



Mark Scheme (Results)

Summer 2022

Pearson Edexcel International Advanced
Level in Chemistry (WCH16)
Paper 01: Practical Skills in Chemistry II

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	<p>An answer that makes reference to the following points:</p> <p>copper(II) chloride / CuCl₂ (2)</p>	<p>copper(II) / Cu²⁺ with incorrect anion scores 1</p> <p>chloride / Cl⁻ with incorrect cation scores 1</p> <p>copper chloride or CuCl scores one mark</p> <p>If name and formula are stated they must both be correct</p>	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	<p>An answer that makes reference to the following points:</p> <p>Either</p> <ul style="list-style-type: none"> add dilute /aqueous ammonia (solution)/NH₃(aq) (1) precipitate dissolves/disappears/forms a colourless solution/soluble (1) <p>Or</p> <ul style="list-style-type: none"> add concentrated sulfuric acid (1) misty / steamy / white fumes (1) 	<p>Ignore add concentrated ammonia/just NH₃</p> <p>M2 depends on addition of ammonia(dil/conc)</p> <p>Ignore just sulfuric acid/H₂SO₄</p> <p>M2 depends on addition of sulfuric acid</p> <p>Do not award white smoke (unless tested with ammonia)</p>	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	An answer that makes reference to the following point: <ul style="list-style-type: none"> ammonia (gas) / $\text{NH}_3(\text{g})$ 	Do not award NH_4^+	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	An answer that makes reference to the following points: <ul style="list-style-type: none"> identification of cation (1) identification of anion (1) 	Accept cation/anion in any order NH_4^+ $\text{Cr}_2\text{O}_7^{2-}$ Ignore CrO_4^{2-} Allow $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ scores (2) $\text{NH}_4\text{Cr}_2\text{O}_7$ scores (1) Allow ammonium dichromate((VI)) scores (1)	(2)

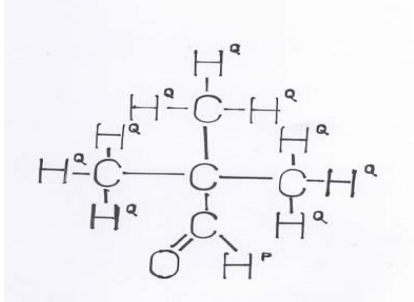
(Total for Question 1 = 7 marks)

Question Number	Answer				Additional Guidance	Mark
2(a)(i)	An answer that makes reference to the following points:				Allow: no (observable) change/no ppt/remains the same for no reaction Any recognisable spelling of precipitate Penalise just no result/no observation/none/nothing once only 2/3 correct scores 1 4/5 correct scores 2 6 correct scores 3	(3)
		2,4-DNPH	Fehling's/Benedicts	I ₂ /NaOH		
	C		no reaction solution (stays)blue	(pale) yellow ppt / antiseptic smell	(1)	
	D	no reaction/ solution(remains)orange/yellow	no reaction/ remains blue		(1)	
	E		(brick)red ppt/solid	no reaction remains colourless (unless ethanal)	(1)	

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	An answer that makes reference to the following point: <ul style="list-style-type: none"> iodoform / triiodomethane / CHI₃ 	ACCEPT HClI ₃ , ClI ₃ H Do not award CH ₃ I, ClI ₃ , iodomethane If name and formula are given, both must be correct	(1)

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	<p>A description that makes reference to the following points:</p> <ul style="list-style-type: none"> dissolve the solid/ppt in the minimum amount of warm/hot solvent/to produce a saturated solution (1) filter (hot) solution and cool/leave (so that crystals/solids form/crystallise) (1) filter the crystals (under reduced pressure) and wash (with cold solvent) (1) dry crystals using filter paper / oven / desiccator (1) 	<p>Marks are independent Allow references to named solvents e.g. ethanol, water</p> <p>Allow addition of solvent to solid and warm/heat</p> <p>Allow hot filter funnel or reduced pressure In M1 and M2 “hot/warm” must be mentioned once Do not award heat/evaporate solvent</p> <p>Allow: dry in a warm place Do not award heat/evaporate solvent unless M2 already lost for similar mistake Do not award use of drying agent except in a desiccator</p> <p>Ignore explanations of each step</p>	(4)

