Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCE
in Chemistry (8CH0) Paper 2
Core Organic and Physical
Chemistry

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Summer 2017
Publications Code 8CH0_02_MS_1706
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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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the mark scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.
Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Mark
1	**1. The only correct answer is A** ***B*** *is not correct because fluorine is very electronegative and has a suitable lone pair of electrons for hydrogen bonding.* ***C*** *is not correct because has hydrogen bonding; compare with water.* ***D*** *is not correct because alcohols can hydrogen bond; compare with water.*	**(1)**

(Total for Question 1 = 1 mark)

Question Number	Answer	Mark
2	**2. The only correct answer is C** ***A*** *is not correct because it has a similar shape to water.* ***B*** *is not correct because it has a trigonal planar shape; resulting from the lone pair and two groups of electrons in the two double bonds.* ***D*** *is not correct because it is planar but not linear.*	**(1)**

(Total for Question 2 = 1 mark)

Question Number	Acceptable Answer		Additional Guidance	Mark
3(a)	• moles of CO_2 /moles of C	**(1)**	<u>example of calculation</u> moles of CO_2 = 3.143/44 (= 0.07143/0.071) = moles of C	**(4)**
	• moles of H	**(1)**	moles of H_2O = 1.284/18 (= 0.07133) moles of H = 2 x moles of H_2O = 0.1427	
	• empirical formula	**(1)**	C:H = 0.07143:0.1427 = 1:2 hence C_1H_2 or CH_2 allow TE from first and/or second mark point(s) Allow any workable calculation Ignore SF in intermediate stages of calculation Award 3 marks for correct C:H ratio, with or without working.	
	• calculates molecular formula C_6H_{12}	**(1)**	84/14 = 6 6 x CH_2 = C_6H_{12} Mark independently of M1, M2, M3	

Question Number	Acceptable Answer		Additional Guidance	Mark
3(b)(i)	• calculation of Q	**(1)**	<u>example of calculation</u> use of Q= m c ΔT Q = 250 x 4.18 x 8.2 = 8569 (J) / 8.569 **kJ** ignore any sign at this stage	**(3)**
	• mass of hydrocarbon burnt and value of $\Delta_c H$	**(1)**	= 112.990 – 112.732 = 0.258 g $\Delta_c H$ = (-) 8569 x 84/0.258 = (-) 2789907 (J mol^{-1}) /(-) 2789.907 (kJ mol^{-1})	
	• sign and significant figures	**(1)**	TE on incorrect value from M1 = -2790/-2800 (kJ mol^{-1}) allow -2790000/-2800000 **J mol^{-1}** final answer to 2 or 3 sig figs only Do not award M3 for incorrect method used in M2 correct final answer without working scores 3	

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)(ii)	an answer that makes reference to the following point: improved/better (thermal/heat) conduction	Allow copper is a good conductor (of heat) Allow reverse argument in terms of (thermal) insulators Ignore references to heat capacity/ heat lost to surroundings/ heat absorbed by container. Ignore any mention of glass breakage	**(1)**

(Total for Question 3 = 8 marks)

Question Number	Acceptable Answer		Additional Guidance	Mark
4(a)	$C_{10}H_{18}O$	**(1)**	Ignore $C_{10}H_{17}OH$	**(2)**
	154 (g mol^{-1})	**(1)**	no TE on incorrect molecular formula except for C_{10} $H_{17}OH$	

