



Mark Scheme (Results)

Summer 2023

Pearson Edexcel International Advanced
Subsidiary Level In Chemistry (WCH16)

Paper 01

Unit 6: Practical Skills in Chemistry II

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	An answer that makes reference to the following point: green precipitate	Allow solid / crystals for precipitate Allow pp _{te} / ppt	(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	An answer that makes reference to the following point: precipitate dissolves / forms a (green) solution	Allow solid / crystals for precipitate Allow pp _{te} / ppt Allow TE of colour from a(i) Ignore colour of precipitate / solid	(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	An answer that makes reference to the following point: Cl⁻	Allow Cl ⁻¹ , Cl ¹⁻ Ignore chloride	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	An explanation that makes reference to the following points: - the nitric acid removes interfering anions / negative ions (1) - naming of any interfering anions or chromium(III) carbonate is not soluble so would not produce a green solution (hence is not present) (1)	Allow to remove / dissolve / destroy anions Anions such as carbonate (CO_3^{2-})/hydrogencarbonate (HCO_3^-) Allow chromium(III) ions are already acidic (and so acid is not required) Ignore hydroxide (OH^-)	(2)

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	An explanation that makes reference to the following points: (precipitate) turns brown (1) (due to formation of) Fe^{3+} / iron(III) (1)	Ignore orange Allow correct formula / complex formula	(2)

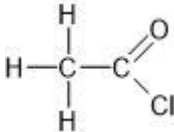
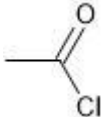
Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	A description that makes reference to the following points: • add barium ions / barium chloride (BaCl_2) / barium nitrate ($\text{Ba}(\text{NO}_3)_2$) (solution) (1) • the formation of a white precipitate (confirms sulfate ions) (1)	M2 is dependent on M1 or near miss (eg $\text{Ba}^+(\text{aq})$) Ignore addition of HCl / HNO_3 Do not award sulfuric acid is added (0 overall) Allow solid / crystals / pppte / ppt (barium sulfate) for precipitate	(2)

Question Number	Answer	Additional Guidance	Mark
1(d)	An answer that makes reference to the following point: • Ni^{2+} OR • V^{3+}	Charge or oxidation number is required. nickel(II) / nickel^{2+} V(III) / vanadium^{3+} Do not award $\text{Ni}(\text{NO}_3)_2$	(1)

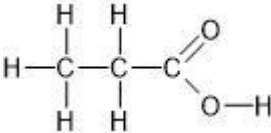
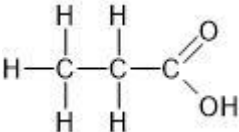
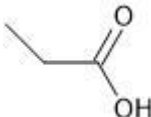
(Total for Question 1 = 10 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	An explanation that makes reference to the following points: (functional group) - acyl chloride / COCl / $-\text{COCl}$ (justification) (because it is hydrolysed by water to give misty fumes of) hydrogen chloride - which produces (a white smoke of) ammonium chloride/ NH_4Cl (when in contact with ammonia)	Penalise mix up of white smoke/misty fumes or combination of these words once only (1) Allow acid chloride / RCOCl Ignore -anoyl chloride Do not award $-\text{COCl}-$ / $^+\text{COCl}$ / $\text{O}-\text{C}-\text{Cl}$ (1) Allow hydrochloric acid Do not award white smoke is HCl (1) Do not award misty fumes are NH_4Cl	(3)

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	An answer that makes reference to the following point: use a fume cupboard / fume hood	Ignore well-ventilated lab Ignore mask	(1)

Question Number	Answer	Additional Guidance	Mark
2(b)	An answer that makes reference to the following point: 	Note if two formulae given both must be correct Allow skeletal / structural / or any combination thereof Allow CH₃COCl Allow  Do not award molecular formula	(1)

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	An answer that makes reference to the following point: suitable ion structure	Accept skeletal / displayed / or any combination thereof COOH⁺ / CO₂H⁺ Ignore position of charge Do not award -COOH⁺ / COOH	(1)

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	An answer that makes reference to the following point: $\text{C}_2\text{H}_5\text{COOH}$ / $\text{CH}_3\text{CH}_2\text{COOH}$	Allow $\text{C}_2\text{H}_5\text{CO}_2\text{H}$ / $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$ Allow skeletal / displayed Allow  Allow  Allow  Ignore vertical connectivity to OH group Do not award C-HO	(1)

