



# **GCE A LEVEL CHEMISTRY**

S21-A410

## **Assessment Resource D**

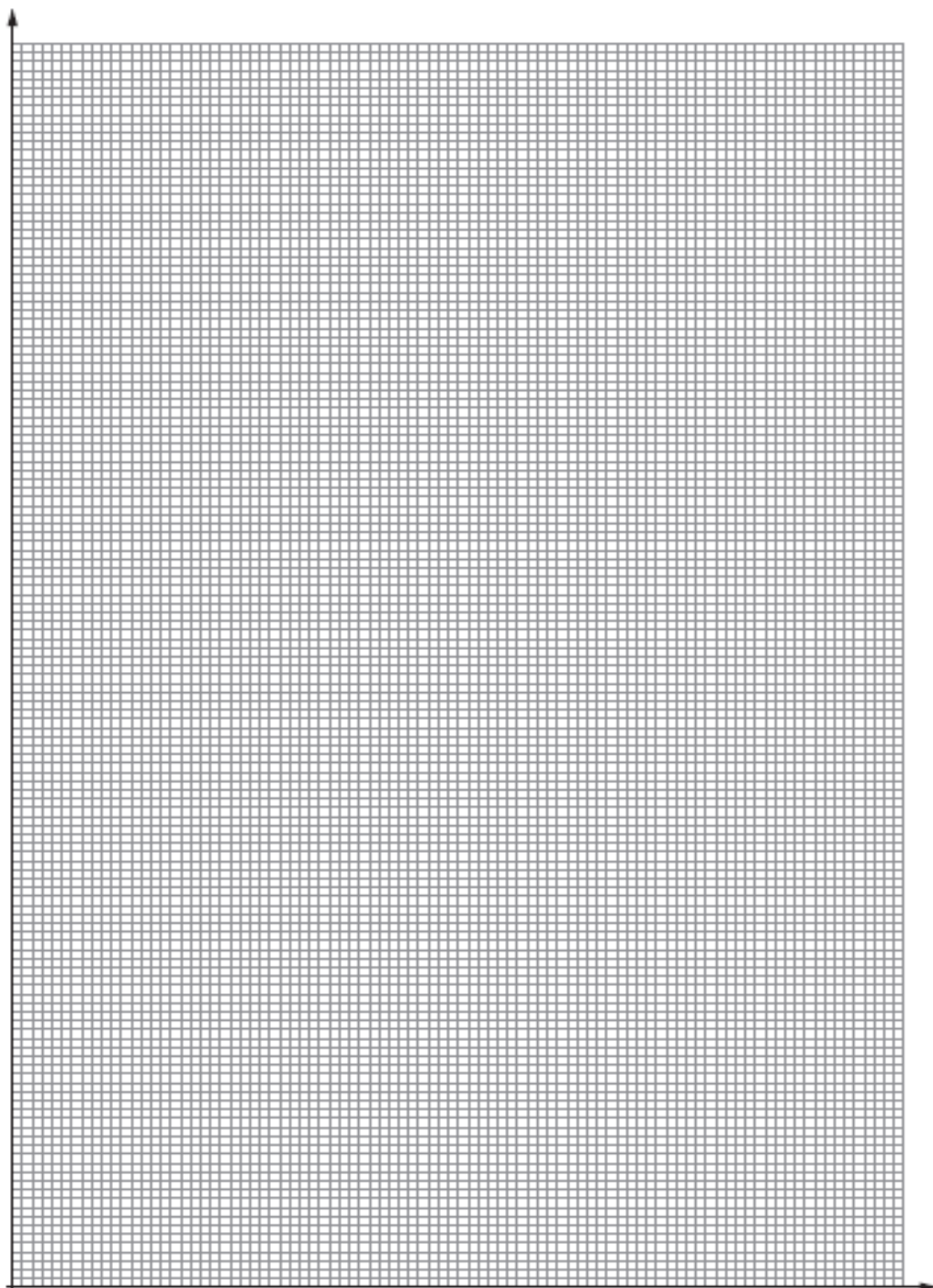
Chemistry in Practice

1. (a) The following pH values were measured during the titration of  $25.0\text{ cm}^3$  of aqueous ethanoic acid, of approximate concentration  $0.1\text{ mol dm}^{-3}$ , with aqueous sodium hydroxide of concentration  $0.0962\text{ mol dm}^{-3}$ .

Volume of sodium hydroxide added / $\text{cm}^3$	pH
0.0	2.9
5.0	4.1
10.0	4.5
15.0	4.9
20.0	5.3
22.0	5.5
24.0	5.8
25.0	6.1
26.0	6.6
27.0	11.2
28.0	11.4
29.0	11.7
30.0	11.8

(i) Plot the titration curve on the grid, clearly labelling the axes.