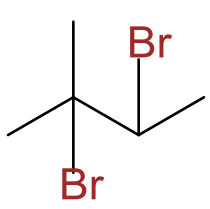
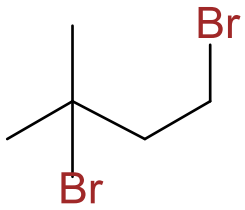
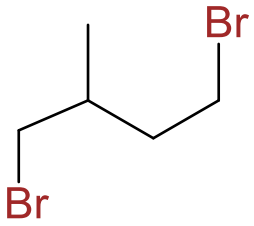
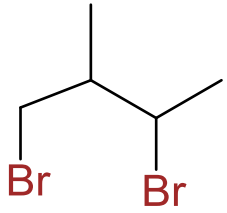
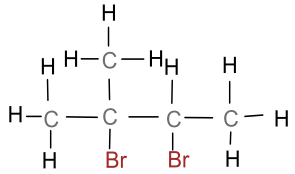
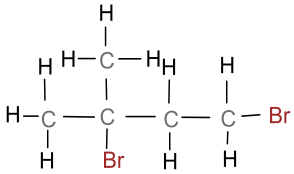
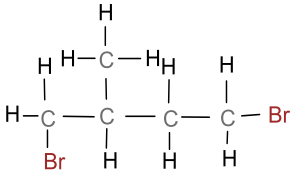
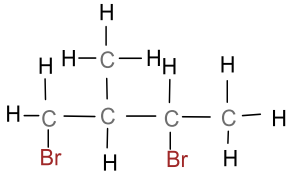
Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(i)	furthest peak to right/ highest *m / z* = 154	Ignore just ' highest peak' may be shown on spectrum alone provided 154 stated Allow parent ion/molecular ion/last peak at 154 Must see the figure 154 in text or on graph	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(ii)	$C_5H_9^+$ / $[C_5H_9]^+$	+ charge is essential, allow charge anywhere on the ion/ outside / inside brackets Allow displayed/structural/skeletal formula or any combination of these. Ignore name of ion even if incorrect (Correct name: 2-methylbut-2-ene ion)	**(1)**

Question Number	Answer Acceptable	Additional Guidance	Mark
4(c)	alkene **and** C=C **and** (IR) peak between 1669 and 1645 (cm^{-1}) OR alkene **and** C-H **and** (IR) peak between 3095 and 3010 OR 3095 and 2995 (cm^{-1}) **(1)** alcohol **and** O-H **and** (IR) peak between 3750 and 3200 (cm^{-1}) **(1)**	can be in either order Allow CH (bond) Ignore any qualification of the wavenumber range eg isolated alcohol or phenol Allow Hydroxyl Do not award Hydroxide Allow OH (bond) Do not award –OH /–O–H If both bonds missing and everything else correct, award 1 mark Ignore all references to alkanes Allow single IR value or range within the data book range	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(d)	An answer that makes reference to the following points: Alkene • bromine water/Br_2(aq)/bromine **(1)** • decolorised or orange/yellow/brown to colourless **(1)** Alcohol • PCl_5/phosphorus pentachloride /phosphorus(V)chloride **(1)** • Misty/steamy/white fumes **(1)**	Allow alkene and alcohol in either order. No TE for other groups incorrectly identified in 4c or alkanes Result dependent on correct test for both functional groups allow acidified potassium manganate/$KMnO_4$. Decolourised (from purple) allow (warm with) acidified $Cr_2O_7^{2-}$ turns from orange to green / blue If name and formula, both must be correct sodium (metal) effervescence OR any other workable test and correct result	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(e)	2 **(1)** number of C atoms in geraniol = 10, C atoms in isoprene = 5, (10/5 = 2) **(1)**	Note: this must be a whole number Allow answers using C chain length ie isoprene = 4, geraniol = 8 Ignore number of hydrogens in both isoprene and geraniol Do not award answers using M_r	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(f)	    one mark for each structure	accept displayed/structural/skeletal formulae     Allow 2 marks for 4 different and correct monobromo isomers Allow 1 mark for 2/3 different and correct monobromo isomers Zero for 1 monobromoisomer accept correct enantiomers (provided both C=C bond react) Deduct one mark only for use of HCl Deduct one mark for (any number of) missing hydrogens	**(4)**

(Total for Question 4 = 16 mark)

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)	an answer that makes reference to the following point: volume/space occupied by one mole of a gas at a specified temperature and pressure/rtp/stp/standard conditions	temp and pressure need not be s.t.p. or r.t.p. ignore just reference to 22.4 or 24 dm^3 Ignore units of volume, if given.	**(1)**

