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Mark Scheme (Results)

Summer 2024

Pearson Edexcel International Advanced Subsidiary Level In Chemistry (WCH13)
Paper 01R: Practical Skills in Chemistry I

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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

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.

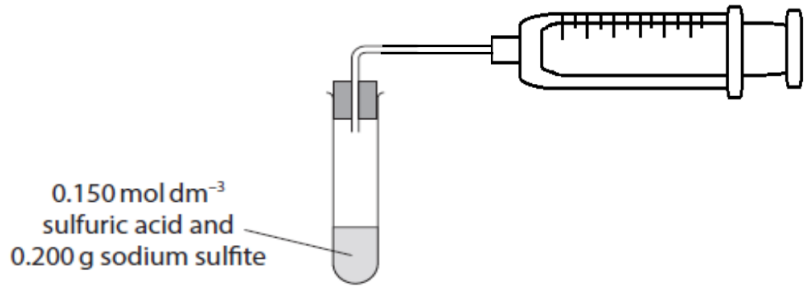
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

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	Answer	Additional Guidance	Mark
1(a)	• diagram of a gas syringe	Example of a diagram:  Gas syringe should have plunger **and** graduations **and** be connected to the delivery tube.	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)	• calculation of M_r of Na_2SO_3 **(1)** • calculation of number of moles **(1)**	Example of a calculation: $((23.0 \times 2) + 32.1 + (3 \times 16) =) 126.1$ Allow 126 $0.200 \div 126.1 = 1.5860 \times 10^{-3}$ / 0.0015860 Allow 1.5873×10^{-3} / 0.0015873 TE from M1 to M2 Ignore SF except 1SF on M2 Correct answer scores (2)	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(c)	• calculation of gas volume **(1)** • conversion to dm^3 **(1)**	Example of a calculation: 29.5 / 0.001586 = 18 600 (cm^3) 18 600 ÷ 1000 = 18.6 dm^3 / 19 dm^3 Alternate method: Convert to dm^3 0.0295 / 2.95×10^{-2} Calc^{n} of gas vol 0.0295 ÷ mol = 18.6 TE from (b) Allow litres in place of dm^3 Ignore SF except 1SF Ignore incorrect standard form Ignore dm^3 mol^{-1}	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(d)(i)	• use of n ÷ c = v **with** units	Example of a calculation: 0.00159 ÷ 0.150 = 0.010573 / 0.0106 dm^3 / 10.6 cm^3 TE from (b) Allow litres in place of dm^3 Ignore SF except 1SF	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	• suitable suggestion	e.g. temperature is **lower** than standard conditions, some gas escapes before the bung can be replaced, some gas escapes as the reaction starts, SO_2 dissolved in the **sulfuric acid** Allow dissolved in sulfuric acid / sodium sulfate solution Ignore incomplete reaction Ignore impure reactants Ignore measurement error Ignore solubility in water / reacts with water Ignore "not standard conditions" Ignore references to pressure	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(e)	An answer that makes reference to the following point: • **sulfur dioxide / SO_2** is toxic	Allow poisonous Allow irritant Allow choking smell Ignore acid rain / pollution / breathing difficulties Do not award "toxic" without named gas	**(1)**

(Total for Question 1 = 8 marks)

Question Number	Answer		Additional Guidance	Mark
2(a)(i)	A description that makes reference to the following points: • Li fizzes / moves (more slowly on the surface of the water)	**(1)**	Allow floats Ignore smoke Do not award "produces precipitate" Sinks to bottom or flame negates M1 Do not award M1 if Lithium is stated as the most reactive	**(3)**
	• sodium fizzes more / moves faster **or** forms a sphere on the water	**(1)**	Allow yellow(-orange) flame produced for sphere	
	• potassium produces a lilac flame	**(1)**	Allow purple for lilac Allow always produces a flame (no colour required) Ignore explosion If no other mark scored allow "Reactivity increases from Li to K" (or description) or "metal disappears/dissolves more quickly from Li to K" (or converse) for 1 mark	

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	An answer that makes reference to two of the following points: • use small pieces of metal **(1)** • use tongs / gloves (to move the metal) **(1)** • ensure all oil is removed from the surface of the metal **(1)** • use a large container / volume of water **(1)**	Allow use less solid Do not award "wear gloves" if related to heat Allow use a safety screen or fume hood Allow lab coat Ignore distance / open space Ignore presence of flames Ignore masks	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	An answer that makes reference to the following points: • balanced ionic equation and state symbols	$Mg^{2+}(aq) + 2OH^{-}(aq) \rightarrow Mg(OH)_2(s)$	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	An answer that makes reference to the following point: • white **and** precipitate	Allow ppt/ppte/solid/suspension Allow goes cloudy/milky	**(1)**

Question Number	Answer		Additional Guidance	Mark
2(b)(iii)	A description that makes reference to the following points: • add (dilute) sulfuric acid / aqueous sulfate ions • a white precipitate (of barium sulfate / $BaSO_4$)	**(1)** **(1)**	Accept named solutions Ignore additional acids Do not award concentrated sulfuric acid Allow ppt/ppte/solid M2 dependent on M1 or a near-miss (e.g. incorrect formula) Ignore further tests	**(2)**

Question Number	Answer		Additional Guidance	Mark
2(b)(iv)	An answer that makes reference to the following points: • magnesium: no colour • barium: (apple) green	**(1)** **(1)**	Allow colourless Do not award white Do not award blue-green	**(2)**

