

Mark Scheme (Results)

June 2008

GCE

GCE Chemistry (6243/01C)

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.

Apparatus and Materials

Apparatus

Each candidate will require:

1. apparatus for a flame test;
2. spatula;
3. 10 cm³ measuring cylinder;
4. 50 cm³ measuring cylinder;
5. 3 test tubes in a rack;
6. supply of dropping pipettes;
7. Bunsen burner;
8. 50 cm³ burette, stand and clamp, with small funnel for filling, white tile and a small beaker for draining burette;
9. 2 × 250 cm³ conical flasks;
10. 25 cm³ pipette with safety filler;
11. expanded polystyrene cup held securely in a 250 cm³ beaker;
12. a thermometer of range from at least room temperature to 50 °C (e.g. 0 to 50 °C or -10 to +110 °C), able to be read to ±0.5 °C or better;
13. access to a balance reading to at least 2 decimal places;
14. apparatus for testing gas with limewater e.g. delivery tube or dropper pipette.

Materials

Each candidate will require:

- (a) approximately 0.5 g of anhydrous sodium carbonate, labelled F. The identity of this must not be revealed to candidates;
- (b) 3 cm³ of aqueous potassium sulphate: concentration approximately 0.1 mol dm⁻³, labelled G. The identity of this must not be revealed to candidates;
- (c) 2 cm³ of aqueous barium chloride: concentration approximately 0.1 mol dm⁻³;
- (d) 10 cm³ of limewater;
- (e) 2 cm³ of dilute hydrochloric acid, concentration approximately 2 mol dm⁻³;
- (f) 200 cm³ of aqueous sodium hydroxide: concentration 0.150 mol dm⁻³, labelled T;
- (g) 200 cm³ of aqueous ethanedioic acid: concentration 8.32 g dm⁻³ of (COOH)₂·2H₂O, labelled U. The identity of the solute and this concentration must not be revealed to candidates;
- (h) phenolphthalein indicator;
- (i) specimen tube containing 5.0 ± 0.05 g of potassium nitrate, labelled B. The identity of this must not be revealed to candidates;
- (j) distilled water.

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(a)	Obs: yellow (1) Inf: sodium/ Na ⁺ (1)	Orange/golden	Na	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(b)	Obs: (Effervescence and) white ppt (1) Inf: Carbon dioxide / CO ₂ (1) Carbonate / CO ₃ ²⁻ (1) hydrogen carbonate/ HCO ₃ ⁻ (1) ions are conditional on CO ₂	Goes milky/cloudy		4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(c)	Na ₂ CO ₃ / NaHCO ₃ Conditional on correct (a) and observation in (b)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(d)(i)	Obs: white precipitate (1) Inf: any two of Sulphate/ SO ₄ ²⁻ (1) Sulphite /SO ₃ ²⁻ (1) Carbonate /CO ₃ ²⁻ (1) Hydrogensulphate/ HSO ₄ ⁻ (1) }	Cloudy/milky		3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1.(d)(ii)	Conditional on two ions in (i) Substances: dilute hydrochloric acid/HCl (aq) (1) Observations: consequential two from (Barium)Carbonate: effervescence (and ppt dissolves) (1) (Barium)Sulphate: Ppt insoluble/Stays/no change (1) (Barium)Sulphite: ppt dissolves (without effervescence) (1) Hydrogensulphate: Add blue litmus HSO ₄ ⁻ goes red SO ₄ ²⁻ stays blue	HCl / HNO ₃		3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(a)	<p>Check subtractions and averaging arithmetic, correcting if necessary</p> <p>All volumes read to 0.05 cm³ (1)</p> <p>All subtractions correct (1)</p> <p>✓✓ <i>top RHS of table 1</i></p> <p>Mean titre</p> <p>For correct averaging of chosen values/choosing identical values and for recording the average correct to 2 or 3 dps or to the nearest 0.05 cm³ [unless already penalised]</p> <p>✓ by the mean titre (1)</p> <p>Accuracy</p> <p>If the candidate has made an arithmetical error in table 1 volumes used in the mean or in averaging, the examiner must calculate a new average.</p> <ul style="list-style-type: none"> • For an averaging error simply calculate a new value using the candidate's chosen values • 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 <p>Calculate the difference between the candidate's mean titre and that of the examiner or supervisor</p> <p>Record the difference on the script as d = **</p> <p>Examiner's titre 22.00 cm³ or s/v value</p> <p>Award marks for accuracy as follows:</p> <p>Difference ± 0.20 (6) Difference ± 0.30 (5) Difference ± 0.40 (4) Difference ± 0.60 (3) Difference ± 0.80 (2) Difference ± 1.00 (1) Difference > 1.00 (0)</p>	<p>Allow 1 slip but withhold this mark if any readings are in the wrong boxes. Accept 0 ; 0.0 ; 0.00 as initial readings</p>	<p>Reject 50 as initial reading</p>	12

	<p>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 on the corrected titres used by the examiner to calculate the mean.</p> <p>Range ± 0.20 (3) Range ± 0.30 (2) Range ± 0.50 (1) Range > 0.50 (0) Examiner to show the marks awarded for accuracy and range as</p> <p>$d = \checkmark 6 \text{ max}$ $r = \checkmark 3 \text{ max}$</p> <p>then the mark out of 12 written in the margin</p>			
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Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(i)	$\frac{0.150 \times \text{titre}}{1000}$ <p>S.F. i) ii) iii) Penalise rounding to 2 s.f. once unless trailing zero iv) Ignore s.f. ignore unit</p>			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(ii)	answer (i) / 2			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(iii)	answer (ii) x 40			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(iv)	5.94 / answer (iii)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2.(b)(v)	titre would be too big/bigger/too large/larger (1) Because some alkali is neutralised with acid remaining in burette (1) Stand alone marks	[Conc of alkali reduced (1)]	Reject just "wrong"	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3.(a)	<u>Table 2</u> Weighings in correct spaces to at least 2 dp (1) Correct subtractions (1) <u>Table 3</u> Two temps recorded (1) BOTH to 0.5 ° C or better (1) ΔT correct with negative sign (1) EXPECTED VALUE -7.6°C or s/v value ± 1.0°C (3) ± 1.5°C (2) ± 2.0°C (1) > 2.0°C (0)			8

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3.(b)(i)	For correct substitution and evaluation(1) positive sign (1) Answer to 2 sig figs (1)			3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3.(b)(ii)	Either less accurate because % of error (in ΔT) greater (1) OR: More accurate because error due to heat gain is less (1)		Heat loss	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4.	Weigh crucible (1) ✓m1 Known mass/stated mass (1) ✓m2 Heat in crucible(1) ✓m3 To constant weight (1) ✓m4 Calculate mass (of gas) lost (1) ✓c1 Moles CO ₂ = $\frac{\text{mass lost}}{44/\text{Mr}}$ = moles CaCO ₃ (1) ✓c2 Mass CaCO ₃ = moles x 100 Mr (hence %) (1) ✓c3	If gas collection method Moles CO ₂ = vol/molar volume ✓C1		7