

Mark Scheme (Results)

October 2020

Pearson Edexcel International Advanced Subsidiary Level
In Chemistry (WCH13)
Paper 1: 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)	An answer that makes reference to the following points: • nitrogen dioxide / NO_2 / nitrogen(IV) oxide (1) • oxygen / O_2 (1)	Allow N_2O_4 / dinitrogen tetroxide Do not award O If name and formula are given both must be correct Ignore reference to observations, even if incorrect	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	• nitrate / NO_3^- / nitrate(V)	Do not award nitrate(III) or nitrite If name and formula are given both must be correct	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)	• barium (ion) /Ba^{2+}	Do not award Ba / Ba^+ If name and formula given both must be correct	(1)

Question Number	Answer	Additional Guidance	Mark
1(d)	An answer that makes reference to the following points: • (Solid **A**) $Ba(NO_3)_2$ **(1)** • BaO **(1)**	TE for both marks on 1(c) for incorrect group 2 / group 1 cation If only names given penalise once only Ignore state symbols, even if incorrect	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(e)	An answer that makes reference to the following points: (Sodium hydroxide) • no change / no reaction / colourless solution **(1)** (Sulfuric acid) • white **and** precipitate **(1)**	TE for both marks on 1(c) for incorrect group 2 / group 1 cation Allow (white) precipitate does not form Ignore nothing / no observation Ignore just colourless / remains clear Ignore solid dissolves Do not award white solution Do not award effervescence / gas evolved Allow ppt(e)/solid/crystals for precipitate Ignore name or formula of precipitate Do not award effervescence / gas evolved	**(2)**

(Total for Question 1 = 8 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)	An answer that makes reference to the following points: • **B** is silver nitrate (solution) / $AgNO_3$ • **C** is hydrochloric acid / HCl • **D** is potassium carbonate (solution) / K_2CO_3 • **E** is sodium chloride (solution) / NaCl	Penalise incorrect formulae once only Any 1 correct = 1 mark Any 2 or 3 correct = 2 marks 4 correct = 3 marks	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(b)	An answer that makes reference to the following points: Step **1** Improvement (**M1**) • use (conc.) hydrochloric acid **(1)** Explanation (**M2 – dependent on M1**) • (metal) chlorides are more volatile **(1)** **or** Improvement (**M1**) • dip wire in (conc.) hydrochloric acid and place in flame **(1)** Explanation (**M2 – dependent on dipping wire in acid and placing in flame)** • to clean the wire / remove traces of previous sample(s) (that might interfere with the result) **(1)** Step **2** Improvement (**M3**) • use nichrome (wire/loop) / platinum (wire/loop) Explanation (**M4 – dependent on use of a different wire**) **(1)** • copper produces a (blue-green) flame colour (so interferes with the result) **(1)**	Ignore reference to use of powder/solid Ignore just chlorides give better result Ignore reference to acid strength Ignore nitric acid is oxidising/hazards of nitric acid Ignore reference to NO_2 (eg toxic/brown) Do not award Cl^-/chloride ions / HCl more volatile Do not award (metal) chlorides are more soluble Ignore dip wire in acid then solid (improvement) …to put more sample on wire (explanation) Allow NiCr / Pt Do not award nickel/Ni or chromium/Cr Allow copper will react with nitric acid Allow copper will melt Ignore copper reacts with flame/burns/oxidises Allow nichrome/platinum would not produce a flame colour / are inert/unreactive/do not react Ignore nichrome/platinum less reactive than copper	**(6)**

