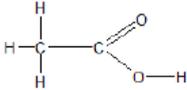


CHERRY HILL TUITION AQA CHEMISTRY AS PAPER 15 MARK SCHEME

1)

(c)(i)	$\text{Ba} + 2\text{H}_2\text{O} \longrightarrow \text{Ba}(\text{OH})_2 + \text{H}_2$	1	$\text{Ba} + 2\text{H}_2\text{O} \longrightarrow \text{Ba}^{2+} + 2\text{OH}^- + \text{H}_2$ Allow multiples Ignore state symbols
(c)(ii)	M1 $\text{Ba}^{2+} + \text{SO}_4^{2-} \longrightarrow \text{BaSO}_4$ M2 <u>White precipitate / solid</u>	2	Ignore state symbols in M1 Not multiples in M1 Extra ions must be cancelled Penalise contradictory observations in M2
(c)(iii)	M1 Barium meal / barium swallow / barium enema OR used in X-rays OR to block X-rays OR X-ray contrast medium OR CT scans M2 <u>BaSO₄ / barium sulfate is insoluble (and therefore not toxic)</u>	2	Accept a correct reference to M1 written in the explanation in M2 , unless contradictory For M2 NOT barium ions NOT barium NOT barium meal and NOT "it" Ignore radio-tracing

2)

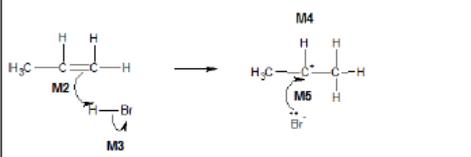
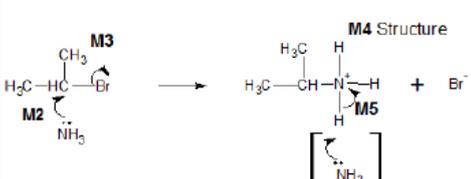
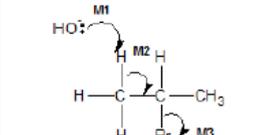
(a)(i)	CH_2O	1	Atoms in any order Accept a clear indication that $\text{C}_6\text{H}_{12}\text{O}_6$ yields CH_2O as the answer
(a)(ii)	No peak / no absorption / no C=O in the <u>range 1680 to 1750</u> (cm^{-1}) (suggesting no evidence of C=O)	1	Allow the words "dip", "spike", "low transmittance" and "trough" as alternatives for absorption Ignore references to other wavenumbers
5(b)	M1 $\text{C}_6\text{H}_{12}\text{O}_6 \longrightarrow 2\text{CH}_3\text{CH}_2\text{OH} + 2\text{CO}_2$ ($\text{C}_2\text{H}_5\text{OH}$) Either order M2 (enzymes from) yeast or zymase M3 $25^\circ\text{C} \leq T \leq 42^\circ\text{C}$ OR $298\text{K} \leq T \leq 315\text{K}$	3	Penalise $\text{C}_2\text{H}_6\text{O}$ Allow multiples of the equation in M1 For M2 and M3 Ignore "aqueous" Ignore "anaerobic/absence of oxygen" Ignore "controlled pH" Ignore "warm"
(c)(i)	<u>Displayed formula</u> for CH_3COOH 	1	All bonds must be drawn out, but ignore bond angles

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(c)(ii)	$O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$	1	Ignore state symbols Negative charge on electron not essential Accept multiples Accept electrons subtracted from RHS
(c)(iii)	$CH_3CH_2OH + H_2O \longrightarrow CH_3COOH + 4H^+ + 4e^-$ (C_2H_6O or C_2H_5OH)	1	Ignore state symbols Negative charge on electron not essential Accept multiples Accept electrons subtracted from LHS
(c)(iv)	M1 <u>Acidified potassium or sodium dichromate</u> OR $H_2SO_4 / K_2Cr_2O_7$ OR $H^+ / K_2Cr_2O_7$ etc. OR correct combination of formula and name M2 (requires an attempt at M1) <u>orange to green</u> Possible alternative M1 (acidified) potassium manganate(VII) OR $KMnO_4 / H_2SO_4$ M2 <u>purple to colourless</u>	2	For M1, it must be a whole reagent and/or correct formulae Do not penalise incorrect attempt at formula if name is correct or vice versa If oxidation state given in name, it must be correct, but mark on from an incorrect attempt at a correct reagent. Credit <u>acidified potassium chromate(VI) / $H_2SO_4 + K_2CrO_4$</u> Other alternatives will be accepted but M2 is dependent on M1 in every case M2 requires an attempt at a correct reagent for M1 Ignore reference to states
(d)(i)	An activity which has no <u>net / overall</u> (annual) <u>carbon emissions to the atmosphere / air</u> OR An activity which has no <u>net / overall</u> (annual) <u>greenhouse gas emissions to the atmosphere / air</u> . OR There is no change in the <u>total amount of carbon dioxide / carbon / greenhouse gas present in the atmosphere / air</u>	1	The idea that the <u>carbon / CO_2</u> given out equals the <u>carbon / CO_2</u> that was taken in <u>from the atmosphere / air</u> Answer <u>must</u> refer to the atmosphere or air
(d)(ii)	Renewable / sustainable ONLY	1	Ignore references to global warming or greenhouse gases
3)			
(a)(i)	(Free-) <u>radical substitution</u>	1	Both underlined words are required Penalise a correct answer if contradicted by an additional answer
(a)(ii)	Initiation $F_2 \longrightarrow 2F\cdot$ First propagation $F\cdot + CH_3F \longrightarrow \cdot CH_2F + HF$ Second propagation $F_2 + \cdot CH_2F \longrightarrow CH_2F_2 + F\cdot$ Termination (must make 1,2-difluoroethane) $2 \cdot CH_2F \longrightarrow CH_2FCH_2F$	4	Penalise absence of dot once only Penalise + or - charges every time Accept dot anywhere on CH_2F radical Mark independently Use of half-headed arrows must be correct to score, but if not correct then penalise once only in this clip
(a)(iii)	$CH_3CH_3 + 5F_2 \longrightarrow CF_3CHF_2 + 5HF$ (C_2H_6) (C_2HF_5)	1	
(b)	1,1,1,2-tetrachloro-2,2-difluoroethane OR 1,2,2,2-tetrachloro-1,1-difluoroethane	1	Accept phonetic spelling eg "fluro, cloro" Penalise "flouro" and "floro", since QoL Ignore commas and hyphens
(c)(i)	$2O_3 \longrightarrow 3O_2$	1	ONLY this equation or a multiple Ignore NO over the arrow Other species must be cancelled
(c)(ii)	$O + NO_2 \longrightarrow NO + O_2$	1	ONLY this answer and NOT multiples Ignore any radical dot on the O atom