Question Number	Answer	Additional Guidance	Mark
2(d)(i)	An answer that makes reference to the following point: ethanol	Allow ethyl alcohol / ethan-1-ol Ignore $\text{C}_2\text{H}_5\text{OH}$ / $\text{CH}_3\text{CH}_2\text{OH}$ Ignore just alcohol	(1)

Question Number	Answer	Additional Guidance	Mark
2(d)(ii)	An answer that makes reference to the following points: - the smell of the acid masks the smell of the ester (1) - sodium hydrogencarbonate neutralises the acid (removing the smell) (1)	Mark independently Allow (esters/sample have a) sweet or fruity smell/odour/aroma Accept 'removes' or 'reacts with' for neutralises. Accept allows ester to float (on aqueous layer) Ignore quench or stop the reaction between X and an alcohol Ignore NaHCO_3 reacts with ester	(2)

Question Number	Answer	Additional Guidance	Mark
2(e)	An answer that makes reference to the following points: (Product with X) CH_3CONH_2 / ethanamide (1) (Product with Y) $\text{C}_2\text{H}_5\text{COONH}_4$ / ammonium propanoate (1)	Allow displayed / skeletal / structural or combination thereof Allow ethyl amide Ignore + NH_4Cl or + HCl Accept inclusion of charges $\text{C}_2\text{H}_5\text{COO}^-\text{NH}_4^+$ Ignore + H_2O	(2)

(Total for Question 2 = 12 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)	An answer that makes reference to the following point: only the iodine concentration affects the rate OR so the concentrations of sulfuric acid and propanone do not affect the rate	Allow so only the iodine concentration changes (significantly) Allow $[H^+]$ and $[CH_3COCH_3]$ do not change (significantly) / (effectively) zero order (wrt $[H^+]$ and $[CH_3COCH_3]$) Ignore just concentrations of H_2SO_4 and CH_3COCH_3 are in excess Ignore comments on limiting reagents	(1)

Question Number	Answer	Additional Guidance	Mark
3(b)	An answer that makes reference to the following point: to stop / quench the reaction	Allow neutralise/remove the (sulfuric) acid/H^+ (catalyst) Ignore slow the reaction Do not award to remove OH^-	(1)

Question Number	Answer	Additional Guidance	Mark
3(c)	An answer that makes reference to the following points: (indicator) starch (solution) (1) (colour change) blue-black/(dark)blue/black to colourless (1)	M2 is dependent on M1 Ignore colour before addition of starch	(2)

Question Number	Answer	Additional Guidance	Mark
3(d)(i)	- axes labelled correctly with units and suitable scale - all points plotted correctly - best fit straight line	Example of graph: (1) Points plotted must cover at least 50% of the graph in both directions (1) Allow ± 1 small square (1) Ignore extrapolation	(3)

Question Number	Answer	Additional Guidance	Mark
3(d)(ii)	An answer that makes reference to the following point: the volume of (sodium) thiosulfate / titre is (directly) proportional to the concentration of iodine	Allow they are (directly) proportional Ignore any comments on correlation	(1)

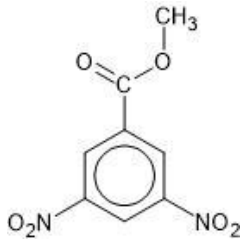
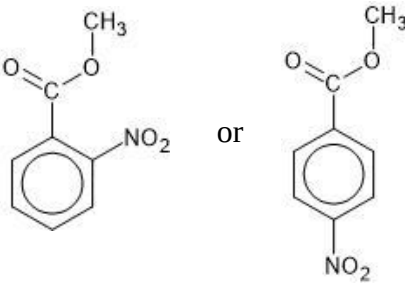
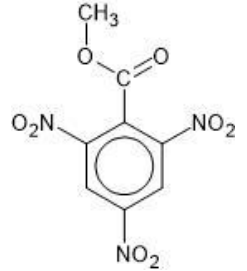
Question Number	Answer	Additional Guidance	Mark
3(d)(iii)	An answer that makes reference to the following point: zero (order) / 0 and straight line (with a negative gradient) graph	Accept rate is proportional to 1/time Accept changes to iodine concentration have no affect on rate Accept zero order and gradient is constant Ignore reference to sign of gradient NOTE: the order wrt iodine must be used in (e)(ii) COMMENT: allow linear for straight line	(1)

Question Number	Answer	Additional Guidance	Mark
3(e)(i)	An answer that makes reference to the following points: - working shown on graph for two half lives - two half-lives of 7 and 8 (seconds)	(1) (1) Allow a range of 6 – 9 (seconds) Ignore references to constant half life Do not award minutes / min	(2)