[4]



(ii) Use information from the titration curve in answering parts I-III.

- I. Calculate the concentration, in  $\text{mol dm}^{-3}$ , of the aqueous ethanoic acid. [3]

Concentration = .....  $\text{mol dm}^{-3}$

- II. Determine the pH of the sodium ethanoate solution formed at the equivalence point. [1]

.....

- III. Calculate the acid dissociation constant,  $K_a$ , of the ethanoic acid. [2]

$K_a$  = .....  $\text{mol dm}^{-3}$

- (b) State the colour obtained if a few drops of the acid-base indicator methyl red are added to a sodium ethanoate solution. Give a reason for your answer. [1]

pH	Methyl red indicator colour
$\leq 4.8$	yellow
$\geq 6.0$	red

.....  
.....

- (c) Aqueous propanoic acid and sodium propanoate can form a buffer solution.

A student requires a buffer of pH 4.46 for an experiment. He adds solid sodium propanoate to  $500\text{ cm}^3$  of aqueous propanoic acid of concentration  $0.210\text{ mol dm}^{-3}$ . Calculate the mass of sodium propanoate needed assuming no change in volume. [4]

( $K_a$  for propanoic acid is  $1.35 \times 10^{-5}\text{ mol dm}^{-3}$ )

Mass = ..... g

2. You are given solutions of six organic compounds, labelled **A-F**, and the following reagents.

Reagent	Name
1	red litmus paper
2	$I_2(aq)$ / $NaOH(aq)$ or $KI(aq)$ / $NaClO(aq)$
3	2,4-dinitrophenylhydrazine (2,4-DNPH)
4	dilute sodium hydroxide solution
5	sodium hydrogencarbonate solution

(a) Answer parts (i) and (ii) by completing the table opposite.

(i) Name compounds **D** and **F**. [2]

(ii) Give the results you would expect to observe on addition of reagents **2** and **3** to **each** of the compounds. Write 'NR' if there is no reaction.

Three of the compounds do not react with either of the reagents. [3]

Compound		Reagent: 2	Reagent: 3
		Conditions: room temperature / gentle heat	Conditions: room temperature
A	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ butylamine		
B	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ butanoic acid		
C	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ butanal		
D	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CONH}_2$ .....		
E	$\text{CH}_3\text{COCH}_2\text{CH}_3$ butanone		
F	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$ .....		

(b) Explain the results observed for compound **F**.

[1]

.....

.....

.....



(c) Devise a scheme of three further tests, using only reagents 1, 4 and 5, that would allow you to positively identify each of the remaining compounds.

(i) Complete the table below giving the reagent(s) and briefly describing each test. Give the observations made for each compound. Any test you suggest must lead to some observable result.

You do not need to include observations for compounds identified by a previous test. [4]

Compound	Reagent:	Reagent:	Reagent:
	Description of test:	Description of test:	Description of test:
	Observations		

(ii) Explain each of the positive results observed. [3]

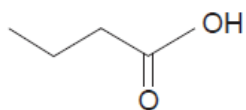
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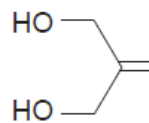
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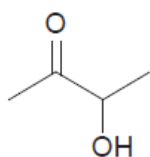
(d)  $C_4H_8O_2$  has a number of different isomers, four of which are shown below.



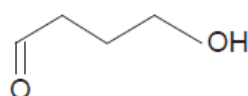
butanoic acid  
compound **B**



2-methylenepropane-1,3-diol  
compound **H**



3-hydroxybutanone  
compound **I**



compound **J**

(i) Name compound **J**.

[1]

.....

Do not use any of the reagents used in parts (a)-(c) [shown below] in your answers to parts (ii)-(iv).

red litmus paper
$I_2(aq)/NaOH(aq)$ or $KI(aq)/NaClO(aq)$
2,4-dinitrophenylhydrazine (2,4-DNPH)
dilute sodium hydroxide solution
sodium hydrogencarbonate solution

- (ii) Give a chemical test which gives a positive result for compounds H, I and J but not for compound B. [1]

Reagent(s) .....

Observation(s) .....

- (iii) Give a chemical test which gives a positive result for compound J but not for compounds B, H and I. [1]

Reagent(s) .....

Observation(s) .....

- (iv) Give a chemical test which gives a positive result for compound H but not for compounds B, I and J. [1]

Reagent(s) .....

Observation(s) .....