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Mark Scheme (Results)

October 2016

Pearson Edexcel International GCE in Chemistry (WCH03) Paper 1

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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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) 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.
Phrases/words in bold indicate that the meaning of the phrase or the actual word is essential to the answer.
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.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

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	Acceptable Answers	Reject	Mark
1(a)(i)	First mark Nichrome (wire) ALLOW Recognisable spelling – nichrome/nicrome OR Platinum (wire) ALLOW Recognisable spelling – platinium Pt If both name and formula given both must be correct (1) Second mark Depends on first mark Except for near miss – eg nichromate/nickel/chromium (The alloy/metal is) unreactive/inert/not reactive/(very) stable/has a high melting temperature ALLOW Less reactive/low(er) reactivity No flame colour OR Does not react with HCl/air (1) IGNORE It can withstand the heat No impurities	 'Nichromate' Nickel/Ni OR Chromium/Cr High boiling point	2

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	Chlorides are (more) volatile Comment – ALLOW Sulfates/nitrates less volatile ALLOW (nearly all) chlorides are soluble IGNORE Other acids too reactive/oxidizing	Dissolves impurities HCl (more) volatile HCl dissolves chlorides HCl does not affect flame colour	1

Question Number	Acceptable Answers	Reject	Mark
1(a)(iii)	Group 1: Lithium/Li^+ (1) IGNORE Rubidium/Rb^+ Group 2: Strontium/Sr^{2+} IGNORE Calcium/Ca^{2+} (1) Penalise the omission of or incorrect charge once only	Any other metal ions	2

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	Hydroxide / OH^-/ ^-OH ALLOW hydroxyl ion	OH– / –OH $O^{2-/-2}$ Carbonate/hydrogen carbonate Just 'hydroxyl'	1

Question Number	Acceptable Answers	Reject	Mark
1(b)(ii)	$H^+ + OH^- \rightarrow H_2O$ OR $H_3O^+ + OH^- \rightarrow 2H_2O$ Ignore state symbols even if incorrect ALLOW multiples ALLOW TE from carbonate/hydrogen carbonate/oxide in 1(c)(i)		1

Question Number	Acceptable Answers	Reject	Mark
1(c)(i)	Strontium sulfate/sulphate((VI)) ALLOW $SrSO_4$ TE from calcium in (a)(iii) No TE from Group 1 ion in (a)(iii) here	Any other spelling of sulfate eg sulfurate $BaSO_4$	1

Question Number	Acceptable Answers	Reject	Mark
1(c)(ii)	$Sr^{2+}(aq) + SO_4^{2-}(aq) \rightarrow SrSO_4(s)$ TE from (c)(i) ALLOW TE on Li or Rb in (a)(iii) here TE for formation of $BaSO_4$ if given in 1(c)(i)	Inclusion of H^+, OH^-, and H_2O	1

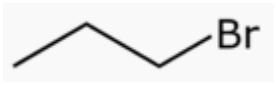
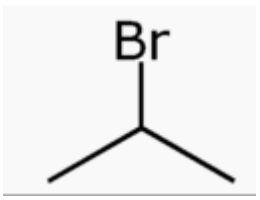
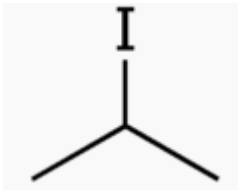
Question Number	Acceptable Answers	Reject	Mark
1(d)	$Sr(OH)_2$ TE for calcium/barium from (c)(i) TE from Li and Rb from (c)(i) ALLOW TE on oxide/carbonate/hydrogen carbonate in (b)(i)	 TE from any other anions in (b)(i)	1

(Total for Question 1 = 10 marks)

Question Number	Acceptable Answers	Reject	Mark
2(a)	Ethanol dissolves (both) halogenoalkanes (and silver nitrate) To allow the halogenoalkane and water/silver nitrate to mix To allow reactants to mix OR Ethanol is a co-solvent ALLOW Ethanol has polar and non-polar parts/is a polar and non-polar solvent/ dissolves ionic and covalent substances IGNORE Halogenoalkanes are insoluble in water	Just 'to provide the same reaction conditions' Just 'ethanol is a solvent'	1

Question Number	Acceptable Answers	Reject	Mark
2(b)	P and Q bromine/Br/C_3H_7Br/bromoalkane ALLOW AgBr (1) R iodine/I/C_3H_7I/bromoalkane ALLOW AgI (1) Penalise halide ion(s) only once Penalise X_2 only once	Bromine and chlorine	2

Question Number	Acceptable Answers	Reject	Mark
2(c)(i)	$CH_3CH_2^+$ / $C_2H_5^+$ ALLOW Structural, displayed, skeletal formulae. Allow charge anywhere on fragment, including outside brackets.	Absence of charge / $C_2H_5^-$ / C_2H_5– ethane ion	1