4)

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(a)	<p>M1 electrophilic addition</p>  <p>M2 must show an arrow from the double bond towards the H atom of the H-Br molecule</p> <p>M3 must show the breaking of the H-Br bond</p> <p>M4 is for the structure of the secondary carbocation</p> <p>M5 must show an arrow from the lone pair of electrons on the negatively charged bromide ion towards the correct (positively charged) carbon atom</p> <p>NB These are double-headed arrows</p>	5	<p>For M1, both words required Accept phonetic spelling</p> <p>For the mechanism M2 Ignore partial negative charge on the double bond</p> <p>M3 Penalise partial charges on H-Br bond if wrong way and penalise formal charges</p> <p>Penalise once only in any part of the mechanism for a line and two dots to show a bond</p> <p>Maximum any 3 of 4 marks for the mechanism for wrong (organic) reactant OR wrong organic product (if shown) OR primary carbocation</p> <p>Accept the correct use of sticks</p>
(b)	<p>M1 Nucleophilic substitution</p>  <p>M2 must show an arrow from the lone pair of electrons on the nitrogen atom of an ammonia molecule to the correct C atom</p> <p>M3 must show the movement of a pair of electrons from the C-Br bond to the Br atom. Mark M3 independently provided it is from <u>their original molecule</u></p> <p>M4 is for the structure of the alkylammonium ion, which could be a condensed formula. A positive charge must be shown on/or close to, the N atom</p> <p>M5 is for an arrow from the N-H bond to the N atom</p> <p>Award full marks for an S_N1 mechanism in which M2 is the attack of the ammonia on the intermediate carbocation</p> <p>NB These are double-headed arrows</p>	5	<p>For M1, both words required Accept phonetic spelling</p> <p>For the mechanism Penalise M2 if NH_3 is negatively charged</p> <p>Penalise M3 for formal charge on C of the C-Br or incorrect partial charges on C-Br</p> <p>Penalise M3 for an additional arrow from the Br to something else</p> <p>The second mole of ammonia is not essential for M5; therefore ignore any species here</p> <p>Penalise once only for a line and two dots to show a bond</p> <p>Maximum any 3 of 4 marks for the mechanism for wrong organic reactant OR wrong organic product if shown</p> <p>Accept the correct use of "sticks"</p>
(c)	<p>M1 (addition) polymerisation OR poly-addition M2 poly(propene) / polypropene</p>	2	<p>Ignore "additional" Credit polyprop-1-ene and polypropylene Penalise "condensation polymerisation"</p>
(d)	 <p>M1 must show an arrow from the lone pair on the oxygen of a negatively charged hydroxide ion to a correct H atom</p> <p>M2 must show an arrow from a correct C-H bond adjacent to the C-Br bond to the appropriate C-C bond. Only award if an arrow is shown <u>attacking</u> the H atom of a correct C-H bond in M1</p> <p>M3 is independent provided it is from <u>their original molecule</u>, but CE=0 if nucleophilic substitution</p> <p>Award full marks for an $E1$ mechanism in which M3 is on the correct carbocation.</p> <p>NB These are double-headed arrows</p>	3	<p>Penalise M1 if covalent KOH</p> <p>Penalise M3 for formal charge on C of C-Br or incorrect partial charges on C-Br.</p> <p>Ignore other partial charges</p> <p>Penalise once only in any part of the mechanism for a line and two dots to show a bond</p> <p>Maximum any 2 of 3 marks for wrong organic reactant</p> <p>Accept the correct use of "sticks" for the molecule except for the C-H being attacked</p>