Question Number	Acceptable Answer		Additional Guidance	Mark
5(b)(i)	(% volume uncertainty =)1%	**(1)**	example of calculation 0.5 cm^3 in 50 cm^3 % uncertainty = $\frac{0.5}{50}$ x 100 = 1%	**(2)**
	(% mass uncertainty =)1/1.1/1.09/1.08696 %	**(1)**	mass of gas = 107.655 – 107.563 = 0.092 g uncertainty = 0.0005 x 2 0.001 g in 0.092 g % uncertainty = $\frac{0.001}{0.092}$ x 100 = 1/1.1/1.09/1.08696 % Ignore uncertainties added together Do not award calculation of uncertainty in each mass reading (often added together +1) eg 0.0004644 + 0.0004648 + 1 = 1.000928	

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(ii)	an answer that makes reference to the following points: halves the % volume uncertainty /0.5 cm^3 in 100 cm^3 = 0.5% **(1)** (volume of gas is doubled so mass of gas doubles), % mass uncertainty (also) halves. **(1)**	 TE for answer to (b)(i) ÷ 2 TE for answer to (b)(i) ÷ 2 Allow 1 mark for both uncertainties decrease	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(iii)	• mass of gas and expression for molar mass **(1)** • molar mass to 2 or 3 SF and correct units **(1)**	<u>example of calculation</u> mass of gas = 107.655 – 107.563 = 0.092 g and molar mass = 0.092 x 24000 /50 = 44.16 Allow any other correct alternative calculation TE from M1 to M2 for incorrect mass only 44.2/44 **g mol^{-1}** Correct answer to 2/3 SF with/without working gets 2 marks	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(iv)	an explanation that makes reference to the following points: • plunger does not return (to zero/original position) when released **(1)** • molar mass will decrease **because** 'air' has a lower molar mass (than 44/carbon dioxide) **(1)**	Mark independently There must be some reference to air	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(c)	An answer that makes reference to the following points: • the calculated molar mass would be greater **(1)** • at a lower temperature there would be more molecules/moles/mass in the same volume /density is greater. **(1)**	Points to be marked independently Standalone mark Do not award for answers that refer to smaller volume Ignore smaller molar volume Ignore particles/molecules/atoms closer together	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(d)	an answer that makes reference to the following point: water (vapour) would decrease/affect molar mass OR gas is now a mixture so would decrease/affect molar mass	Ignore gas may dissolve in water Do not award water may react with gas in syringe Do not award wet gas is heavier Ignore answers that refer to molar volume	**(1)**

(Total for Question 5 = 12 marks)

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>*6(a)</td>
<td>This question assesses a student’s ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.
Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.
The following table shows how the marks should be awarded for indicative content.
<table>
<tr><th>Number of indicative marking points seen in answer</th><th>Number of marks awarded for indicative marking points</th></tr>
<tr><td>6</td><td>4</td></tr>
<tr><td>5-4</td><td>3</td></tr>
<tr><td>3-2</td><td>2</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td></tr>
</table>
The following table shows how the marks should be awarded for structure and lines of reasoning.
<table>
<tr><th></th><th>Number of marks awarded for structure and sustained lines of reasoning</th></tr>
<tr><td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout.</td><td>2</td></tr>
<tr><td>Answer is partially structured with some linkages and lines of reasoning.</td><td>1</td></tr>
<tr><td>Answer has no linkages between points and is unstructured.</td><td>0</td></tr>
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</td>
<td>Guidance on how the mark scheme should be applied:

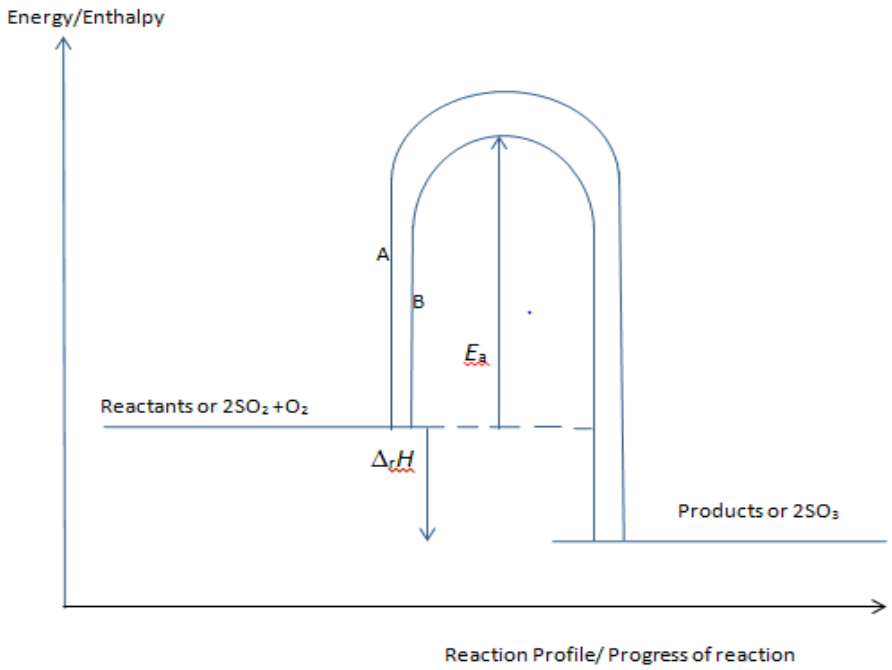
The mark for indicative content should be added to the mark for lines of reasoning. For example, an answer with five indicative marking points that is partially structured with some linkages and lines of reasoning, scores 4 marks (3 marks for indicative content and 1 mark for partial structure and some linkages and lines of reasoning).

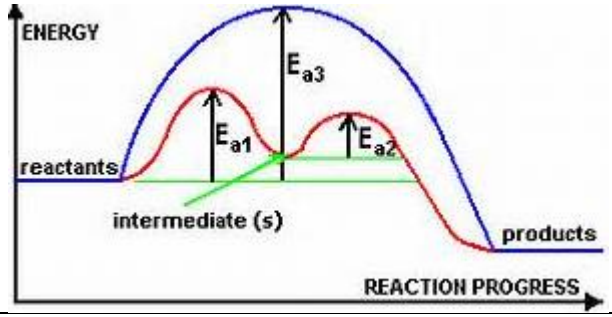
If there are no linkages between points, the same five indicative marking points would yield an overall score of 3 marks (3 marks for indicative content and no marks for linkages).

In general it would be expected that 5 or 6 indicative points would get 2 reasoning marks, and 3 or 4 indicative points would get 1 mark for reasoning, and 0, 1 or 2 indicative points would score zero marks for reasoning.

If there is any incorrect chemistry, deduct mark(s) from the reasoning. If no reasoning mark(s) awarded do not deduct mark(s).
Comment: Look for the indicative marking points first, then consider the mark for the structure of the answer and sustained line of reasoning.</td>
<td>(6)</td>
</tr>
</table>

***6(a)**	**Indicative content:** • IP1 increase in temperature will increase rate • IP2 (but) increase in temperature will decrease yield/move the equilibrium to the LHS/ produce less SO_3 **because** it is an exothermic reaction (in the forward direction) • IP3 increase in temperature increases **energy** costs • IP4 increase in pressure has no effect on rate (because all the active sites are already occupied on a heterogeneous catalyst). **OR** increase in pressure will increase rate (of reaction) • IP5 increase in pressure will move position of eqm to RHS/increase yield **because** there are less moles/molecules (of gas) on the RHS • IP6 but increased pressure increases (construction and running) costs/reduces economic viability	Decreased yield with no reference to exothermic reaction does not get IP2. Allow increases yield of reactants/SO_2 **and** O_2 (with reference to exothermic reaction) Increased yield with no reference to number of moles does not get IP5. Award one mark for IP2 and IP5 if correct references to yield in both but reasons not given Allow IP3 and IP6 if increased costs of higher temperature and pressure are mentioned together **provided** that the temperature costs are linked to energy costs. Otherwise only IP6 can be awarded. Ignore any reference to catalyst	