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	<p>An explanation that makes reference to two of the following points:</p> <ul style="list-style-type: none"> identifies C is pentan-2-one (1) correct reason linked to information and data in Tables 1 and/or 2 (1) <p>M2 depends on M1</p>	<p>Examples of reasons:</p> <ul style="list-style-type: none"> it must have a COCH₃ group/positive iodoform (it cannot be 2-ethylbutanal/3-methyl butanal) because the measured melting temperature shouldn't be above the actual melting temperature/it must be a ketone/cannot be an alkanal it must be a non-cyclic ketone the(measured) melting temperature is closest ketone to the (actual) melting temperature 	(2)

Question Number	Answer	Additional Guidance	Mark
2(c)	<p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> correct formula for 2,2 dimethyl propanal (1) proton environments clearly labelled (1) <p>M2 dependent on correct M1</p>	 <p>M1 Allow -CH₃ but not COH/CHO M2 Allow proton environments for Q protons shown on methyl groups Do not award proton environment for P protons on C or O of aldehyde group</p>	(2)

(Total for Question 2 = 12 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	<p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> (concentrated) nitric acid is corrosive and wear/use gloves nitrogen (di)oxide/NO₂ (gas) is toxic/corrosive and carry out experiment in a fume cupboard 	<p>Ignore irritant/harmful Do not award any other reagent e.g. sodium thiosulfate, iodine, brass</p> <p>Allow burns/blisters skin</p> <p>(1) Ignore toxic Ignore avoid skin contact Do not award nitric acid is flammable</p> <p>(1) Allow well ventilated room Ignore reference to flames/bunsens/gas mask/face mask</p>	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	<ul style="list-style-type: none"> green solution formed (reddish/yellow) brown fumes formed 	<p>(1) Allow any shade of green/blue solution formed Ignore metal would dissolve</p> <p>(1) Ignore just effervescence</p>	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(iii)	<p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> to prevent too much effervescence/fizzing / the reaction mixture spilling over /CO₂ being formed too quickly 	<p>Allow the reaction is vigorous/ to slow down the reaction</p> <p>Ignore exothermic (reaction)/water might boil/ splashing not linked to gas given off Do not award to stop the reaction</p>	(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(iv)	<p>A description that makes reference to three of the following points:</p> <ul style="list-style-type: none"> (transfer contents of beaker to) and washings to a volumetric flask (1) make up to the mark with (distilled/deionised) water (1) shake / mix (1) 	<p>If beaker/measuring cylinder used penalise in M1 only If incorrect solvent e.g. ethanol/ethanoic acid used penalise in M2 only</p> <p>Allow standard / graduated flask</p> <p>Allow any indication of mixing e.g. inverting/swirling</p>	(3)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	<ul style="list-style-type: none"> adding electrode potentials (1) cell potential is negative/<0 (so not feasible) (1) 	<p>Example of calculation</p> $E_{\text{cell}} = +0.15 - 0.54 = -0.39(\text{V})$ <p>Incorrect negative E_{cell} value can score M2</p>	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	<ul style="list-style-type: none"> the copper (I) iodide/Cu^+ precipitates / is removed from the equilibrium / the concentration of copper(I) in solution is very low (1) the equilibrium position moves to the right-hand side (1) 	<p>Accept the actual electrode potential (for $\text{Cu}^{2+}/\text{Cu}^+$) is higher/more positive than the standard electrode potential</p> <p>Ignore reference to activation energy / rate of reaction/non-standard temperature/pressure</p> <p>Allow 1 mark for concentrations are non-standard</p> <p>If value in (i) for E_{cell} is positive then allow 1 mark in (ii) for reference to a spontaneous reaction for a positive E_{cell}</p>	(2)

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	<ul style="list-style-type: none"> an (insoluble) complex/solid will be formed 	Allow iodine binds to the starch and makes the end point more difficult to see	(1)

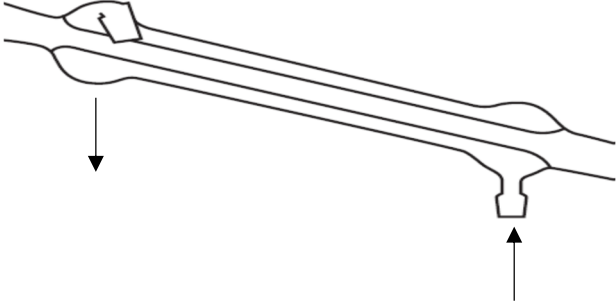
Question Number	Answer	Additional Guidance	Mark
3(c)(ii)	<ul style="list-style-type: none"> blue-black to colourless (at the end point) 	Allow blue or black Ignore clear	(1)