Question Number	Answer	Additional Guidance	Mark
3(e)(ii)	An answer that makes reference to the following point: rate = $k[\text{CH}_3\text{COCH}_3][\text{H}^+]$	Allow r for rate Allow H_2SO_4 / acid for H^+ Allow names for formulae Accept inclusion of '1' for powers Allow TE from diii Ignore inclusion of $[\text{I}_2]^0$ NOTE: The order wrt to iodine must be consistent with the answer in 3(d)(iii) Ignore state symbols even if incorrect	(1)

(Total for Question 3 = 12 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that makes reference to the following point: more effective cooling because greater (surface area) contact	Allow more quickly / more efficiently for effective Allow reverse argument Do not award reduced risk of explosion	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that makes reference to the following point: suitable nitrated methyl benzoate structure 	Accept displayed / structural / skeletal or any combination of Allow the 2-nitro or the 4-nitro isomer such as  or Allow any di-nitrated isomer Allow any tri-nitrated isomer such as  Ignore structure of methyl 3-nitrobenzoate Ignore water	(1)

Question Number	Answer	Additional Guidance	Mark
4(c)	An answer that makes reference to the following points: - no / needs filter paper (in the Buchner funnel) (1) - no / needs side arm on the flask (1) - no / needs pump (to reduce the pressure) (1)	May be shown on diagram Ignore just no solid on filter paper Ignore just filter paper should be flat Allow needs a Buchner flask / no outlet on the flask Ignore just not connected (to pump) Do not award round bottom flask Allow vacuum / Venturi tube / tap vacuum Ignore flask should be extra thick to withstand vacuum	(3)

Question Number	Answer	Additional Guidance	Mark
4(d)	A description that makes reference to the following points: - dissolve (solid) in the minimum (volume) of hot ethanol (1) (hot) (gravity) filtration to remove insoluble impurities (1) - cool (solution) to precipitate the solid / methyl 3-nitrobenzoate (1) (suction) filtration to remove the soluble impurities (1)	Allow solvent for ethanol Ignore warm Allow crystallise Ignore any washing comments	(4)

Question Number	Answer	Additional Guidance	Mark
4(e)(i)	An answer that makes reference to the following point: • difficult to separate the solid drying agent from the product	Allow difficult to dry a solid with another solid Allow would contaminate or make product impure Ignore they are both solids Do not award reacts with the product	(1)

Question Number	Answer	Additional Guidance	Mark
4(e)(ii)	An answer that makes reference to the following point: • suitable drying method such as desiccator / (warm) oven	Allow use filter paper / paper towel Allow leave (in a warm place) to dry Ignore leave in a cool place Do not award hot oven	(1)

Question Number	Answer	Additional Guidance	Mark
4(f)	Method 1 • evaluation of mass of methyl benzoate (1) • evaluation of moles of methyl benzoate (1) • evaluation of mass of methyl 3-nitrobenzoate and percentage yield (1) or evaluation of moles of moles of methyl 3-nitrobenzoate and percentage yield Method 2 • evaluation of mass of methyl benzoate (1) • evaluation of maximum mass (1) • percentage yield (1)	Example of calculation: $m = (1.08 \times 4 =) 4.32 \text{ (g)}$ $n = (4.32 \div 136 =) 0.031765 \text{ (mol)}$ $m = (0.0317647 \times 181 =) 5.7494 / 5.75 \text{ (g)}$ and $\% = ((3.05 \div 5.75) \times 100 =) 53.043 / 53\%$ $n = (3.05 \div 181 =) 0.016851 \text{ (mol)}$ and $\% = ((0.016851 \div 0.0317647) \times 100 =) 53.043 / 53\%$ Accept 53.049% from keeping values in calculator $m = (1.08 \times 4 =) 4.32 \text{ (g)}$ $m = ((181 \div 136) \times 4.32 =) 5.7494 / 5.75 \text{ (g)}$ $\% = ((3.05 \div 5.75) \times 100 =) 53.043 / 53\%$ Ignore SF except 1 SF Allow TE throughout but do not allow M3 if yield is higher than 100% Allow 53% scores 3	(3)

Question Number	Answer	Additional Guidance	Mark
4(g)	An answer that makes reference to the following points: - any melting temperature range of 4 or more degrees and higher figure 70-79°C and lower figure no lower than 65°C (1) - impurities make the melting temperature range lower and wider (1)	Mark independently Ignore comments about sharp	(2)

(Total for Question 4 = 16 marks)

TOTAL FOR PAPER = 50 MARKS