



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

# Mark scheme

# June 2002

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## GCE

## Chemistry

## Unit CHM6/P

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**Exercise 1** Skill assessed **Implementing (2)**1. Points assessed by supervisor during the practical examination

- |                                    |   |   |
|------------------------------------|---|---|
| (a) (i) <b>test tube reactions</b> | 1 uses appropriate quantities<br>2 no spillages<br>3 shakes mixture | 7 scoring points  |
| (ii) use of the <b>water bath</b>  | 4 water bath set up correctly<br>5 appropriate volume of water      | any 6 <b>including</b><br>safety = <b>2 marks</b><br>any 4 = 1 mark |
| (iii) <b>general</b>               | 6 does not require additional sample                                |   |
| (iv) <b>safety</b>                 | 7 works safely - eye protection, water bath etc                     |   |

2. Points assessed from candidate's written report.

- |  |                                       |                |
|--|---------------------------------------|----------------|
| (b) the <b>recording</b> of results          | results recorded clearly in the table | <b>1 mark</b>  |
| (c) The <b>accuracy</b> of the observations. | 26 scoring points                     |                |
|  | 22 - 26 points                        | <b>5 marks</b> |
|  | 17 - 21 points                        | 4 marks        |
|  | 12 - 16 points                        | 3 marks        |
|  | 7 - 11 points                         | 2 marks        |
|  | 1 - 6 points                          | 1 mark         |

## Exercise 2

## Skill 3 Analysing

- (a) **plotting a pH graph**      pH on the y axis, volume of alkali on the x axis      7 scoring points  
uses sensible scale for y axis      any 6 = 2 marks  
uses sensible scale for x axis      any 4 = 1 mark  
labels the axes  
plots the points correctly  
line through the points is      smooth  
best fit
- (b) **using graph to find  $K_a$**       identifies endpoint       $24.2 \text{ cm}^3 \pm 0.2$       5 scoring points  
identifies half-equivalence point      half of the above      all 5 = 2 marks  
pH at half-equivalence point       $3.0 \pm 0.2$       any 3 = 1 mark  
evidence of working  
correctly calculates value for  $K_a$       3.1 gives  $7.94 \times 10^{-4}$
- (c) **identify acid**      chloroethanoic acid      1 mark
- (d) **precision**      quotes either volume to 1 or 2 decimal places      3 scoring points  
pH reading to 1 place of decimals      any 2 = 1 mark  
 $K_a$  value to 2 or 3 significant figures
- (e) **estimation of errors**      estimates error in using pipette ( 0.2% )      4 scoring points  
estimates error in using burette ( using 24.2,  $\pm 0.62\%$  )      any 3 = 1 mark  
estimates error in using pH meter ( using 3.0, 3.33% )  
calculates the overall apparatus error (4.2%)
- (f) **nomenclature**      clear graph with sharp trace      3 scoring points  
explains calculations clearly & logically, with sensible layout      all 3 = 1 mark  
uses terminology accurately e.g.  $K_a$  not confused with  $pK_a$

**Total 8 marks**

## Exercise 2

## Skill 4 Evaluating

0. ignores anomalous result at  $23 \text{ cm}^3$  in plotting graph      1 mark
1. calculation of difference       $1.3 \times 10^{-3} - 1 \times 10^{-3} = 3 \times 10^{-4}$       1 mark  
a 23% difference      1 mark
2. appreciates discrepancy > maximum apparatus error      1 mark
4. repeat the experiment  
or more readings or use datalogger  
or smaller burette additions near endpoint      any 2 = 2 marks
- 
- thermostat the mixture or constant temperature      any 1 = 1 mark
- 
- calibrate meter  
use pH meter which is more accurate or more decimal places or digital

**Total 6 marks**

**Exercise 3** Skill assessed **Planning (1)**

- (a) the **scale** of working used (s) **max 4** scoring points  
equation  $\text{HOC}_6\text{H}_4\text{COOH} + (\text{CH}_3\text{CO})_2\text{O} \rightarrow \text{CH}_3\text{COOC}_6\text{H}_4\text{COOH} + \text{CH}_3\text{COOH}$   
calculates theoretical mass of acid to make 5g aspirin (3.83g)  
calculates likely mass of acid to make 5g aspirin (5.11g)  
calculates mass of ethanoic anhydride needed (3.78g)
- (b) (i) **apparatus** (a) **max 3** scoring points  
measuring cylinders **or** pipettes  
flask or other suitable  
balance  
named filtration apparatus eg Buchner or filter funnel and filter paper  
condenser
- (ii) the **method** used (m) **max 5** scoring points  
mixes reagents  
adds a few drops of acid  
care **or** cool if necessary  
reflux 15 minutes  
add water  
care / a little at a time  
filter
- (c) **recrystallisation** (r) **max 5** scoring points  
dissolves in the minimum quantity  
of hot water  
cools hot solution  
filters crystals  
dries crystals  
weighs dry sample  
purity check
- (d) **safety** (h) **max 3** scoring points  
ethanoic anhydride / phosphoric acid corrosive  
potential fire hazard with organics **or** no naked flames  
avoid skin contact **or** flood affected areas **or** gloves  
use fume cupboard  
eye protection

<b>Grading</b>	20 scoring points	18 - 20	scores	8 marks
		16 - 17	scores	7 marks
		14 - 15	scores	6 marks
		12 - 13	scores	5 marks
		9 - 11	scores	4 marks
		6 - 8	scores	3 marks
		3 - 5	scores	2 marks
		1 - 2	scores	1 mark

**Total 8 marks**

## Question 1

 $\text{Co}^{2+}$  $\text{Fe}^{2+}$  $\text{Cu}^{2+}$  $\text{Zn}^{2+}$  $\text{Mn}^{2+}$ 

Test	Observation with Compound A	Observation with Compound B	Observation with Compound C	Observation with Compound D	Observation with Compound E
1. Addition of sodium hydroxide solution	pink or blue ppt (1) insoluble in excess (1)	green ppt (1) insoluble in excess (1)	blue ppt (1) insoluble in excess (1)	white ppt (1) soluble in excess or colourless solution (1)	white / pale brown/ buff ppt (1) insoluble in excess (1)
2. Heating the mixture from Test 1	darkens or turns pink or turns brown or turns grey (1)	darkens or turns dark green or turns red-brown or turns orange (1)	ppt turns black or brown (1)	no visible change (1)	darkens or turns brown or turns black (1)
3. Addition of potassium thiocyanate solution	no visible change (1)	yellow /orange (solution) (1)	green (solution) (1) white ppt (on standing) (1)	no visible change (1)	no visible change (1)
4. Addition of potassium hexacyanoferrate(II) solution	green ppt (1)	blue ppt (1)	brown ppt (1)	white ppt (1)	white ppt (1)