Question Number	Acceptable Answers	Reject	Mark
2(c)(ii)	P $CH_3CH_2CH_2Br$ (1) Q $CH_3CHBrCH_3$ (1) R CH_3CHICH_3 (1) ALLOW Displayed or skeletal formulae for any or all parts P  **Q**  R  TE for incorrect halogen(s) in 2(b) Penalise the same error in structural/displayed/skeletal formulae once only. Special cases P $CH_3CHBrCH_3$, Q $CH_3CH_2CH_2Br$, and R $CH_3CH_2CH_2I$ (1) P $CH_3CH_2CH_2Br$, Q $CH_3CH_2CH_2Br$, and R $CH_3CH_2CH_2I$ (1)		3

(Total for Question 2 = 7 marks)

Question Number	Acceptable Answers	Reject	Mark
3(a)(i)	(Freshly prepared) starch (solution/indicator) ALLOW Startch (1) Blue-black / blue / dark blue/ black to colourless IGNORE ..to clear (1) Mark independently	 Purple to...	2

Question Number	Acceptable Answers	Reject	Mark
3(a)(ii)	Pale yellow/straw coloured	Brown/yellow/brown-yellow/tawny	1

In 3(b) to (d)(ii)

Penalise rounding errors only once

Penalise 1 SF only once

(Both may be penalised)

Question Number	Acceptable Answers	Reject	Mark
3(b)	Fully scroll down answer Number of moles of electrons $= \frac{0.2 \times 15 \times 60}{96\,500}$ $= 1.865 \times 10^{-3}$ / 0.001865 (mol) Correct answer with no working scores 1 IGNORE SF except 1SF IGNORE electrons for units		1

Question Number	Acceptable Answers	Reject	Mark
3(c)(i)	19.45 18.6(0) 19.05 18.7(0) (cm^3)		1

Question Number	Acceptable Answers	Reject	Mark
3(c)(ii)	Method 1 Titres/results/runs 1 and 3 should be discarded (1) as they are not concordant/within (±) 0.2 cm^3 IGNORE The(ir) first reading is zero OR Reading(s) too far from the others (1) Method 2 Run 1 as rangefinder/rough (1) Run 2 as not concordant / within (±) 0.2 cm^3 (1) Use method giving higher mark		2

Question Number	Acceptable Answers	Reject	Mark
3(c)(iii)	18.65/18.7 (cm^3) ALLOW TE from (i) and (ii) Runs 2, 3, 4 give 18.783/18.78/18.8 Runs 1, 3, 4 give 19.067/19.07/19.1 Runs 3, 4 give 18.875/ 18.88/ 18.9	18.6 19.06 18.87	1

Question Number	Acceptable Answers	Reject	Mark
3(c)(iv)	$\frac{18.65 \times 0.0100}{1000}$ = 1.865×10^{-4} / 0.0001865 (mol) TE from (iii)		1

Question Number	Acceptable Answers	Reject	Mark
3(c)(v)	$1.865 \times 10^{-4} \times 100/10$ $= 1.865 \times 10^{-3} / 0.001865$(mol) TE from (iv)		1

Question Number	Acceptable Answers	Reject	Mark
3(d)(i)	$2S_2O_3^{2-}(aq) \rightarrow S_4O_6^{2-}(aq) + 2e(-)$ (1) $2I^-(aq) \rightarrow I_2(aq) + 2e(-)$ (1) OR $2S_2O_3^{2-}(aq) - 2e(-) \rightarrow S_4O_6^{2-}(aq)$ (1) $2I^-(aq) - 2e(-) \rightarrow I_2(aq)$ (1)		2

Question Number	Acceptable Answers	Reject	Mark
3(d)(ii)	$1.865 \times 10^{-3} / 0.001865$ (mol) of electrons... lost/gained/equals/reacts with/taken from/ given to/equivalent to $1.865 \times 10^{-3}/0.001865$ (mol) $S_2O_3^{2-}$ NOTE Numbers do not have to be the same eg 0.001865 electrons with 0.001906 $S_2O_3^{2-}$ OR 1 mol of electrons equivalent to 1 mol $S_2O_3^{2-}$ ALLOW Any indication of 1:1 ratio for electrons: $S_2O_3^{2-}$ IGNORE Answers referring to equations only.		1

Question Number	Acceptable Answers	Reject	Mark
3(e)(i)	Uncertainty in titre value: (±)0.51/0.514% OR $\frac{2 \times 0.05}{19.45} \times 100 =$ = 0.5 (1) Uncertainty in the pipette measurement: $\frac{(0.04 \times 100)}{(10.0)} = (\pm)0.4\%$ (1)		