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)(i)	• vertical axis labelled: H/enthalpy/energy/E **(1)** • level of reactants / $2SO_2 + O_2$ above level of products / $2SO_3$ **(1)**	 Do not award ΔH Ignore horizontal axis label Ignore units if given ignore state symbols even if incorrect	**(3)**

	• correct profile for uncatalysed reaction labelled A **and** peak lower for catalysed reaction labelled B **(1)**	allow vertical lines for catalysed and uncatalysed reactions to run together allow double hump profile  	

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)(ii)	enthalpy change, $\Delta_r H / \Delta H /$ (-)197(kJ mol^{-1}), shown correctly **(1)** activation energy, E_a, shown correctly (upper diagram) **(1)**	Ignore presence/absence of arrowheads Allow a degree of imprecision in the start/finish points of the lines for ΔH and E_a Ea shown on double hump profile - shown in this diagram as Ea_1 Ignore Ea2 if also shown	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(c)(i)	$(K_c =) \quad \frac{[SO_3]^2}{[O_2][SO_2]^2}$	Do not award just K or K_p. must be square brackets do not accept partial pressures ignore units or lack of units ignore state symbols Allow x sign in the denominator but not +	**(1)**

Question Number	Answer	Mark
6(c)(ii)	**6(c)(ii). The only correct answer is B** ***A*** *is not correct because it refers to the inverted expression for* K_c ***C*** *is not correct because units do not cancel for concentration*^{2}*/concentration*^{3} ***D*** *is not correct because it refers to concentration*^{3}*/concentration or similar ratio of powers*	**(1)**

(Total for Question 6 = 13 marks)

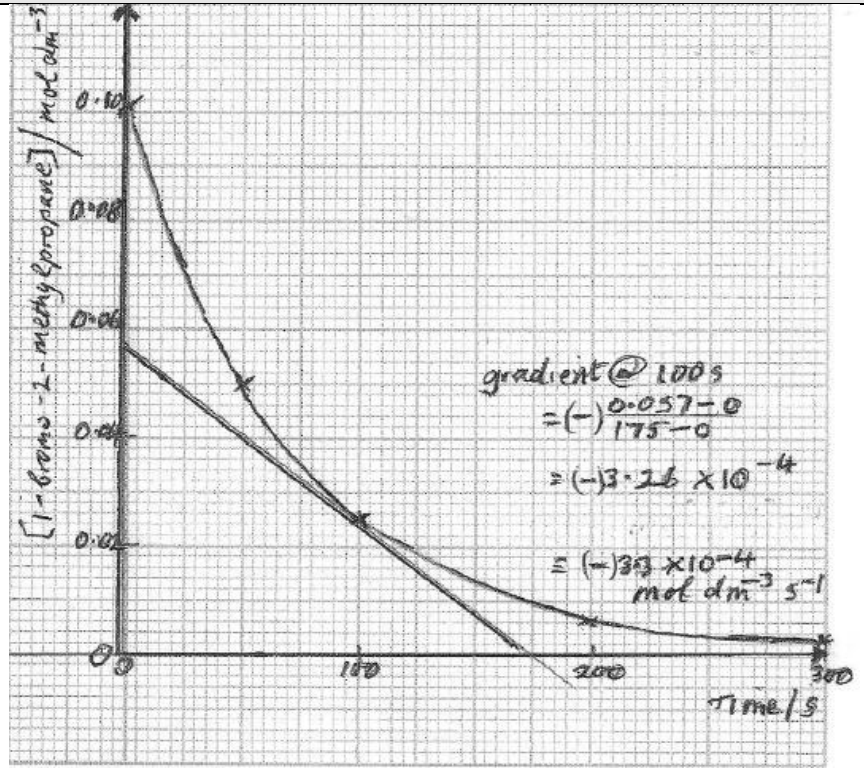
Question Number	Answer	Mark
7(a)(i)	**7(a)(i). The only correct answer is B** ***A*** *is not correct because X,Y,Z is chloro/bromo/iodo, and would be for increasing* ***rate*** *not time taken* ***C*** *is not correct because Y,X,Z is bromo/chloro/iodo, ie incorrect for rate or time taken* ***D*** *is not correct because Z,X,Y is iodo/chloro/bromo, also incorrect for either rate or time taken*	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)(ii)	to increase the solubility of / dissolves the halogenoalkane /reactants / so that reactants are miscible	Do not award just 'as a good solvent' Allow cosolvent / as a (good) solvent for both reactants Ignore 'stop formation of layers' Ignore 'to allow mixing' Comment Water, aqueous silver nitrate and just silver nitrate are all acceptable alternatives for the other reactant	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)(iii)	to allow the solutions to equilibrate / reach the same temperature /reach 50°C/reach the required temperature	Do not award to keep temperature constant Ignore references to reaction rates Ignore reference to fair test	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)(iv)	an explanation that makes reference to the following points: • (the halogenoalkane is) hydrolysed by water **(1)** • C- Hal bond breaks (heterolytically producing ions) **(1)**	reward recognition of reaction with water Do not award reaction with OH^- Comment Must be clear that the C-Hal bond is breaking. Allow statements like 'the halogen ion / halide breaks off'	**(2)**

