



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)	An answer that makes reference to the following points: copper(II) chloride / CuCl₂ (2)	copper(II) / Cu²⁺ with incorrect anion scores 1 chloride / Cl⁻ with incorrect cation scores 1 copper chloride or CuCl scores one mark If name and formula are stated they must both be correct	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	An answer that makes reference to the following points: Either - add dilute /aqueous ammonia (solution)/NH₃(aq) (1) - precipitate dissolves/disappears/forms a colourless solution/soluble (1) Or - add concentrated sulfuric acid (1) - misty / steamy / white fumes (1)	Ignore add concentrated ammonia/just NH₃ M2 depends on addition of ammonia(dil/conc) Ignore just sulfuric acid/H₂SO₄ M2 depends on addition of sulfuric acid Do not award white smoke (unless tested with ammonia)	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	An answer that makes reference to the following point: 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: - identification of cation - identification of anion	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)

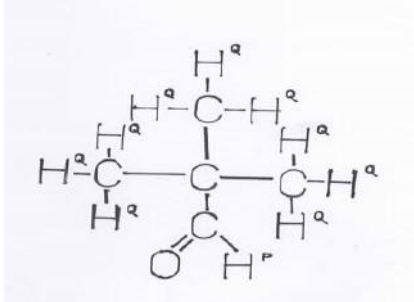
(Total for Question 1 = 7 marks)

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: 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)	A description that makes reference to the following points: - 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)	Marks are independent Allow references to named solvents e.g. ethanol, water Allow addition of solvent to solid and warm/heat Allow hot filter funnel or reduced pressure In M1 and M2 “hot/warm” must be mentioned once Do not award heat/evaporate solvent 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 Ignore explanations of each step	(4)

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	An explanation that makes reference to two of the following points: - identifies C is pentan-2-one (1) - correct reason linked to information and data in Tables 1 and/or 2 (1) M2 depends on M1	Examples of reasons: - 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)	An answer that makes reference to the following points: - correct formula for 2,2 dimethyl propanal (1) - proton environments clearly labelled (1) M2 dependent on correct M1	 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	(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: (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	Ignore irritant/harmful Do not award any other reagent e.g. sodium thiosulfate, iodine, brass Allow burns/blisters skin (1) Ignore toxic Ignore avoid skin contact Do not award nitric acid is flammable (1) Allow well ventilated room Ignore reference to flames/bunsens/gas mask/face mask	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	- green solution formed (reddish/yellow) brown fumes formed	(1) Allow any shade of green/blue solution formed Ignore metal would dissolve (1) Ignore just effervescence	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(iii)	An answer that makes reference to the following point: to prevent too much effervescence/fizzing / the reaction mixture spilling over /CO₂ being formed too quickly	Allow the reaction is vigorous/ to slow down the reaction Ignore exothermic (reaction)/water might boil/ splashing not linked to gas given off Do not award to stop the reaction	(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(iv)	A description that makes reference to three of the following points: (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)	If beaker/measuring cylinder used penalise in M1 only If incorrect solvent e.g. ethanol/ethanoic acid used penalise in M2 only Allow standard / graduated flask Allow any indication of mixing e.g. inverting/swirling	(3)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	- adding electrode potentials (1) - cell potential is negative/<0 (so not feasible) (1)	Example of calculation $E_{\text{cell}} = +0.15 - 0.54 = -0.39(\text{V})$ Incorrect negative E_{cell} value can score M2	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	- 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)	Accept the actual electrode potential (for $\text{Cu}^{2+}/\text{Cu}^+$) is higher/more positive than the standard electrode potential Ignore reference to activation energy / rate of reaction/non-standard temperature/pressure Allow 1 mark for concentrations are non-standard 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}	(2)

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	an (insoluble) complex/solid will be formed	Allow iodine binds to the starch and makes the end point more difficult to see	(1)