Question Number	Acceptable Answers	Reject	Mark
3(e)(ii)	The uncertainty is not significant because the data are rounded to 1 SF / produce a ratio to the nearest whole number ALLOW Uncertainties are very small/ < 5%/ < 1% Other reasonable points: eg insignificant as only equation is required	..is significant Uncertainties do not matter as titres have been averaged	1

(Total for Question 3 = 16 marks)

Question Number	Acceptable Answers	Reject	Mark
4(a)(i)	Risk of inhalation / breathing in / risk of going into nose/mouth (1) Weigh in a fume cupboard OR Wear a face mask (1) IGNORE risk of spillage/gloves/safety glasses Mark independently		2

Question Number	Acceptable Answers	Reject	Mark
4(a)(ii)	First mark (why are they needed) (Anti–bump granules) prevent the liquid mixture shooting out / splattering/spurting/spitting/explosive boiling/violent boiling/sudden boiling/ promote smooth/calm/even boiling OR they prevent the mixture superheating /localised boiling OR prevent large bubbles forming Second mark (How they work) (Provide)(rough) surface/small holes/nucleation sites OR promote (small) bubble formation OR facilitate/promote heat/energy transfer ALLOW facilitate/promote smooth/ uniform/even heating	Just: 'prevent explosion' OR Just 'boiling too fast/strongly' OR Just to stop bumping OR Just to prevent boiling OR Just so reaction proceeds smoothly anything to do with rate of reaction	2

Question Number	Acceptable Answers	Reject	Mark
4(a)(iii)	Read the whole answer first First mark In the top of the still head/3 EITHER thermometer holder/4/cork (containing a thermometer/8) (IGNORE position of thermometer unless incorrect) OR 6/stopper (1) Second mark The still head/3 is in the top of the flask/5 OR The condenser/7 OR delivery tube/2 is connected to the side arm (1) Third mark The condenser/7 OR delivery tube/2 delivers to a beaker/test tube/ measuring cylinder/flask (1) Rescue mark Selection of items 3, 5, 2 or 7, and 4/6/8 (1) All marks may be shown on diagram	delivers to gas syringe /graduated flask Item 1	3

Question Number	Acceptable Answers	Reject	Mark
4(b)(i)	A greater mass /more sodium dichromate((VI)) is used / a greater portion/concentration of sodium dichromate((VI)) OR more/excess oxidizing agent/oxidant (1) (More) concentrated/50% sulfuric acid (is added) (1) Just 'more concentrated reactants' (1) IGNORE needs to be completely oxidized	Just 'more reactants'	2

Question Number	Acceptable Answers	Reject	Mark
4(b)(ii)	The water must flow up the condenser/ from bottom to top/down to up AND If it does not, it will trickle down one side/will not fill OR air bubbles may form/air blockage OR less effective/efficient cooling/condensing ALLOW no cooling/condensing OR causes loss of reactants/products/reaction mixture		1

Question Number	Acceptable Answers	Reject	Mark
4(b)(iii)	First mark (A condenser is needed because the organic) mixture/chemicals/materials/reactants/ products/ alcohol/propanal is/are volatile / would boil away/escape (while heating) IGNORE Prevent gas escaping (1) Second mark Clear description of condensing process, for example: Volatile products/ vapours/gases condense/form liquids (on the cooled glass surface) (which drip/go back into the reaction flask) ALLOW Ensure complete oxidation (1)		2

Question Number	Acceptable Answers	Reject	Mark
4(c)(i)	Both are (clear) colourless liquids ALLOW No colour liquid IGNORE Smell OR Oil like OR Transparent OR Formulae	Colourless solutions Any other colours	1

Question Number	Acceptable Answers	Reject	Mark
4(c)(ii)	Test for propanal (Boil with) Benedict('s)/Fehling('s) (solution) Allow 'Fheling(s)' ALLOW (almost) correct description of Benedicts/Fehlings eg alkaline copper sulfate (1) red precipitate/ solid (forms) (1) OR Tollens' reagent ALLOW (almost) correct description of Tollens reagent eg ammoniacal silver nitrate (1) silver mirror (forms) (1) Rescue marks 'Silver mirror test' (forms silver mirror) 1max Acidified potassium/sodium dichromate goes green/blue 1max 2,4-DNH/Brady's (reagent) forms yellow/ orange precipitate/ solid 1max Test for propanoic acid Add to sodium carbonate /hydrogencarbonate solution OR Any (metal) carbonate/hydrogen carbonate ALLOW Magnesium / Mg (1) Fizzing / bubbles /effervescence/gas turns limewater milky (1) OR Alcohol (any) with concentrated sulfuric acid (1) gives fruity/gluey smell (1) Rescue marks Add sodium fizzing occurs / bubbles form / effervescence 1max OR Add PCl_5/phosphorus(V) chloride/phosphorus pentachloride. Steamy (ALLLOW White) fumes (form) 1max	Just 'gas'	4

(Total for Question 4 = 17 marks)

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