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Mark Scheme (Results)
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GCE

GCE Chemistry (6243) Paper 1A

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the mark scheme

1. / means that the responses are alternatives and either answer should receive full credit.
2. ( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
3. [ ] words inside square brackets are instructions or guidance for examiners.
4. Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
5. ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

In general, an inference should follow an observation.

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(a)	Observation (white) solid (re-)forms higher up tube / white smoke (1) Inferences sublimes / sublimation (1) Ammonium / NH_4^+ (1) Ignore NH_3 /HCl	 Can be awarded if given in observation White sublimate (2)	White fumes/misty/ Gas/ precipitate NH_4Cl	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(b)	Observation red $\rightarrow$ blue (1) (and blue-no change) Inferences ammonia / NH_3 (1) - must follow obs. ammonium / NH_4^+ (1) – must follow obs/NH_3		 Ignore NH_4CL Just alkaline gas NO_3^- / NO_2^-	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(c)	Observations white ppt / white suspension (1) dissolves / soluble / colourless solution (in ammonia) / disappears (1) Inference Cl^-/ chloride (1)	Goes cloudy/milky Goes clear	Cream / yellow ppt Any "solution" Partially soluble Chlorine Just "AgCl" Ignore NH_4CL	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(d)	It prevents other anions forming a precipitate OR (Nitric) acid destroys interfering anions.	Destroys carbonate /hydroxide/sulphite	Just "makes it acidic"	1

<table>
<tr><th>Question Number</th><th>Correct Answer</th><th>Acceptable Answers</th><th>Reject</th><th>Mark</th></tr>
<tr><td>2.(a)</td><td>
Table 1
Check subtractions and averaging arithmetic, correcting if necessary.
All volumes recorded to 0.05 cm^3 (1)
ALLOW one slip but withhold this mark if any readings are in the wrong boxes.
ALLOW 0 as initial volume NOT 50 as initial volume
All subtractions correct (1)

[✓✓top RHS of Table 1]

Mean titre
For correct averaging of chosen values / choosing identical values and for recording the average correct to 2 or 3 dps or to nearest 0.05 cm^3 (1)
Do not penalise lack of 2nd d.p. in mean if this has been penalised in Table 1.
Allow loss of 2nd d.p. if zero

[✓by the mean in space <u>or</u> near the dotted line in paragraph below]

Accuracy
If the candidate has made an arithmetical error in the Table 1 volumes used in the mean or in averaging the examiner must calculate a new average.
• For an averaging error simply calculate a new value using the candidate's chosen titres.
• If a wrongly subtracted titre has been used in the mean then choose any two identical titres or take an average of the closest two titres.
Calculate the difference between the candidate's mean titre and that of the examiner or supervisor.

Examiner's titre = 26.20 cm^3 (to be confirmed at standardisation)

Award marks for accuracy as follows.
<table>
<tr><td>Difference d =</td><td>±0.30</td><td>±0.40</td><td>±0.50</td><td>±0.60</td><td>±0.80</td><td>±1.00</td></tr>
<tr><td>Mark</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
</table>
Range
Award a mark on the range of titres used by the candidate to calculate the mean. The range(r) is the difference between the outermost titres used to calculate the mean. If the examiner has corrected titres because of incorrect subtraction then award the range mark on the corrected titres used by the examiner to re-calculate the mean
<table>
<tr><td>Range of titres/cm^3</td><td>0.20</td><td>±0.30</td><td>±0.50</td></tr>
<tr><td>Mark</td><td>3</td><td>2</td><td>1</td></tr>
</table>
Examiner to show the marks awarded for accuracy and range as
d= value ✓6max r = value ✓3 max
Then the mark out of 12 written in margin.
[Overseas scripts: examiner to write "SR = titre value" on each script]
</td><td></td><td></td><td>12</td></tr>
</table>

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(i)	$\frac{\text{Mean titre}}{1000} \times 0.100$ Mark is for answer to > 2sf. [Penalise sf once only in (i)-(iii)] Allow loss of 3rd s.f. if it would be a zero Ignore units even if wrong	Answer with no working.		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(ii)	Moles HCl in 25 cm^3 = Answer to (i) Moles HCl in 250 cm^3 = above moles x 10 Mark is for answer to > 2sf. [Penalise sf once only in (i)-(iii)] Allow loss of 3rd s.f. if it would be a zero Ignore units even if wrong	Answer with no working.		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(iii)	1st answer to (ii) $\times \frac{1000}{2.5}$ (1) or 2nd answer to (ii) $\times \frac{1000}{25}$ (1) Correct value to > 2sf And units (if given) correct (1)	Correct value with no working (2) $^1/_{10}$ of correct value with no working (1)		2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(c)(i)	Titre will be very low / about $^1/_{10}{}^{th}$ of value obtained by student.(1) % error increases (1) Must follow 1st mark		Any indicator colour change reference. Less accurate	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(c)(ii)	Water in pipette and/or burette would dilute solution/alter concentration (1) Water added to flask anyway so no effect on concentration of solution. (1)	Water does not affect amount HCl present.	Alter titre	2

