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 ppte / 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 ppte / 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 **(1)** or chromium(III) carbonate is not soluble so would not produce a green solution (hence is not present)	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)**

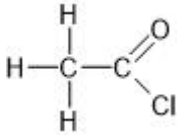
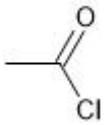
Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	A description that makes reference to the following points: • add barium ions / barium chloride ($BaCl_2$) / barium nitrate ($Ba(NO_3)_2$) (solution) **(1)** • the formation of a **white** precipitate (confirms sulfate ions) **(1)**	**M2 is dependent on M1 or near miss** (eg $Ba^+(aq)$) Ignore addition of HCl / HNO_3 Do not award sulfuric acid is added (0 overall) Allow solid / crystals / ppte / 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 $Ni(NO_3)_2$	**(1)**

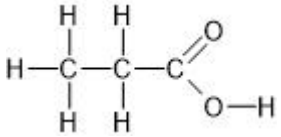
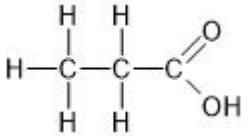
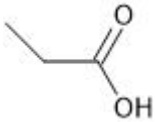
(Total for Question 1 = 10 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	An explanation that makes reference to the following points: (functional group) • acyl chloride / COCl / -COCl **(1)** (justification) • (because it is hydrolysed by water to give misty fumes of) hydrogen chloride **(1)** • which produces (a white smoke of) ammonium chloride/ NH_4Cl (when in contact with ammonia) **(1)**	Penalise mix up of white smoke/misty fumes or combination of these words once only Allow acid chloride / RCOCl Ignore -anoyl chloride Do not award -COCl- / $^{+}$COCl / O-C-Cl Allow hydrochloric acid Do not award white smoke is HCl 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 CH_3COCl 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 $COOH^+$ / CO_2H^+ 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: • C_2H_5COOH / CH_3CH_2COOH	Allow $C_2H_5CO_2H$ / $CH_3CH_2CO_2H$ 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 C_2H_5OH/CH_3CH_2OH 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)**

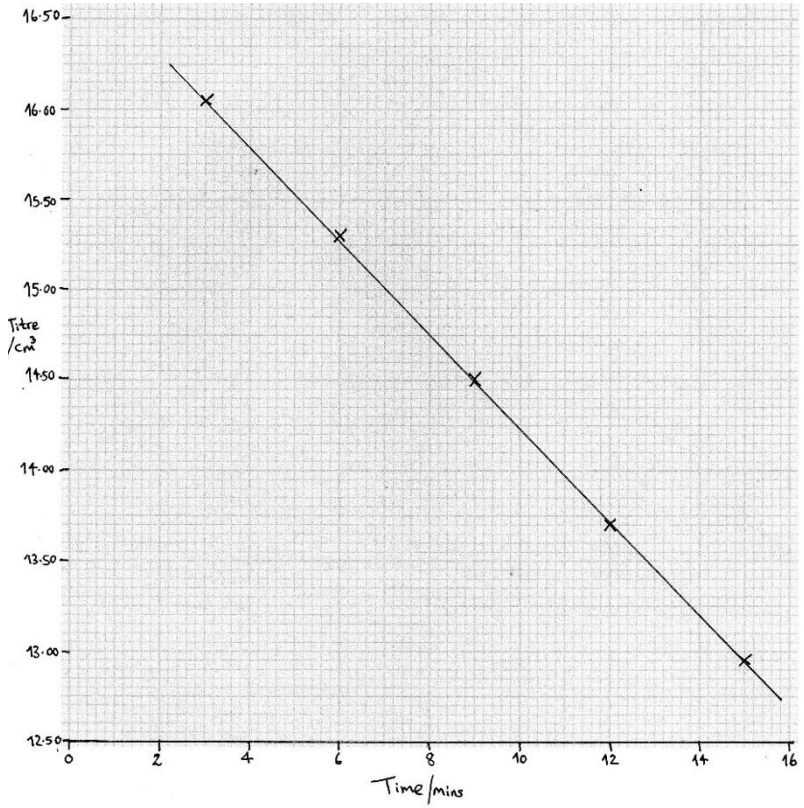
Question Number	Answer	Additional Guidance	Mark
2(e)	An answer that makes reference to the following points: • (Product with X) CH_3CONH_2 / ethanamide **(1)** • (Product with Y) $C_2H_5COONH_4$ / ammonium propanoate **(1)**	Allow displayed / skeletal / structural or combination thereof Allow ethyl amide Ignore + NH_4Cl or + HCl Accept inclusion of charges $C_2H_5COO^-NH_4^+$ 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 **(1)** • all points plotted correctly **(1)** • best fit **straight** line **(1)**	Example of graph:  Points plotted must cover at least 50% of the graph in both directions Allow ±1 small square 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)**

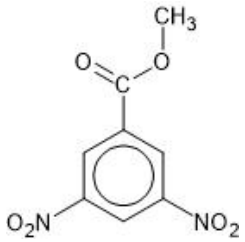
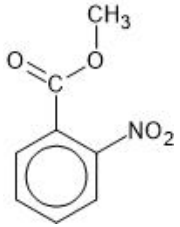
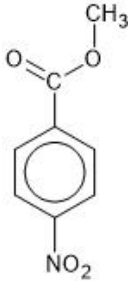
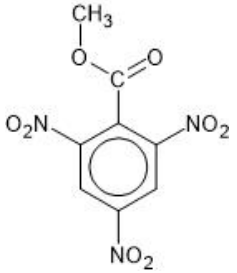
Question Number	Answer	Additional Guidance	Mark
3(d)(iii)	An answer that makes reference to the following point: • zero (order) / 0 **and** straight line (with a negative gradient) graph	Accept rate is proportional to 1/time Accept changes to iodine concentration have no affect on rate Accept zero order **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 **(1)** • two half-lives of 7 and 8 (seconds) **(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[CH_3COCH_3][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 $[I_2]^0$ 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) • no / needs side arm on the flask • no / needs pump (to reduce the pressure)	**(1)** **(1)** **(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 • (hot) (gravity) filtration to remove insoluble impurities • cool (solution) to precipitate the solid / methyl 3-nitrobenzoate • (suction) filtration to remove the soluble impurities	**(1)** **(1)** **(1)** **(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 • evaluation of moles of methyl benzoate • evaluation of mass of methyl 3-nitrobenzoate **and** percentage yield or evaluation of moles of moles of methyl 3-nitrobenzoate **and** percentage yield Method 2 • evaluation of mass of methyl benzoate • evaluation of maximum mass • percentage yield	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	Example of calculation: m = (1.08 × 4 =) 4.32 (g) n = (4.32 ÷ 136 =) 0.031765 (mol) m = (0.0317647 × 181 =) 5.7494 / 5.75 (g) **and** % = ((3.05 ÷ 5.75) × 100 =) 53.043 / 53% n = (3.05 ÷ 181 =) 0.016851 (mol) **and** % = ((0.016851 ÷ 0.0317647) × 100 =) 53.043 / 53% Accept 53.049% from keeping values in calculator m = (1.08 × 4 =) 4.32 (g) m = ((181 ÷ 136) × 4.32 =) 5.7494 / 5.75 (g) % = ((3.05 ÷ 5.75) × 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^{o}C and lower figure no lower than 65^{o}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