Pearson Edexcel

Mark Scheme (Results)

Summer 2018

Pearson Edexcel International Advanced Level
In Chemistry (WCH06)
Chemistry Laboratory Skills II

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Summer 2018
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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.

Question Number	Acceptable Answers	Reject	Mark
1 (a) (i)	Fe^{3+} /$[Fe(H_2O)_6]^{3+}$ ALLOW Fe^{+3} IGNORE State symbols, even if incorrect Incorrect number of water ligands	$Cr_2O_7^{2-}$ Mn^{2+}	1

Question Number	Acceptable Answers	Reject	Mark
1 (a) (ii)	$Fe(OH)_3$ OR $Fe(OH)_3(H_2O)_3$ ALLOW TE on incorrect cation from (a)(i) Ligands in any order Incorrect number of water ligands	$Fe(OH)_3^+$	1

Question Number	Acceptable Answers	Reject	Mark
1 (a) (iii)	Iodine/ I_2 /I_3^-	I, FeI_3, I^-	1

Question Number	Acceptable Answers	Reject	Mark
1 (a) (iv)	Silver nitrate (solution) / $AgNO_3$((aq)) ALLOW Ag^+((aq)) IGNORE Subsequent tests e.g. addition of ammonia		1

Question Number	Acceptable Answers	Reject	Mark
1 (a) (v)	Effervescence / bubbles (of colourless gas)/ fizzing IGNORE Gas is evolved Carbon dioxide forms Gas turns limewater cloudy Solid disappears Formation of precipitate	Coloured gases Other gases	1

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	Mark the three parts of this item independently. Observation: (pale /dark) green (1) ALLOW for M2 and M3 Ligands in any order Incorrect number of water ligands Inference: (precipitate) $Fe(OH)_2$ / $Fe(OH)_2(H_2O)_4$ (1) (Cation) Fe^{2+} /$[Fe(H_2O)_6]^{2+}$ (1) Allow TE only on Cr^{6+} in (a)(i) and Cr^{3+} in (b)(i) in which case all three marks may be awarded: green / blue-green (1) $Cr(OH)_3$ (1) Cr^{3+} (1)	 Blue-green $Fe(OH)_2(NH_3)_4$	3

Question Number	Acceptable Answers	Reject	Mark
1(b)(ii)	Mark independently $Fe(OH)_3$ OR $Fe(OH)_3(H_2O)_3$ ALLOW Fe_2O_3	FeO	1

Question Number	Acceptable Answers	Reject	Mark
1(c)	$2Fe^{3+} + SO_2 + 2H_2O \rightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$ OR Use of hydrated ions (e.g. $2[Fe(H_2O)_6]^{3+}$ and $2[Fe(H_2O)_6]^{2+}$) in equation IGNORE State symbols even if incorrect.		1

(Total for Question 1 = 10 marks)

Question Number	Acceptable Answers	Reject	Mark
2(a)	Sodium hydrogencarbonate / $NaHCO_3$ (solution) ALLOW $KHCO_3$ Sodium bicarbonate Sodium carbonate/ Na_2CO_3 Potassium carbonate/ K_2CO_3 IGNORE ice cold water	Strong alkalis	1

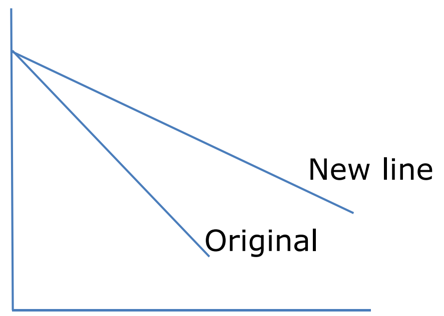
Question Number	Acceptable Answers	Reject	Mark
2(b)	When half of the reaction mixture has been pipetted into the quenching solution ALLOW Immediately after the all solution has been transferred (to the quenching solution)		1

Question Number	Acceptable Answers	Reject	Mark
2(c)(i)	0.01(00) (mol dm^{-3}) If given, units must be correct		1

Question Number	Acceptable Answers	Reject	Mark
2(c)(ii)	M1 Mol thiosulfate = 1.85×10^{-4} (1) M2 Mol I_2 in sample $= \frac{(1.85 \times 10^{-4})}{2} = 9.25 \times 10^{-5}$ Concentration I_2 = $(9.25 \times 10^{-5}) \times 100$ = 9.25×10^{-3} mol dm^{-3} TE on M1 (1) ALLOW Alternative method for calculating iodine concentration with correct answer for (2) M3 Rate of change = $\frac{(0.01 - 9.25 \times 10^{-3})}{70}$ (1) M4 This mark depends on the use of a time in M3. rate = $1.07143 \times 10^{-5} = 1.07 \times 10^{-5}$ and mol dm^{-3} s^{-1} TE on (c)(i) and M2 ALLOW mol dm^{-3}/ s (1) IGNORE SF except 1	$[I_2)]_i < [I_2)]_t$	4