(Total for Question 2 = 11 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)	An answer that makes reference to the following points: • colourless **(1)** • (to) pink **(1)**	Do not award purple / red 1 mark if colours are correct but inverted	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)	• mean titre calculated	Example of a calculation: (21.10 + 21.15) ÷ 2 = 21.125 / 21.13 / 21.1 (cm^3) Do not award 21.10 Do not award 21.15	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(c)	• moles calculated **(1)** • concentration calculated **(1)**	Example of a calculation: 5.00 ÷ 116 = 0.043103 (mol) 0.043103 ÷ 0.25 = 0.17241 / 0.17 (mol dm^{-3}) Ignore SF except 1SF TE M1 to M2	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(d)	• moles of maleic acid **(1)** • use of ratio and moles of NaOH **(1)** • concentration of sodium hydroxide **(1)**	Example of a calculation: $(20 \div 1000) \times 0.17241 = 0.0034482 / 3.4482 \times 10^{-3}$ (mol) 2:1 ratio so $0.0068964 / 6.8964 \times 10^{-3}$ mol NaOH $0.0068964 \div (21.125 \div 1000) = 0.32646 / 0.33$ mol dm^{-3} TE throughout and on 3(b) and 3(c) Ignore SF except 1SF	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(e)(i)	A description that makes reference to the following points: • (shaken with) bromine water **(1)** • will decolourise with maleic acid **and** will not change colour with succinic acid **(1)**	Allow bromine Accept goes from brown/orange/yellow to colourless Allow red-brown to colourless Allow acidified potassium manganate(VII) for M1, will decolourise with maleic acid (M2) **and** no change with succinic acid	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(e)(ii)	An answer that makes reference to the following point: • *Z*-but(-2-)enedioic acid	 Allow *cis*-but(-2-)enedioic acid Allow Z-2-butene-1,4-dioic acid Allow cis-but-2-endioic acid	**(1)**

(Total for Question 3 = 11 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that makes reference to the following points: • 40-60ºC **(1)** • justification **(1)**	Allow any temperature in this range The solution needs to be warm but if too hot presents a scald risk Allow so the organic liquid doesn't boil/evaporate Allow suggestions relating to rate needing to be increased Ignore responses based on time Marks are independent	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that makes reference to the following points: • 1-chlorobutane **and** 1-bromobutane **(1)** • all halogenoalkanes must be primary (to allow comparison) **OR** molecules must have the same chain length (to ensure similar solubility/miscibility/inductive effect) **(1)**	Accept $CH_3CH_2CH_2CH_2Cl$ and $CH_3CH_2CH_2CH_2Br$ Ignore C_4H_9Cl and C_4H_9Br Allow same type/class/structure of halogenoalkane Allow only the halogen changes, not the alkane	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(c)	An answer that makes reference to the following points: • 1 ÷ time	 Allow 1/time or reciprocal of time or one divided by time	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(d)	An answer that makes reference to the following point: • the data (is discontinuous and) already shows the trend	 Accept the percentage/experimental error/uncertainty in measuring the times is small in comparison with the differences between them. Allow the values are very different so the trend is clear Allow the three haloalkane rates are compared under identical conditions. .	**(1)**

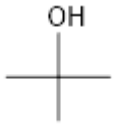
Question Number	Answer	Additional Guidance	Mark
4(e)	An answer that makes reference to the following point: • ammonia / NH_3	 Allow NH_4OH Ignore references to concentration Do not award $NH_3 \cdot H_2O$	**(1)**

(Total for Question 4 = 7 marks)

Question Number	Answer	Additional Guidance	Mark
5(a)	An answer that makes reference to the following points: • letters in the correct order **(2)**	A F B D E C All five in the correct order scores (2) Any two letters in the correct place (1)	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	• correct equation **(1)** • correct state symbols **(1)**	Example of an equation: $NaHCO_3(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$ Allow ionic equation $HCO_3^-(aq) + H^+(aq) \rightarrow H_2O(l) + CO_2(g)$ M2 dependent on M1 (or a near-miss)	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	An answer that makes reference to the following points: • to dry the (organic) liquid **(1)**	Allow to absorb water Allow to act as a drying agent Allow dry the (organic) solution Allow “eliminate water” Ignore “remove water” alone Do not award dehydration	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	An explanation that makes reference to the following points:  • alcohol X / /2-methylpropan-2-ol **(1)** • (alcohol X) is tertiary / 3° **(1)** • (alcohol X) will form a more stable carbocation **(1)**	If X, the formula and the name are given all must be correct Allow forms a tertiary carbocation Ignore shape of carbocation Ignore comments on activation energy	**(3)** **Expert**

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	A description that makes reference to the following points: • heat (with sulfuric acid and potassium dichromate(VI)) **(1)** • **X** will not turn green **(1)** • distil the products (from **Y** and **Z**) **(1)** • **Z** product will react with Fehling's/Benedict's **(1)** • to give a red/brown precipitate **(1)**	Allow warm Ignore reflux for M1 when aldehydes are implied Do not award hydrochloric acid Accept Y **and** Z will produce a colour change orange to green Allow X will not produce a colour change from orange Accept converse for **Y** product Accept **Z** product will react with Tollens' (1) to give a silver mirror (1) M5 has to have the correct reagent to be awarded "silver mirror" without Tollens would not score. Alternative: reflux (M1) M2 and M3 are the same as above Z product will react with CO_3^{2-}/HCO_3^-(M4) To fizz / gas turns lime water milky/white (M5) Or Z product will react with PCl_5 (M4) To produce misty fumes (M5) Allow triiodomethane (iodoform) as a negative test for the product of **Z** (1), **Y** will give a pale-yellow precipitate (1)	**(5)** **Expert**

(Total for Question 5 = 13 marks)
TOTAL FOR PAPER = 50 MARKS

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