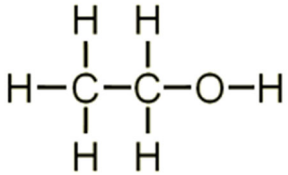
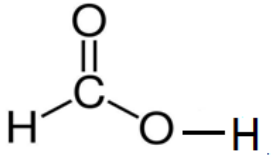
	Step **3** Improvement (**M5**) • use the Bunsen burner with the air-hole (fully) open Explanation (**M6 – dependent on M5**) • so flame colour is easier to see (with non-luminous Bunsen flame) / flame is hotter or • flame colour is more difficult to see (with luminous Bunsen flame when air-hole closed) / flame is too cool / not hot enough	**(1)** **(1)**	Allow half-open / should not be closed Allow Bunsen with non-luminous flame Ignore colour change for flame colour Ignore reference to combustion Ignore colour change for flame colour	

(Total for Question 2 = 9 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	• hydrogen chloride/HCl((g))/hydrochloric acid/HCl(aq)	If name and formula are given both must be correct	(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	• carbon dioxide / CO_2	If name and formula are given both must be correct	(1)

Question Number	Answer		Additional Guidance	Mark
3(a)(iii)	• F = alcohol	(1)	Allow hydroxyl / hydroxy Ignore any reference to primary/secondary/tertiary Do not award hydroxide / OH^-	(2)
	• G = carboxylic acid	(1)	Allow carboxylic/carboxyl/carboxy Ignore just acid Ignore hydroxy and carbonyl Do not award carboxic/carbonic	
			Award one mark for both F = (–)OH and G = (–)COOH / (–)CO_2H Award one mark for correct answers reversed	

Question Number	Answer	Additional Guidance	Mark
3(a)(iv)	 (1)  (1)	Ignore bond angles and connectivity of OH group unless horizontal C-HO Allow non-displayed OH Allow non-displayed OH Award 1 mark for two correct skeletal/structural formulae Ignore molecular formulae	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(v)	An answer that makes reference to the following points: • Yes **and** **F**/alcohol would not have a (peak due to) C=O **or** **G**/(carboxylic) acid would have a (peak due to) C=O	Allow TE on any alcohol and carboxylic acid in (a)(iv) Allow yes **and** O−H (peak) values are different in **F**/alcohol and **G**/(carboxylic) acid Allow OH / –OH / –O–H for O−H Do not award C–OH for O−H Allow Yes **and** fingerprint region would be different Ignore just different functional groups give different peaks Ignore just G has an extra peak	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)	An answer that makes reference to the following points: (bromine water) • from brown / orange / yellow **(1)** • to colourless **(1)** (Benedict's / Fehling's reagent) • from blue **(1)** • to red / brick red **and** solid / precipitate **(1)**	Ignore any reference to miscibility / layers Do not award red Allow decolourises Ignore clear Do not award effervescence / gas evolved Allow ppt(e) Allow red-brown for red Do not award brown/orange/pink for red	**(4)**

(Total for Question 3 = 11 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	• To make sure that all the (hydrochloric) acid / HCl((aq)) has been used up	Accept completely neutralised/reacted for used up Ignore 'to ensure the reaction goes to completion' Ignore reference to excess/limiting reagents Ignore reference to temperature change	(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	An answer that makes reference to the following points: • maximum temperature of the mixture: 27.5 **and** temperature change: 6(.0)	 Allow 27.6 Allow 6.1 (for maximum temperature of 27.6)	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that makes reference to the following points: • Calculation of energy change **(1)** • Calculation of the moles of HCl **(1)** • Calculation of enthalpy change **(1)** • Negative sign and units **(1)**	Example of calculation Ignore SF except 1SF throughout 55 × 6(.0) × 4.2 = 1386(J) / 1.386 (kJ) TE on temperature change from (a)(ii) 25 × 1.0 ÷ 1000 = 2.5×10^{-2} / 0.025 (moles) Allow 1/40 1386 ÷ 0.025 = 55440 (J mol^{-1}) TE on energy change TE on moles HCl Must follow a calculation where an energy change has been divided by an amount −55440 J $mol^{-(1)}$/ −55.440 kJ $mol^{-(1)}$ Do not award J/$mol^{-(1)}$ or kJ/$mol^{-(1)}$	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(c)	An answer that makes reference to the following points: • less exothermic **(1)** • glass is a better conductor (of heat) **or** polystyrene is a better insulator (of heat) **(1)**	Allow less negative Ignore higher/greater/lower/smaller value Allow glass is a worse insulator Allow glass is a good conductor Ignore reference to heat loss Allow polystyrene is a good insulator Allow glass beaker has a higher heat capacity (than polystyrene cup) Allow glass beaker absorbs more heat/energy (than polystyrene cup)	**(2)**