Answer to (c)(i)	Answer to M3, including unit	Mark for (c)(ii)
0.01	$\frac{9.25 \times 10^{-3}}{70} = 1.32 \times 10^{-4}$ (0.01 not used)	3
0.05	$\frac{(0.05 - 9.25 \times 10^{-3})}{70} = \frac{0.0408}{70} = 5.82 \times 10^{-4}$	4
0.02	$\frac{(0.02 - 9.25 \times 10^{-3})}{70} = \frac{0.0108}{70} = 1.54 \times 10^{-4}$	4
0.5	$\frac{(0.5 - 9.25 \times 10^{-3})}{70} = \frac{0.491}{70} = 7.01 \times 10^{-3}$	4
0.25	$\frac{(0.25 - 9.25 \times 10^{-3})}{70} = \frac{0.241}{70} = 3.44 \times 10^{-3}$	4

Question Number	Acceptable Answers	Reject	Mark
2(c)(iii)	Iodine concentration does not affect rate OR rate equation is zero order wrt iodine ALLOW Iodine (concentration) does not appear in the rate equation (1) (Diagram shows that the) rate is constant (1)	zero order wrt thiosulfate Because the gradient is zero Just 'gradient is constant'	2

Question Number	Acceptable Answers	Reject	Mark
2(c)(iv)	Straight line with less negative gradient, starting from same point as the original  		1

Question Number	Acceptable Answers	Reject	Mark
2(c)(v)	These marks are stand alone The rate is half of the value in the original experiment ALLOW The gradient of the line is half of the value in the original experiment (1) IGNORE Rate / gradient would be lower The reaction is first order wrt propanone OR The rate is proportional to the concentration of propanone (1) IGNORE Propanone is in the rate equation	Rate constant changes	2

Question Number	Acceptable Answers	Reject	Mark
2(d)	Starch indicator (1) Added when pale yellow / straw coloured ALLOW added just before the end-point (1) End-point is blue-black / blue / black to colourless (1)	 Yellow At the end-point	3

(Total for Question 2 = 15 marks)

Question Number	Acceptable Answers	Reject	Mark
3(a)	(dilute) sulfuric acid / H_2SO_4	Just H^+ hydrochloric acid nitric acid concentrated sulfuric acid	1

Question Number	Acceptable Answers	Reject	Mark
3(b)	A salt bridge ALLOW (Strip of) filter paper OR inverted U-tube containing gel (1) (saturated) potassium nitrate solution/ KNO_3 OR sodium nitrate solution/ $NaNO_3$ (1)	 pH paper NaCl / KCl / NaBr / KBr / NaI /KI	2

Question Number	Acceptable Answers	Reject	Mark
3(c)(i)	M1 For direction of electron flow e.g. electrons flow to the positive side OR from left to right OR to the $KMnO_4$ side ALLOW $KMnO_4$ side is cathode (1) M2 Reduction occurs at the right-hand electrode OR Potassium manganate(VII) gains electrons and Potassium manganate(VII)/ manganate(VII) ions stronger oxidising agent (1) ALLOW Reverse arguments		2

Question Number	Acceptable Answers	Reject	Mark
3(c)(ii)	$MnO_4^- + 8H^+ + 5e^{(-)} \rightarrow Mn^{2+} + 4H_2O$ ALLOW Multiples Reverse equation if answer to (c)(i) is potassium dichromate		1

Question Number	Acceptable Answers	Reject	Mark
3(d)	becomes more orange/ less green / less brown ALLOW Green to orange IGNORE "dark" or "light" before colour	Anything purple Orange to green Green to yellow Just one colour (not a change)	1

Question Number	Acceptable Answers	Reject	Mark
3(e)	Ion concentration(s) / solution(s) should be 1.00 mol dm^{-3} / 1 Molar/ 1M OR Mixing (equal volumes of) two solutions each 2.00 mol dm^{-3} ALLOW 'concentration = 1.00 mol dm^{-3}' 'ion concentration = 1.00 mol dm^{-3}' IGNORE $[H^+]$ = 8.00 mol dm^{-3} / 1.00 mol dm^{-3} if others are 1.00 mol dm^{-3} Pressure / temperature	Answer implying only one compound needs to be 1M	1

Question Number	Acceptable Answers	Reject	Mark
3(f)(i)	Penalise use of mauve/violet/lilac once only in (f)(i) and (ii) Remains purple ALLOW Paler purple due to dilution	Just "no change" Mauve/violet/ lilac/pink Colourless to purple	1

Question Number	Acceptable Answers	Reject	Mark
3(f)(ii)	Goes from colourless to purple ALLOW from colourless to (pale) pink	very pale pink as the starting colour (to) mauve/violet/ lilac / brown	1

(Total for Question 3 = 10 marks)

Question Number	Acceptable Answers	Reject	Mark
4(a)	Method 1 Add bromine (solution) / Br_2 (1) White precipitate (with 2-hydroxybenzoic acid) OR Bromine is decolorised (1) IGNORE Medicinal smell Method 2 Add (neutral) iron(III) chloride solution/ ferric chloride / $FeCl_3$ (1) Red/ blue / green / purple violet colour (1) Method 3 Add ethanoyl chloride/ an acyl chloride ALLOW Add named carboxylic acid and a strong acid (1) Characteristic smell / steamy fumes ALLOW Fruity / medicinal smell Observation mark if carboxylic acid but no strong acid (1)	Testing with PCl_5 Na Na_2CO_3 NaOH $K_2Cr_2O_7$	2