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5)

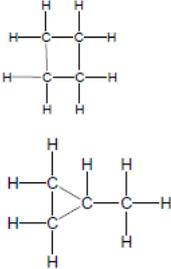
<p>M1 and M2 (either order) Any two from</p> <ul style="list-style-type: none"> purple <u>vapour/gas</u> (white solid goes to) black or black/grey or black/purple <u>solid</u> bad <u>egg smell</u> or words to this effect <p>M3 The <u>iodide ion(s) / they lose (an) electron(s)</u> OR $2\text{I}^- \longrightarrow \text{I}_2 + 2\text{e}^-$</p> <p>M4 Oxidation state of S changes from <u>+6 to -2</u> or <u>changes by 8</u></p> <p>M5 $\text{H}_2\text{SO}_4 + 8\text{H}^+ + 8\text{e}^- \longrightarrow \text{H}_2\text{S} + 4\text{H}_2\text{O}$ OR $\text{SO}_4^{2-} + 10\text{H}^+ + 8\text{e}^- \longrightarrow \text{H}_2\text{S} + 4\text{H}_2\text{O}$</p>	5	<p>Ignore misty white fumes Ignore yellow solid Ignore purple solid Ignore "goes (dark) brown"</p> <p>Or multiples for possible equation in M3</p> <p>Accept "changes by - 8"</p>
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6)

(a)	<p>M1 $\text{Cl}_2 + 2\text{Br}^- \longrightarrow 2\text{Cl}^- + \text{Br}_2$</p> <p>M2 solution goes <u>orange / yellow</u> (from colourless)</p>	2	<p>Accept a correct equation using $\frac{1}{2} \text{Cl}_2$ but no other multiples Ignore reference to brown colour Penalise incorrect observations eg fumes, precipitates</p>
(b)	<p>M1 $\text{Cl}_2 + 2\text{NaOH} \longrightarrow \text{NaClO} + \text{NaCl} + \text{H}_2\text{O}$ (NaOCl)</p> <p>M2 bleach or kills bacteria / bacteriacide / micro-organisms / microbes</p> <p>M3 <u>sodium chlorate(I)</u> ONLY</p>	3	<p>Or a correct ionic equation Ignore reference to "swimming pools" and to "disinfectant"</p>
(c)	<p>M1 $\text{Cl}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HClO} + \text{HCl}$ (HOCl)</p> <p>M2 The (health) benefit outweighs the risk or wtte OR a clear statement that once it has done its job, little of it remains OR used in (very) dilute concentrations / small amounts / low doses</p>	2	<p>Equilibrium symbol <u>required</u> in M1 Accept ionic RHS</p>
(d)	<p>M1 Silver nitrate OR AgNO_3 (with or without nitric acid)</p> <p>M2 (depends on M1) white precipitate / white solid</p> <p>M3 $\text{Ag}^+ + \text{Cl}^- \longrightarrow \text{AgCl}$</p>	3	<p>For M1 If only the formula is written then it must be correct If both the formula and the name are written then ignore incorrect attempt at the formula, but penalise an incorrect name If the reagent is incomplete eg Ag^+ ions, penalise M1 and mark on Penalise both M1 and M2 for alkaline AgNO_3 OR for the use of HCl to acidify the silver nitrate OR for Tollens' reagent</p>

7)

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(a)(i)	(Compounds with the) same molecular formula But different structural formula / different displayed formula/different structures / different skeletal formula	1 1	Allow same number and type of atom for M1 Ignore same general formula. M2 dependent on M1 Not different positions of atoms/bonds in space.
(a)(ii)	But-2-ene	1	Allow but-2-ene. Allow but 2 ene. Ignore punctuation.
a)(iii)	(2)-methylprop-(1)-ene	1	Do not allow 2-methyleprop-1-ene.
a)(iv)		1	Do not allow skeletal formulae. Penalise missing H and missing C
(b)(i)	$C_4H_8 + 2O_2 \rightarrow 4C + 4H_2O$	1	Accept multiples.
(b)(ii)	Exacerbates asthma / breathing problems / damages lungs / smog / smoke / global dimming	1	Ignore toxic / pollutant / soot / carcinogen. Do not allow greenhouse effect / global warming / acid rain / ozone.
(c)(i)	$C_{16}H_{34}$	1	Allow $H_{34}C_{16}$ C and H must be upper case.
(c)(ii)	Jet fuel / diesel / (motor) fuel / lubricant / petrochemicals / kerosene / paraffin / central heating fuel / fuel oil	1	Ignore oil alone. Not petrol / bitumen / wax / LPG / camping fuel.
(d)(i)	$C_8H_{18} + 25NO \rightarrow 8CO_2 + 12.5 N_2 + 9H_2O$	1	Accept multiples.
(d)(ii)	Ir / iridium OR Pt / platinum OR Pd / palladium OR Rh / rhodium	1	