(Total for Question 4 = 8 marks)

Question Number	Answer	Additional Guidance	Mark
5(a)	• pipette (and filler)	Do not award teat pipette/burette	(1)

Question Number	Answer	Additional Guidance	Mark
5(b)	• (from) yellow **(1)** • to orange **(1)**	Allow peach for orange Do not award pink or red Award one mark for correct colours reversed	(2)

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	<table><tr><td>1</td><td>2</td><td>3</td></tr><tr><td>25.25</td><td>25.0(0)</td><td>24.8(0)</td></tr></table>	All 3 values correct Do not award 25 for titration number 2	(1)

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	• (titres 2 and 3 chosen) = 24.9(0) (cm^3)	Do not award 25.02 (cm^3) for mean of all three titres	(1)

Question Number	Answer	Additional Guidance	Mark
5(c)(iii)	• moles of hydrochloric acid in the titration	Example of calculation 24.90 x 0.10 ÷ 1000 = 2.49 x 10^{-3} / 0.00249 (mol) TE on 5(c)(ii) Ignore SF except 1SF	(1)

Question Number	Answer		Additional Guidance	Mark
5(c)(iv)	• moles of M_2CO_3 in 25 cm^3 of solution	(1)	Example of calculation 2.49 × 10^{-3} ÷ 2 = 1.245 × 10^{-3} / 0.001245 (mol) TE on 5(c)(iii)	(2)
	• moles of M_2CO_3 in 250 cm^3 of solution	(1)	1.245 × 10^{-3} × 10 = 1.245 × 10^{-2} / 0.01245 (mol) TE on M1 Ignore SF except 1SF	

Question Number	Answer	Additional Guidance	Mark
5(c)(v)	• molar mass of $M_2CO_3.10H_2O$	Example of calculation 3.56 ÷ 1.245 x 10^{-2} = 285.9 / 286 (g $mol^{-(1)}$) TE on 5(c)(iv) Allow g for g $mol^{-(1)}$ Ignore SF except 1SF	(1)

Question Number	Answer		Additional Guidance	Mark
5(c)(vi)	• subtraction of mass of CO_3 and $10H_2O$ from molar mass	(1)	Example of calculation 286 – 180 – 48 – 12 (= 46) TE on 5(c)(v)	(2)
	• identification of metal, M	(1)	Dependent on M1 (or attempt at subtraction of carbonate and water) = 46 ÷ 2 = 23 (g $mol^{-(1)}$) and Na Allow g for g $mol^{-(1)}$ Just Na with no working scores 0 Metal must be identified as the Group 1 element with molar mass closest to the calculated value	

Question Number	Answer	Additional Guidance	Mark
5(d)	A description that makes reference to the following points: • evaporate/heat **and** to crystallisation/saturation (point) **(1)** • leave to (stand and) crystallise / cool **(1)** • (decant the supernatant liquid and) dry crystals between filter paper **(1)**	Penalise use of indicator once only Penalise use of drying agent in M1 and M3 once only Ignore reference to filtration throughout Allow evaporate some/half/most of the water Allow heat until solid starts to form Allow heat to concentrate the solution Do not award evaporate to dryness Do not award heat to constant mass Do not award remove some water with drying agent Allow dry between tissue / in a desiccator/oven Ignore reference to washing of crystals prior to drying Do not award dry crystals with drying agent	**(3)**

(Total for Question 5 = 14 marks)

TOTAL FOR PAPER = 50 MARKS

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