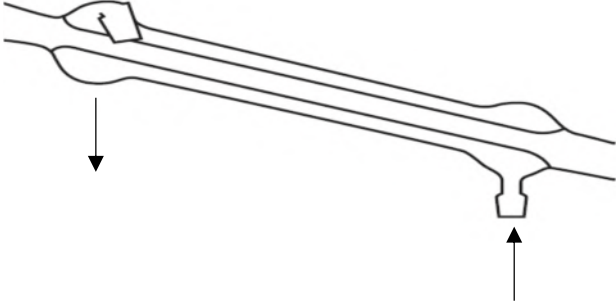
Question Number	Answer	Additional Guidance	Mark
3(c)(ii)	blue-black to colourless (at the end point)	Allow blue or black Ignore clear	(1)

Question Number	Answer	Additional Guidance	Mark
3(c)(iii)	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)

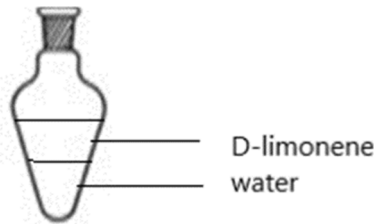
Question Number	Answer	Additional Guidance	Mark
3(c)(iv)	- calculation of moles thiosulfate in titre - calculation of mass of copper in 25cm³ as stoichiometry of Cu: thiosulfate is 1:1 - calculation of % of copper by mass in sample	Example of calculation (1) $\frac{26.55}{1000} \times 0.095 = 2.52225 \times 10^{-3} / 0.00252225 \text{ (mol)}$ TE on (c)(iii) (1) $2.52(225) \times 10^{-3} \times 63.5 = 0.160163 \text{ (g)}$ (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)	(3)

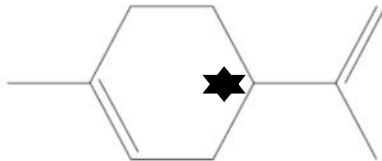
Question Number	Answer	Additional Guidance	Mark
3(c)(v)	An explanation that makes reference to two of the following points: - because more iodine will be produced - more thiosulfate will be needed (so the titre will be greater) and the percentage of copper will be greater		(2)

(Total for Question 3 = 20 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	An answer that makes reference to the following point: arrows/labels showing water going in at the bottom and out at the top	 Allow single arrow on condenser going from right to left	(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	An answer that makes reference to the following point: limonene is degraded / decomposed / broken down by high temperatures	(Limonene) distils at a lower temperature than its boiling temperature.	(1)

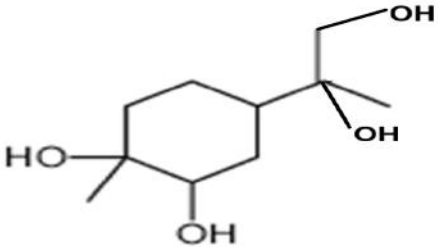
Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	a diagram of a (pear-shaped) flask containing two layers with (D-)limonene being labelled the upper layer		(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	identification of the correct chiral carbon	 Allow any indication of chiral carbon	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	An answer that makes reference to the following points: - polarimeter/ two polarised filters (1) - rotates the plane of plane-polarised light (1)	Allow polariser(s) Allow rotates plane-polarised light Ignore angles of rotation Do not award rotation of the molecule	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	- calculation of mass of limonene - calculation of molar mass of limonene - calculation of moles of limonene	Example of calculation $1.2 \times 0.851 = 1.0212 \text{ (g)}$ Accept $0.851 \div 1.20 = 0.70916666 \text{ (g)}$ $10 \times 12 + 16 = 136$ $1.0212 / 136 = 7.5088 \times 10^{-3} / 0.0075088 \text{ (mol)}$ $= 7.5 \times 10^{-3} \text{ (mol)}$ TE from “Accept” $0.70917 / 136 = 5.21446 \times 10^{-3} / 0.0052145 \text{ (mol)}$ $5.2145 \times 10^{-3} \text{ (mol)}$ Both answers score all three marks with some working TE from incorrect mass, molar mass and density Ignore SF	(3)

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	An answer that makes reference to the following point: purple to colourless	Allow pink to colourless Allow purple to pink because in part (ii) excess is being used Do not award violet	(1)

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	An answer that makes reference to the following point: both double bonds replaced by two OH groups	 Allow drawn structures with one or both C=C double bonds broken Ignore bond angles/lengths/connectivity of -OH	(1)

(Total for Question 4 = 11 marks)

TOTAL FOR PAPER = 50 MARKS