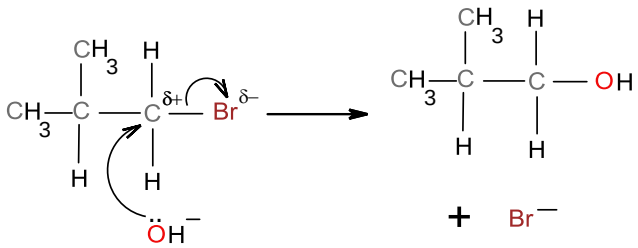
Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)(v)	$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$	Ignore previous workings. Mark the final equation. Do not award **uncancelled** spectator ions	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)(i)	Graph: both axes labelled and graph covering at least half the grid in both directions. **(1)**	 Do not award 1-bromo-2-methylpropane without [ ] Do not award just 'concentration/mol dm^{-3}' Allow 'concentration of 1-bromo-2-methylpropane/mol dm^{-3}' Units required on both axes Accept / between label and mol dm^{-3} or (mol dm^{-3}) Non-linear scale on either axis loses M1 and M2 but can get M3 for a smooth curve based on their points	**(1)**

	points plotted correctly **(1)** smooth line of best fit **(1)**	Reversed axes loses M1 only Accuracy ± ½small square Do not award dot-to-dot lines	

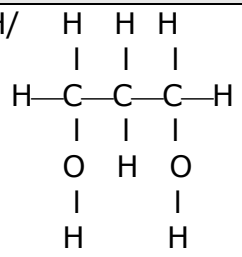
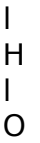
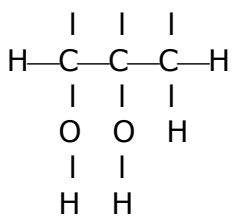
Question Number	Acceptable Answer		Additional Guidance	Mark
7(b)(ii)	line drawn as tangent to curve at time 100 s.	**(1)**		**(3)**
	gradient= (-)3.3 x10^{-4} (allow range (-)2.5 x10^{-4} to (-)4.5 x10^{-4})	**(1)**	ignore missing negative sign. Allow any SF except 1 Do not award answers that use only the one point at 100s Example 0.0250/100 = 2.5 x 10^{-4} Do not award for gradient of a straight line graph Do not award for gradient as a fraction	
	mol dm^{-3} s^{-1}	**(1)**	Allow mol dm^{-3} /s	

Question Number	Answer	Mark
7(c)(i)	**1. The only correct answer is D** ***A*** *is not correct because the* OH^- *ion is consumed, therefore not acting as a catalyst* ***B*** *is not correct because the* OH^- *ion has negative charge and will not act as an electrophile* ***C*** *is not correct because the* OH^- *ion does not have a single unpaired electron therefore not a free radical*	**(1)**

