GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Chemistry
(Subject Code CHM6/P)

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CHM6/P Practical Examination

Exercise 1 Skill assessed **Implementing (2)**

(a) Points assessed by supervisor *Manipulative skills* **m**

(i) use of pipette	1	empties under gravity	10 scoring points
	2	transfers from pipette without spillage	any 8 = 2 marks
	3	touches surface with pipette	any 5 = 1 mark
(ii) use of burette	4	uses manganate(VII) in burette	
	5	removes the funnel before titrating	
	6	dropwise addition near the endpoint	
	7	swirls mixture	
	8	reads burette correctly	
(iii) general	9	does not require additional sample	
	10	works safely	

Notes * *if does not work safely, maximum 1 mark*

(b) Points assessed from candidate's written report.

(i) the recording of results *Recording* **r**
results recorded clearly and in full in the table 1 mark
Notes * *if you can read it, it is clear*
* *full means completes at least two columns correctly*
* *allow clear answer outside of the box*
* *if initial reading is 50cm^3 lose recording mark*
* *if initial and final readings are transposed lose recording mark*

(ii) the awareness of precision *Precision* **p**
results of at least **2** titrations which are counted 3 scoring point
indicates results which are counted - *can appear in calculation of average* all 3 = 1 mark
volumes to 0.05 cm^3
Notes * *ignore precision of zero entries*
* *allow one other error*
* *if indicates first titre is rough one, ignore this column, unless candidate uses rough titre in calculating the average, when p=0*
* *quotes titres to other than nearest 0.05 loses the precision mark*

(iii) the concordancy of the results used in calculating the mean *Concordancy* **c**

results are concordant if both are within 0.1 cm^3 of each other 1 mark
Notes * *award the mark for concordancy if the table contains at least two concordant results*

(iv) The accuracy of the mean value, measured against a teacher value *Accuracy* **a**

mean titre is within 1% of target value	3 marks
mean titre is within 1.5 % of target value	2 marks
mean titre is within 2% of target value	1 mark

Notes
* *ensure average titre is calculated correctly*
* *if value entered by the candidate is wrong, underline the wrong value and write the correct value by the side*
* *use the corrected value to assess accuracy*
* *if staff value is wrong or missing use a group average; complete a discrepancy form*
* *when calculating a group average ignore wild data*

Total 8 marks

Exercise 2 Skill assessed **Analysing (3)**

1 the plotting of the graph
plots log (1/time) on the *y* axis, log (volume of KI) on the *x* axis — 4 scoring points
sensible scale for *y* axis — any 3 = 1 mark
sensible scale for *x* axis
labels the axes

plots the points correctly — both = 1 mark
line through the points is smooth

line through the points plotted is best fit — 1 mark

Notes
* *if graph does not cover half of the paper deduct 1 mark; do not penalise again under nomenclature*
* *if the graph plot goes off the squared paper deduct 1 mark; do not penalise again under nomenclature*
* *if uses an ascending y axis of negative numbers deduct 1 mark; do not penalise again under nomenclature*
* *if plots a non-linear/broken scale deduct 1 mark; mark part 2 consequentially but loses the nomenclature mark*
* *three points scored across the sections gives at least 1 mark*
* *if axes unlabelled use data to decide that log (1/time) is on y axis*
* *allow mark for axes labelled "(1/time)" and "volume of KI"*

2 correct use of the graph to determine gradient
appropriate *x* and *y* readings on graph or clearly in part 2 — 1 mark
correctly calculates gradient 0.90 ± 0.02 — 1 mark
shows working — 1 mark

Notes
* *consequential marking from candidate's data, to a maximum of 2;*
* *if gradient calculation upside down maximum of 2;*
* *for second mark must quote gradient to 1 dp or 2 dp*
* *ignore if candidate proceeds to state order or includes a negative sign*

3 correct estimation of errors
estimates error in using measuring cylinder (0.5 in 10 = 5%) — 3 scoring points
estimates error in using clock (1 in 36 = 2.8%) — any 2 = 1 mark
calculates the overall apparatus error (7.8% on above values)

Notes
* *ignore precision of answers*
* *consequential marking for overall error*
* *penalise doubled errors once*
* *lose mark if answers wrong because (x 100) missing from calculations; don't penalise again in awarding the nomenclature mark*
* *lose mark if don't use values from Experiment 3; don't penalise again in awarding the nomenclature mark*

