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Mark Scheme (Final)
Summer 2008

GCE

GCE Chemistry (6243/02)

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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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- show clarity of expression
- construct and present coherent arguments
- demonstrate an effective use of grammar, punctuation and spelling.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated 'QWC' in the mark scheme BUT this does not preclude others.

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(i)	Lighted/burning splint (1) Pops/explodes/squeaky pop (1) 2nd mark conditional on 1st being correct (see above) or a near miss (glowing splint, smouldering splint, burn, ignite are near misses)	Lit/flaming flint/spill flame	Near misses do not score 1st mark Just 'splint' Correct result without test or near miss scores zero	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(ii)	Glowing splint (1) Reignites/relights (1) 2nd mark conditional on 1st OR Burning splint burns more brightly (2)	Smouldering Burning splint relights scores 1	Splint alone No test	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(i)	White precipitate / solid (1) Insoluble in (hydrochloric) acid / HCl (1)	Solution turns cloudy/milky ppt or ppte for precipitate No change/ reaction with HCl or acid	Just 'No reaction with HCl' 'Precipitate' Turns white	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(ii)	Precipitate dissolves/ disappears **in** (hydrochloric) **acid**	effervescence with (hydrochloric) **acid** or Pungent gas evolved with **acid** or Gas evolved with **acid** which turns (potassium) dichromate green/blue	Just 'precipitate dissolves' or 'Effervescence' or 'Gas evolved' or (blue) litmus/pH paper turns red	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(iii)	Add sodium hydroxide (solution), (warm) (1) Gas evolved turns red litmus blue (1) 2nd mark conditional on 1st being correct (see above) or a near miss (alkali, hydroxide (ions) or just 'warm' or 'heat', alkali with Zn/ Al/ Devarda's alloy are near misses)	Potassium hydroxide White fumes with HCl Universal indicator /pH paper turns blue	Near misses do not score 1st mark Alkaline gas/gas Incorrect chemistry for test scores zero (e.g. 'add acid' or add NaOH followed by acid	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(i)	Lilac	Purple		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(ii)	Potassium flame masked (by strong sodium flame colour)	Sodium (yellow) flame persistent /strong Yellow flame seen instead of lilac Potassium flame not seen (clearly)	Both colours seen Colours mix Flame is yellow	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	Moles of 2-methylpropan-2-ol = $\frac{7.9}{74}$ (1) = 0.10676 Either Theoretical mass of 2-chloro-2-methylpropane = 92.5 x $\frac{7.9}{74}$ (1) = 9.875 (g) 100 x $\frac{5.8}{9.875}$ = 58.7% (1) Or actual moles of 2-chloro-2-methylpropane = $\frac{5.8}{92.5}$ (1) = 0.0627 100 x $\frac{0.0627}{0.10676}$ = 58.7/59 % (1) [ignore s.f. except 1 s.f.]	Correct answer some working scores 3 Correct answer, no working (1) Ecf on moles = 92.5 x $\frac{7.9}{74}$ (1) = 9.9 g 100 x $\frac{5.8}{9.9}$ = 58.6% (1) Or actual moles of 2-chloro-2-methylpropane = $\frac{5.8}{92.5}$ (1) = 0.0627 100 x $\frac{0.0627}{0.107}$ = 58.6 % (1)	100 x $\frac{5.8}{7.9}$ =73.4% scores zero	3

