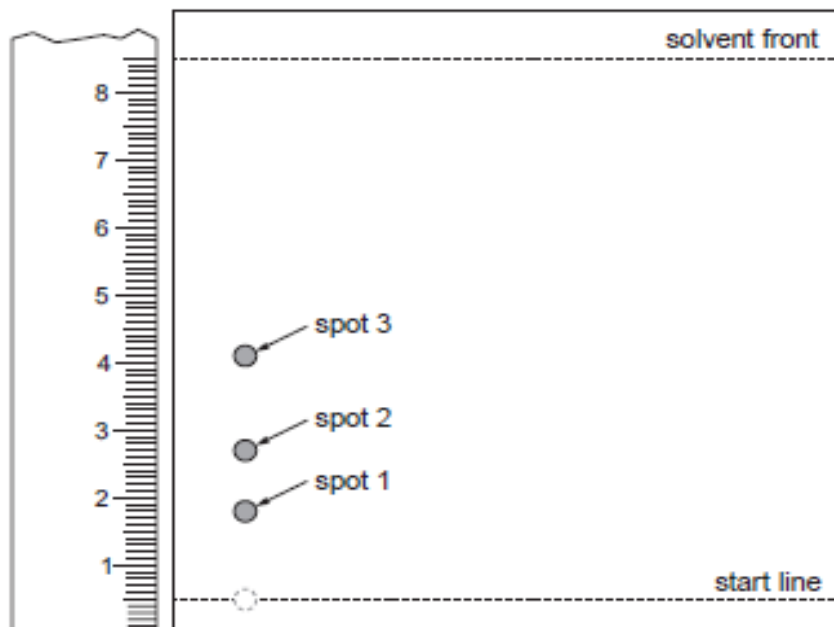
Unit .....

2. A mixture of amino acids produced on hydrolysis of a peptide can be analysed by thin layer chromatography.

$R_f$  values for different amino acids in two different solvents are given in the table below.

Amino acid		$R_f$ phenol/ammonia solvent	$R_f$ butanol/ethanoic acid solvent
alanine		0.55	
cysteine		0.13	0.05
glycine		0.41	0.17
leucine		0.86	0.61
serine		0.35	0.17
valine		0.76	0.45

- (a) A drop of solution that contains a mixture of four amino acids was analysed using thin layer chromatography. The plate was placed in a butanol/ethanoic acid solvent for 30 minutes. It was then dried and sprayed with a developing agent. The following chromatogram was obtained.



Chromatogram 1: butanol/ethanoic acid solvent

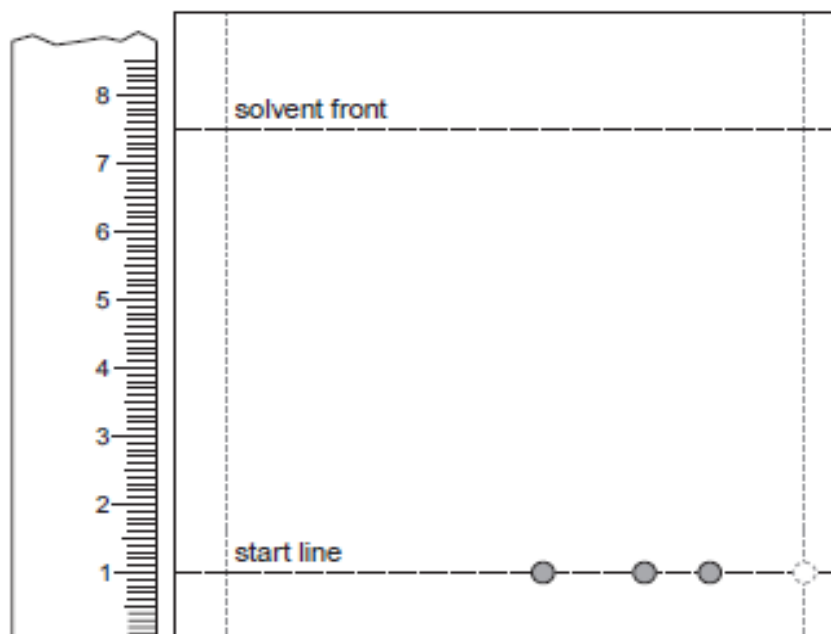
- (i) Spot 2 on this chromatogram corresponds to alanine. Calculate the  $R_f$  value of alanine in this solvent. [2]

$$R_f = \dots\dots\dots$$

- (ii) Explain, in terms of the data provided, why only three spots are present on this chromatogram even though the solution contains a mixture of four different amino acids. [1]

.....  
.....

- (iii) The plate was rotated through  $90^\circ$  in an anticlockwise direction and then placed in a phenol/ammonia solvent. Complete the diagram below to show the chromatogram you would expect to obtain. [4]



Chromatogram 2: phenol/ammonia solvent

- (b) Give the structural formula of one of the dipeptides that may be formed from serine and leucine. [1]