<table>
<tr><th>Question Number</th><th>Correct Answer</th><th>Acceptable Answers</th><th>Reject</th><th>Mark</th></tr>
<tr><td>3.(a)</td><td>Table 2
Three temperatures recorded in correct spaces.(1)

Each to at least 1 dp (1)

Change in temperature correctly calculated to at least 1 d.p. but allow loss of d.p's if zero (1)
Award marks for accuracy as follows.

<u>Home Centres</u>

Compare candidate's temperature change (corrected if necessary) with table
<table><tr><td>Range r =</td><td>6.0 – 7.5</td><td>5.5 -8.0</td><td>5.0 – 8.5</td></tr><tr><td>Marks</td><td>✓3</td><td>✓2</td><td>✓1</td></tr></table><u>International Centres</u>
Write supervisor's value "s=" on script
Compare candidate's temperature change (corrected if necessary) with table
<table><tr><td>Range</td><td><u>+</u> 0.8</td><td><u>+</u> 1.3</td><td><u>+</u> 1.8</td></tr><tr><td>Marks</td><td>✓3</td><td>✓2</td><td>✓1</td></tr></table></td><td></td><td>Negative value</td><td>6</td></tr>
</table>

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3.(b)(i)	<u>25 x 1.0</u> = 0.025 ONLY 1000	Answer with no working.		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3.(b)(ii)	<u>50 x 4.18 x ΔT</u> (kJ) 1000 OR 50 x 4.18 x ΔT (J) Mark is for method IGNORE sf, sign both of ΔT and answer and units (even if wrong)	Correct answer with no working		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3.(b)(iii)	<u>Answer to (ii)</u> Answer to (i) Value consequential on (ii). (1) If units given, must be kJ mol $^{-1}$ or kJ Sign – negative only – stand alone (1) 2 sf – only award if correct method (1)			3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3.(b)(iv)	any two Use pipette / burette not measuring cylinder. (1) Use a more precise /more accurate / / digital thermometer (1) Use more concentrated solutions (1)	Add NaOH in small volumes & plot volume /temp graph Lid on polystyrene cup	Repeat expt. Larger volumes	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4.	**Method 1** ✔[1] Collect gas in gas syringe/over water/diagram (1) ✔[2] Mix $CaCO_3$ + HCl/reagents (1) ✔[3] When no more bubbles evolved / syringe stops moving/reaction complete(1) ✔[4] Record volume of gas collected (1) ✔[5] Moles CO_2 = $\frac{\text{volume } CO_2 (cm^3)}{24{,}000}$ OR Moles CO_2 = $\frac{\text{volume } CO_2 \text{ } dm^3}{24}$ (1) ✔[6] Moles HCl = 2 x moles CO_2 (1) ✔[7]Concentration HCl = $\frac{1000 \times \text{moles HCl}}{\text{Vol HCl used}}$(1)	No more CO_2 evolved Record syringe volume (at start and end) for 2 marks	Unworkable diagram negates 1st mark Adding a little at a time	7
	Method 2 ✔[1] Weigh $CaCO_3$ (1) ✔[2] Mix $CaCO_3$ + HCl / reagents (1) ✔[3] When reaction is complete / no more bubbles evolved / no more effervescence. (1) ✔[4] Filter off, dry and weigh $CaCO_3$ (1) ✔[5]Moles $CaCO_3$ reacted = $\frac{\text{mass } CaCO_3 \textbf{ reacted}}{100 \text{ or RMM}}$ (1) ✔[6]Moles HCl = 2 x moles $CaCO_3$ (1) ✔[7]Concentration HCl = $\frac{1000 \times \text{moles HCl}}{\text{Vol HCl used}}$ (1)	No more CO_2 evolved	Adding a little at a time	
	Method 3 ✔[1]Mix $CaCO_3$ + HCl / reagents (1) ✔[2]Weigh immediately / tare balance (1) ✔[3]When reaction is complete / no more bubbles evolved / no more effervescence / no more weight loss (1) ✔[4]Re-weigh flask + reaction mixture / record loss of mass if tared (1) ✔[5]Moles CO_2 = $\frac{\text{mass } CO_2 \text{ loss in mass}}{44/\text{RMM}}$ (1) ✔[6]Moles HCl = 2 x moles CO_2 (1) ✔[7]Concentration HCl = $\frac{1000 \times \text{moles HCl}}{\text{Vol HCl used}}$ (1)	No more CO_2 evolved	Adding a little at a time	

Reject all titration methods.