Mark Scheme (Results)

January 2023

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

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 <u>meaning</u> 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.

Question Number	Answer		Additional Guidance	Mark
1(a)	An answer that makes reference to the following points:			**(2)**
	• Alkene	**(1)**	Allow C=C / carbon-carbon double bond Ignore ene Ignore just "double bond"	
	• hex-1-ene, (*E/Z*,cis/trans)hex-2-ene, (*E/Z*,cis/trans)hex-3-ene	**(1)**	Allow hexene /1-hexene etc	

Question Number	Answer		Additional Guidance	Mark
1(b)	An answer that makes reference to the following points:			**(2)**
	• K^+ / potassium	**(1)**	Do not award K	
	• I^- / iodide	**(1)**	Do not award just I / iodine Allow one mark for just KI Ignore state symbols Ignore "iodine ion"	

Question Number	Answer		Additional Guidance	Mark
1(c)(i)	An answer that makes reference to the following points:			(2)
	• balanced ionic equation	(1)	$2I^-(aq) + Br_2(aq) \rightarrow I_2(aq) + 2Br^-(aq)$ Allow multiples Do not award uncancelled ions on both sides	
	• state symbols	(1)	Allow one mark for correct state symbols for an unbalanced / incorrect species equation	

Question Number	Answer		Additional Guidance	Mark
1(c)(ii)	An answer that makes reference to the following points:			(3)
	• two layers would form	(1)	This mark can be awarded from a description of colour changes of two layers.	
	• the organic / colourless layer would change to purple / violet (and then decolourises slowly)	(1)	Accept top layer would change to purple / violet Do not award pink	
	• the aqueous / red-brown layer would become colourless / fade / yellow	(1)	Accept bottom layer would become colourless / fade / yellow If no layers stated then allow one mark for decolorised In M2 and M3 Do not award precipitate formed/goes cloudy Do not award any gas/fumes given off /bubbles Penalise once only	

(Total for Question 1 = 9 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	An answer that makes reference to the following point: • reducing the heat loss	Allow reference to ensuring the flame is stable Allow ensuring more of the energy from the flame is transferred to the water Ignore just reducing/stopping draughts Ignore prevent heat loss	(1)

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	An answer that makes reference to the following point: 	Allow any recognisable flame Ignore lack of line Do not award oxidising symbol 	(1)

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	An answer that makes reference to the following points: • 7.3(ºC) **and** 0.32(g)		(1)

Question Number	Answer		Additional Guidance	Mark
2(b)(ii)			Example of calculation:	(3)
	• calculation of energy transferred to water	(1)	$Q = 150 \times 4.18 \times 7.3 \div 1000 = 4.5771$ (kJ) Allow 4577.1 (J)	
	• calculation of moles ethanol burned	(1)	$0.32 \div 46 = 0.0069565 / 6.9565 \times 10^{-3}$ (mol)	
	• calculation of enthalpy of combustion with negative sign **and** 2/3 SF	(1)	$4.5771 / 0.0069565 = -657.96$ $= -660 / -658$ (kJ mol^{-1}) Allow $-660\,000 / -658\,000$ J mol^{-1} Ignore SF except in final answer TE throughout Correct answer with no working scores 3 Do not award incorrect units in final answer only	

Question Number	Answer		Additional Guidance	Mark
2(b)(iii)	An explanation that makes reference to the following points:			(2)
	• some of the ethanol would be burned without heating the water / the mass of ethanol burned would be greater than expected	(1)	Ignore references to effect on ΔT Ignore just heat loss to the environment	
	• so final value for enthalpy change of combustion would be less exothermic / less negative	(1)	Allow lower / less / smaller M2 depends on M1 or near miss	

Question Number	Answer	Additional Guidance	Mark
2(b)(iv)	• calculation of percentage uncertainty	Example of calculation: $(2 \times 0.1 \div 7.3) \times 100 = 2.7397 / 2.740 / 2.74 / 2.7 / 3\ \%$ Ignore SF	(1)

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	An answer that makes reference to the following point: • increasing the temperature (change) / mass of ethanol burned (will improve / reduce the percentage uncertainty)		(1)

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	An explanation that makes reference to the following points: • uncertainty values indicate the range (over which the measured value is valid) **(1)** • accuracy is an indication of the difference between the experimental value and the data book value **(1)**	 Allow heat loss greater because the temperature is higher so the experiment will be less accurate	(2)

(Total for Question 2 = 12 marks)

Question Number	Answer		Additional Guidance	Mark
3(a)(i)	An answer that makes reference to the following points: • (pipette) lower / decrease	**(1)**	Ignore any explanations even if incorrect	**(2)**
	• (volumetric flask) no change / no effect	**(1)**		

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	An answer that makes reference to the following point: • to ensure that the solution has the same concentration throughout / is homogeneous	Accept to make sure that it is mixed (thoroughly) / uniform Ignore references to dissolving	**(1)**

Question Number	Answer		Additional Guidance	Mark
3(a)(iii)	An answer that makes reference to the following points: • (sodium hydroxide) solution is an irritant / harmful / damages eyes / skin	**(1)**	Do not award corrosive / caustic / toxic	**(2)**
	• (if filled above head height) the sodium hydroxide might splash into eyes / into face / onto arm	**(1)**	Allow reverse argument Do not award references to fumes / inhalation	