Question Number	Answer	Additional Guidance	Mark
3(c)(iii)	<ul style="list-style-type: none"> calculation of titre and mean of concordant results 	Example of calculation (27.05;26.65) 26.45 $(26.65 + 26.45) \div 2 = 26.55(\text{cm}^3)$	(1)

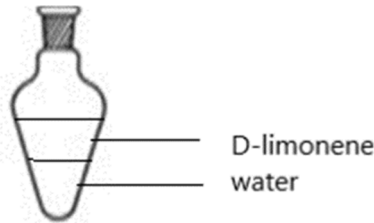
Question Number	Answer	Additional Guidance	Mark
3(c)(iv)	<ul style="list-style-type: none"> calculation of moles thiosulfate in titre calculation of mass of copper in 25cm³ as stoichiometry of Cu: thiosulfate is 1:1 calculation of % of copper by mass in sample 	<p>Example of calculation</p> <p>(1) $\frac{26.55}{1000} \times 0.095 = 2.52225 \times 10^{-3} / 0.00252225 \text{ (mol)}$ TE on (c)(iii)</p> <p>(1) $2.52(225) \times 10^{-3} \times 63.5 = 0.160163 \text{ (g)}$</p> <p>(1) $\frac{0.160163}{2.53} \times 10 \times 100 = 63.305 / 63.31 / 63.3 / 63 \%$ TE on M2 unless greater than 100 % Ignore SF except 1 SF Correct answer with some working scores (3)</p>	(3)

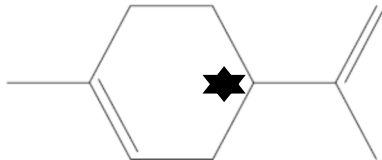
Question Number	Answer	Additional Guidance	Mark
3(c)(v)	<p>An explanation that makes reference to two of the following points:</p> <ul style="list-style-type: none"> because more iodine will be produced more thiosulfate will be needed (so the titre will be greater) and the percentage of copper will be greater 		(2)

(Total for Question 3 = 20 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	<p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> arrows/labels showing water going in at the bottom and out at the top 	 <p>Allow single arrow on condenser going from right to left</p>	(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	<p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> limonene is degraded / decomposed / broken down by high temperatures 	(Limonene) distils at a lower temperature than its boiling temperature.	(1)

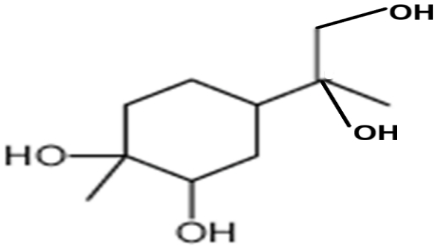
Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	<ul style="list-style-type: none"> a diagram of a (pear-shaped) flask containing two layers with (D-)limonene being labelled the upper layer 		(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	<ul style="list-style-type: none"> identification of the correct chiral carbon 	 <p>Allow any indication of chiral carbon</p>	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	<p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none"> polarimeter/ two polarised filters (1) rotates the plane of plane-polarised light (1) 	<p>Allow polariser(s)</p> <p>Allow rotates plane-polarised light</p> <p>Ignore angles of rotation</p> <p>Do not award rotation of the molecule</p>	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	<ul style="list-style-type: none"> calculation of mass of limonene calculation of molar mass of limonene calculation of moles of limonene 	<p>Example of calculation</p> <p>$1.2 \times 0.851 = 1.0212 \text{ (g)}$ Accept $0.851 \div 1.20 = 0.70916666 \text{ (g)}$</p> <p>$10 \times 12 + 16 = 136$</p> <p>$1.0212 / 136 = 7.5088 \times 10^{-3} / 0.0075088 \text{ (mol)}$ $= 7.5 \times 10^{-3} \text{ (mol)}$ TE from “Accept” $0.70917 / 136 = 5.21446 \times 10^{-3} / 0.0052145 \text{ (mol)}$ $5.2145 \times 10^{-3} \text{ (mol)}$</p> <p>Both answers score all three marks with some working TE from incorrect mass, molar mass and density Ignore SF</p>	(3)

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	<p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> purple to colourless 	<p>Allow pink to colourless Allow purple to pink because in part (ii) excess is being used Do not award violet</p>	(1)

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	<p>An answer that makes reference to the following point:</p> <ul style="list-style-type: none"> both double bonds replaced by two OH groups 	 <p>Allow drawn structures with one or both C=C double bonds broken Ignore bond angles/lengths/connectivity of -OH</p>	(1)

(Total for Question 4 = 11 marks)

TOTAL FOR PAPER = 50 MARKS