Question Number	Acceptable Answers	Reject	Mark
4(b)(i)	(Very) flammable and corrosive Inflammable and corrosive	Extra answers eg flammable and oxidising/ Corrosive and acidic Oxidant for flammable	1

Question Number	Acceptable Answers	Reject	Mark
4(b)(ii)	Mol 2-hydroxybenzoic acid = 2.0/138 = 0.0144928/ 0.0145 /0.014 (1) Mass ethanoic anhydride = (0.0144928) x 102 = 1.47826087 / 1.48 / 1.5 (g) (1) $\frac{2.0 \times 102}{138}$ = 1.48 (g) scores (2) IGNORE SF except 1SF Intermediate rounding if final answer is correct		2

Question Number	Acceptable Answers	Reject	Mark
4(b)(iii)	Mass ethanoic anhydride (= 4 x 1.08) = 4.32 g (greater than 1.48 so excess) OR 1.48 g of ethanoic anhydride = (1.48/1.08) = 1.37 cm^3 (less than 4.0 cm^3 so excess) OR Mol ethanoic anhydride = (4.32/102) =0.0424 Mol 2-hydroxybenzoic acid = (2/138) =0.0145 (less than ethanoic anhydride) IGNORE Extra calculation showing how much is excess		1

Question Number	Acceptable Answers	Reject	Mark
4(b)(iv)	Final answer will depend on rounding of intermediate steps. Most rounding leads to answers between 65 and 65.4% Correct answer without calculation shown scores 2 Mol aspirin = 1.70/180 = 9.444×10^{-3} (1) % yield = $(9.444 \times 10^{-3} \times 100)/$ 0.0144927 =65.1669/ 65.2 /65% ALLOW % yield = $(9.4 \times 10^{-3} \times 100)/ 0.014$ =67% (1) OR Max yield = $\frac{2.00 \times 180}{138}$ = 2.608696 g (1) % Yield = $\frac{1.7 \times 100}{2.608696}$ = 65.1666/ 65.2 / 65 (1) Ignore SF except 1 SF TE except yield > 100%	(1.7 x 100)/2 =85% $\frac{2 \times 100}{2.6}$ = 77%	2

<table>
<tr><th>Question Number</th><th>Acceptable Answers</th><th>Reject</th><th>Mark</th></tr>
<tr><td>4(b)(v)</td><td>The correct answer may be shown on the diagram.

Top of condenser should not be sealed (so thermometer must be removed)

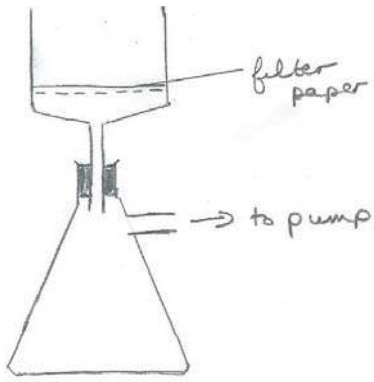
ALLOW
Thermometer must be removed
OR
Thermometer should be in water bath

IGNORE
There is nowhere for gas to escape
OR
Thermometer not needed for reflux
(1)

The condenser has no inner tube
OR
an inner tube and outer water jacket should be shown
OR
Diagram showing Liebig condenser

ALLOW
Column should be replaced by Liebig condenser (1)</td><td>Move thermometer closer to liquid level

Incorrect diagram of Liebig condenser</td><td>2</td></tr>
</table>

Question Number	Acceptable Answers	Reject	Mark
4(b)(vi)	 Funnel with perforated base ALLOW Funnel as in diagram labelled Buchner funnel Conical funnel labelled Hirsch funnel (1) IGNORE Shape of funnel if shown as perforated Filter paper and flask with side arm (Buchner flask) (1) Sealed system and (Reduced pressure achieved by) connection to (suction) pump/ to vacuum pump / to flow of water through valve/ to (water) aspirator. This may be shown on diagram ALLOW (air to) vacuum (1) M3 can be awarded with incorrect funnel	Simple gravity filtration Just “to tap”	3

Question Number	Acceptable Answers	Reject	Mark
4(c)(i)	$C_6H_4O(^+)$ ALLOW Atoms in any order IGNORE Benzene ring connected to O^+ if apparently rough work for $C_6H_4O(^+)$	Structural/ skeletal formulae Incorrect charge(s) $C_6H_4O^{2+}$ C_7H_8 $(^+)$ C_6H_5 $CH_3(^+)$ C_6H_5 C $(^+)$ C_5O_2 $(^+)$	1

Question Number	Acceptable Answers	Reject	Mark
4(c)(ii)	Circles round H in OH and each H in CH_3 ALLOW OH and CH_3 completely circled		1

(Total for Question 4 = 15 marks)

TOTAL MARKS FOR PAPER = 50 MARKS