Question Number	Answer		Additional Guidance	Mark
3(a)(iv)	An answer that makes reference to the following points: • (from) colourless / no colour	**(1)**	Correct colours in reverse order scores 1	**(2)**
	• (to) (pale) pink	**(1)**	Do not award red / purple	

Question Number	Answer	Additional Guidance	Mark
3(a)(v)	• completion of titrations 2 and 3 **and** calculation of mean from four concordant values	Example of calculation: (Titrations 2 and 3 28.85 and 28.7(0)) $(28.75 + 28.85 + 28.70 + 28.90) \div 4 = 28.8(0)$ (cm^3)	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(a)(vi)	An answer that makes reference to the following point: • titrations 1 and 2 are concordant	Allow titrations 1 and 2 are within 0.2 cm^3 Allow there are already (two) concordant results Accept consistent for concordant	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(a)(vii)	An answer that makes reference to the following point: • otherwise the titres would be greater than the capacity of a burette/ so the titres would not be greater than the volume of the burette	Allow the titre would be too large for the burette / ten times bigger / very large / too much alkali required for an accurate titration	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	An answer that makes reference to the following points: • 3 **and** 3		**(1)**

Question Number	Answer		Additional Guidance	Mark
3(b)(ii)	• calculation of moles sodium hydroxide in titre	(1)	Example of calculation: $28.80 \times 0.267 \div 1000 = 7.6896 \times 10^{-3}$ / 0.0076896 (mol)	(5)
	• calculation of moles citric acid in 25 cm³ aliquot	(1)	$7.6896 \times 10^{-3} \div 3 = 2.5632 \times 10^{-3}$ / 0.0025632 (mol)	
	• calculation of concentration of citric acid in Solution B	(1)	$2.5632 \times 10^{-3} \div 25 \times 1000 = 0.10253$ (mol dm^{-3})	
	• calculation of concentration citric acid in Solution A	(1)	$0.10253 \times 250 \div 25 = 1.0253$ (mol dm^{-3})	
	• calculation of concentration of citric acid in g dm^{-3} **and** to 3SF	(1)	$1.0253 \times 192 = (196.86)$ $= 197$ (g dm^{-3}) Correct answer with no working scores 5. Ignore SF except 1 SF until final answer to 3 SF TE throughout and from (b)(i) Ignore units Steps can be done in any order	

Question Number	Answer		Additional Guidance	Mark
3(b)(iii)	An answer that makes reference to the following points: • there is no difference in effectiveness /effectiveness is (slightly) less	(1)	Allow answers based on TE from (ii). Answer must be comparative for M1 if the calculated value is much less/much more than the correct value	(2)

| | | • the measured concentration of the descaler was almost the same as / slightly less / only ~1.5% less than the stated concentration | (1) | If candidates have failed to ×10 then the measured concentration of the descaler is much less (so it would be much less effective) If candidates value is very high then concentration of descaler is much greater so might damage the appliance or be unsafe to use in the home. | |

(Total for Question 3 = 18 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)	An explanation that makes reference to the following points: • (in a dry test tube, add a small portion of) phosphorus(V) chloride / PCl_5 **(1)** • steamy/misty fumes (would be seen) **(1)**	**M2 dependent on M1 or near miss** Accept phosphorus pentachloride Ignore heating Ignore phosphorus chloride in M1 as a near miss Accept sodium Accept carboxylic acid (and H^+) **and** warm Do not award $PCl_5(aq)$ Do not award acidified potassium dichromate(VI) Allow white fumes Do not award smoke unless ammonia used to test fumes If sodium used accept effervescence / bubbles If carboxylic acid used accept fruity smell	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	An answer that makes reference to the following points: • orange **(1)** • (to) green **(1)**	 Allow blue	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	An answer that makes reference to the following point: • (2-)methylpropan-2-ol / $(CH_3)_3 COH$	 Accept skeletal / displayed formula Allow methly- / methy- / methylpropane-2-ol	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	An answer that makes reference to the following points: • formula of butan-2-ol **(1)** • formula of butanone **(1)** • formula of (2-)methylpropan-1-ol **(1)**	Accept displayed / skeletal / structural formulae Penalise use of names once only If **L** is incorrectly shown as butan-1-ol then allow 1 mark for butanal or butanoic acid as the oxidation product.	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(b)(iv)	An answer that makes reference to the following points: • add Fehling's or Benedict's solution (and warm) **(1)** • no reaction with (oxidation product) of L **(1)** • (brick) red ppt with (oxidation product) of M **(1)** OR • add Tollen's reagent/ammoniacal silver nitrate solution (and warm) **(1)** • no reaction with (oxidation product) of L **(1)** • silver mirror / black ppt with (oxidation product) of M **(1)** OR • add acidified sodium/potassium dichromate solution **(1)** • no reaction with (oxidation product) of L **(1)** • (orange to) green (solution) with (oxidation product) of M **(1)** OR • add iodine solution **and** aqueous sodium hydroxide **(1)** • (pale) yellow precipitate with (oxidation product) of L **(1)** • no reaction with (oxidation product) of M **(1)**	**M2 and M3 are dependent on M1 or near miss** No other tests than these four should be accepted. If L oxidation product is an aldehyde or missing, M2 is not awarded Allow orange If L oxidation product is an aldehyde or missing, M2 is not awarded If L oxidation product is an aldehyde or missing, M2 is not awarded Allow antiseptic smell If L oxidation product is an aldehyde or carboxylic acid or missing, M2 is not awarded	**(3)**

(Total for Question 4 = 11 marks)
(Total for Paper = 50 marks)