4 the correct use of nomenclature and terminology
clear graph with sharp trace — 4 scoring points
graph has correct profile- appreciates need to plot negative numbers — all 4 = 1 mark
explains the calculation of the gradient clearly and logically
explains the calculation of the errors clearly
Notes * *ignore units*
* *if part 2 or part 3 is blank then loses nomenclature mark*

Total 8 marks

Exercise 2 Skill assessed **Evaluating (4)**

1 profile is good straight line/ results good quality/order close to 1/ can deduce order with confidence 1 mark

Notes * *must make a clear written comment*
* *mark consequentially to candidate's graph*

anomalous result in Expt 5 or 20 cm^3 1 mark

Notes * *mark consequentially to candidate's graph*
* *clear written comment or clearly indicated on the graph; allow ring drawn around Expt 5 point if it is the only point on the graph which is ringed*
* *if candidate includes Expt 5 point in best fit line, loses this mark if claims Expt 5 is an anomaly*
* *if candidate includes Expt 5 point in best fit line, and states no anomalies allow this mark*
* *if candidate includes Expt 5 point in best fit line, and correctly identifies another point as anomalous allow this mark*

2 thermostat the mixture or constant temperature 1 mark
rate affected by temperature change 1 mark

use burette/ pipette/ larger volume OR use more accurate clock 1 mark
more accurate volume more accurate timings 1 mark

spectroscopy to monitor colour change 1 mark
eliminates human error 1 mark

Maximum 4 marks

Notes * *Do not penalise additional answers unless they contradict*

Total 6 marks

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

(a) the appreciation of scale **s** max 3 scoring points
appreciates a 1:1 reactionappreciates acid solution should be 0.1mol dm^{-3} or other sensible value
calculates correct mass for chosen volume (250 cm^3 needs 3.75g for 0.1M)
Notes * *to score last point need a definite correct link between mass and conc.*

(b) the method used **m** max 10 scoring points
uses pH meter
calibrates pH meter
measures specified volume (20-50 cm^3) acid into a conical flask/beaker using a pipette
adds alkali from a burette
in sensible small portions (0.5-2 cm^3)
to excess/up to at least 30 cm^3/ steady high pH
stirs or swirls mixture
measures pH after each addition *use of a datalogger scores*
records pH value *these two points*
smaller volumes added near endpoint
repeats experiment
Notes * *can score points from a diagram*
* *ignore additional apparatus unless contradictory - lose apparatus point(s)*
* *allow if acid in burette but check pH curve profile is appropriate*
* *if method is clearly unworkable, CE; allow points common to correct method; consult DGW*
* *if anything unsafe award no hazard points*

(c) the use of results **r** max 5 scoring points
sensible sketch of pH against volume with correct profile
uses rough scales for pH and volume
explains clearly how to determine the endpoint
divides endpoint titre by 2 to determine half-equivalence point
reads pH at this volume - *indicated on sketch or clearly in written account*
converts pK_a value to K_a value
Notes * *can score points from sketch*
* *on x axis accept actual volumes (endpoint 20-30 cm^3) or in terms of v and v/2*

(d) safety factors **h** max 2 scoring points
eye protection
acid may be toxic/corrosive/irritant - protective clothing/ gloves / flood skin with water
alkali is corrosive/irritant - protective clothing/ gloves / flood skin with water
use a pipette filler

GRADING 20 scoring points

18 - 20	scores	8 marks	9 - 11	scores	4 marks
16 - 17	scores	7 marks	6 - 8	scores	3 marks
14 - 15	scores	6 marks	4 - 5	scores	2 marks
12 - 13	scores	5 marks	1 - 3	scores	1 mark

Approach if candidates do not plot a pH curve

1. *If candidate does a routine titration*:

* mark by the standard scheme for method and results
* do not award extra method points for *washing of apparatus*, *addition of indicator*, *colour change*, *concordant results* or *standard precautions*

2. *If candidate does a routine titration then takes the pH of a half neutralised solution*:

* mark by the following scheme for method maximum 10 scoring points
  measures specified volume (20-50 cm^3) acid into a conical flask/beaker
  using a pipette
  adds alkali from a burette
  adds appropriate named indicator - e.g. phenoplhthalein
  correct colour change
  stirs or swirls mixture
  dropwise near endpoint
  concordant results
  prepares half neutralised solution
  uses pH meter
  calibrates pH meter
  repeats experiment
  Notes * *allow if acid in burette but check preparation of half-neutralised solution*

* mark by the following scheme for results maximum 4 scoring points
  calculates an average titre
  divide average titre by two
  take pH of half neutralised solution
  converts pK_a to K_a
  Notes * *first three scoring points may well be in the method section*