Question Number	Acceptable Answer		Additional Guidance	Mark
7(c)(ii)			 S_N2 mechanism M1, M2 and M4 still available for S_N1 mechanism	(4)
	correct structure of 1-bromo-2-methylpropane	**(1)**	TE for any other halogenoalkane, M2, M3 and M4 still available	
	dipole on C – Br bond, i.e. δ+ and δ-	**(1)**		
	lone pair shown on OH^- **and** curly arrow from lone pair on OH^- to correct carbon	**(1)**	Lone pair must be located (anywhere) on the O atom of the hydroxide ion	
	curly arrow from C-Br bond to Br and correct products	**(1)**		

Question Number	Acceptable Answer	Mark
7(c)(iii)	**7(c)(ii). The only correct answer is D** ***A*** *is not correct because addition involves the joining together of two molecules to make a bigger one* ***B*** *is not correct because elimination involves the loss of a small molecule during the reaction* ***C*** *is not correct because there are no changes in oxidation number*	**1**

(Total for Question 7 = 18 mark)

Question Number	Acceptable Answer		Additional Guidance	Mark
8(a)	$CH_2OHCH_2CH_2OH$/ 	**(1)**	allow displayed / skeletal formula allow OH undisplayed If more than one formula given for a molecule, both must be correct Penalise C–H–O only once Do not penalise bond to H of pendent OH Do not award C 	**(2)**
	$CH_2OHCHOHCH_3$/ 	**(1)**	Ignore names even if incorrect Penalise missing alkane H once only Do not award missing H from OH Allow formulae of propane-1,1-diol or propane-2,2-diol Do not award for other diols	

Question Number	Acceptable Answer	Mark
8(b)(i)	**8(b)(i). The only correct answer is A** ***B*** *is not correct because hydrogen chloride would be lost during heating* ***C*** *is not correct because reflux is required to ensure complete oxidation* ***D*** *is not correct because reflux is required to ensure complete oxidation*	**(1)**

Question Number	Acceptable Answer	Mark
8(b)(ii)	**8(b)(i). The only correct answer is B** ***A*** *is not correct because the correct colour change is reversed* ***C*** *is not correct because the orange dichromate(VI) ions are reduced to* ***green*** *chromium(III) ions* ***D*** *is not correct because the* ***orange*** *dichromate (VI) ions are reduced to* ***green*** *chromium(III) ions*	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(c)(i)	moles of NaOH 18.45 x 0.400/1000 = 7.38 x 10^{-3}/0.00738 **(1)** moles of propanedioic acid 7.38 x 10^{-3}/2 = 3.69 x 10^{-3}/0.00369 **(1)**	TE: moles of NaOH/2	**(2)**

Question Number	Acceptable Answer		Additional Guidance	Mark
8(c)(ii)			<u>example of calculation</u>	**(2)**
	moles of propanedioic acid in 250 cm^3	**(1)**	moles of propanedioic acid 25 x answer to (c)(i) = 25 x 3.69 x 10^{-3} = 0.09225	
	mass of propanedioic acid in 250 cm^3	**(1)**	0.09225 x 104 = 9.6/9.59/9.594 (g) Allow calculation in either order e.g. calculate mass propanedioic acid in 10.0 cm^3 first then x 25 Allow TE from c(i) eg 0.00738 gives 19.188 (g)	

Question Number	Acceptable Answer	Additional Guidance	Mark
8(c)(iii)	theoretical yield **(1)** % yield **(1)**	<u>example of calculation</u> theoretical yield 15.2 x104/76 = 20.8 g % yield answer to c(ii) x 100/20.8 9.594 x 100/20.8 = 46/46.1/46.12/46.13/46.125 (%) use of 9.6 gives 46.15385 allow any number of sig figs except one Correct answer with or without working scores 2 marks TE on incorrect theoretical yield and answer to c(ii) Both marks will be lost for use of 15.2 as theoretical yield (gives 63.1%)	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(c)(iv)	an answer that makes reference to one of the following points: • transfer losses • incomplete reaction/oxidation/ formation of aldehyde • side reaction(s)	 Ignore spillage/impure reactants/incompetence/references to uncertainties Ignore other products formed/loss by evaporation Penalise additional incorrect reasons ie +1 -1 = zero	**(1)**

(Total for Question 8 = 11 marks)

TOTAL FOR PAPER = 80 MARKS

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