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	Transfer / handling losses, or specific examples of these eg 'product left in aqueous layer', or 'other products formed'	Side reactions occur Or reaction incomplete Or by-products	experimental error or spillages or evaporation or equilibrium	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(i)	Sensible separating funnel with tap (1) Organic layer on top (1) – stand alone		Conical/filter or Buchner funnel with tap	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(ii)	To prevent pressure building up due to formation of carbon dioxide or gas	To release the carbon dioxide/gas formed/pressure	To release vapour	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)	50 — 52 (°C)	49 or 50 – 52 or 53		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (d)	Add PCl_5 (1) (or $SOCl_2$) Any one of No steamy/misty/white fumes(1) no gas turns (damp) blue litmus / UI / pH paper red (1) no white smoke with ammonia (1)	Na (1) Any one of No bubbles (1) No pop with a lit splint (1) Positive result if alcohol present	PCl_3 White smoke with PCl_5 Any physical test Any oxidant No reaction	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(i)	(glass/volumetric/ graduated/25cm^3) pipette		Burette / measuring cylinder/teat pipette	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(ii)	With (the) sodium hydroxide (solution) Ignore **initial** rinsing with (distilled) water	Solution to be used in the burette Alkali	Solution to be used / final rinsing with (distilled) water	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(iii)	Colourless (1) to Pink (1) Pink to colourless (1)	…to permanent pink/pale pink	Red or purple or magenta	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(i)	Titres agree to within 0.2 (cm^3)	0.05 – 0.20 (cm^3)		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(ii)	$\frac{(26.35 + 26.45)}{2}$ = 26.40 (1)	26.4 correct answer with no working (1)		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(iii)	$\frac{0.205 \times 26.40}{1000} = 5.41 \times 10^{-3}$	Ecf from (ii) 5.412×10^{-3}	If the factor of 1000 is omitted penalise on each occasion	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(iv)	$\frac{5.41 \times 10^{-3} \times 1000}{25}$ (1) = 0.216 (mol dm^{-3})(1) Ignore s.f. except 1 s.f. If 26.40 & 25 transposed in 3 (b)(iii) and 3 (b)(iv) penalise once	Ecf from (iii)	If the factor of 1000 is omitted penalise on each occasion	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(v)	$100 \times \frac{0.216}{2.25}$ = 9.6 %	Ecf from (iv) 9.62 % (if left on calculator)	10 % values > 100%	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)	(Indicator) colour change cannot be seen/is masked (because of the colour of the wine)		Just 'end-point cannot be seen'	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)	Bromine (water/solution) (1) Orange/yellow/red-brown solution decolourised/goes colourless (1) OR Acidified potassium manganate(VII) (1) Purple/pink solution decolourised/goes colourless (1) OR alkaline/neutral potassium manganate(VII) (1) Purple/pink solution to green or brown (ppt)	 brown solution goes……. Potassium permanganate	 Discoloured Goes clear Initial colour omitted	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)	Compare measured boiling point/boiling temperature to (data) book value Compare IR/mass spectrum/NMR spectrum to reference data	IR/mass spectrum/NMR spectrum (Measure) boiling point /boiling temperature Melting point /melting temperature		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)	Initially $CuSO_4$ in excess so amount of reaction depends on amount of Zn or More $CuSO_4$ reacts (as more Zn added) (1) Graph levels off because all $CuSO_4$ used up (1)	$CuSO_4$ in excess More Zn reacts Zn now in excess	Reaction is exothermic Just ‘Reaction is complete’	2

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(i)	Heat capacity (of metal) low (compared with that of solution)	Metal has negligible/low specific heat capacity Metal absorbs (much) less heat (than solution/ water)		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(ii)	q = 50 x 63.5 x 4.18 = 13271.5 J Units, if given, must be correct Ignore signs	13300/13270/13272 Answer in kJ only if units stated	13271	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(iii)	Moles $CuSO_4$ = 50 x $\frac{1.25}{1000}$ = 0.0625 (1) $\triangle H$ = (-) $\frac{13271.5}{0.0625 \times 1000}$ (1) = - 212 (kJ mol $^{-1}$) 1 mark for negative sign 1 mark for answer to 3 SF Units, if given, must be correct	Correct answer with some working scores full marks Ecf from moles Ecf from (ii) gives -213/-212/ -212		4

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(i)	Extra precision negligible compared with approximations in calculations/heat loss	Measuring cylinder is least accurate measuring instrument		1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)(ii)	Use a lid on the cup (to reduce heat loss)	Extra insulation for cup Weigh $CuSO_4$ solution Use burette/ pipette to measure volumes	Repeat experiments OR use more accurate balance OR Smaller mass intervals	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6	**Strategy**: Statement or diagram of method (1) Measurement (1) Deduction (1) Equal moles (1) One other measure to ensure consistent results (1) <u>Examples of method and measurement</u> Heating and detecting CO_2 with limewater (any valid method) (1) Time for lime water to turn milky (1) Heating and measuring volume of CO_2 (any valid method) (1) Volume in a fixed time or time for a fixed volume (1) Heating and measuring mass loss (any valid method) (1) Mass loss in a fixed time (1) Heating to constant mass or complete decomposition can only score equal moles and measure to ensure consistent results marks (max 2)	 Shorter time or faster rate = less stable (1) Equal amounts Consistent heating (e.g. position of crucible/tube or same Bunsen setting (stating 'blue flame' or same height flame can gain this mark)) Or same volume or concentration of lime water. Valid methods include • bubbling into limewater • transferring CO_2 to limewater using a teat pipette Amount of CO_2 provided a valid volume-measurement method used	 Equal mass Use of water bath to control temperature time for a fixed mass loss	5

Same for all methods