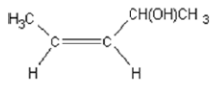


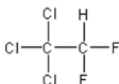
CHERRY HILL TUITION AQA CHEMISTRY AS PAPER 13 MARK SCHEME

1(a)(i)	M1 yeast or zymase M2 <u>ethanol</u>	2	Ignore "enzyme" In M2, ignore "alcohol" and ignore any formula
1(a)(ii)	M1 (Concentrated) H ₃ PO ₄ OR (Concentrated) H ₂ SO ₄ M2 <u>butan-2-ol</u>	2	Credit correct names Ignore "hydrogenphosphate or hydrogensulfate" Ignore "dilute" or "aq" Do not penalise absence of hyphens in name. In M2, ignore any formula
Question	Marking Guidance	Mark	Comments
2 (a)	Ca(OH) ₂ OR Mg(OH) ₂	1	Ignore name Could be ionic
(b)	NaF or sodium fluoride OR NaCl or sodium chloride	1	Either formula or name can score Do not penalise the spelling "fluoride" When both formula and name are written, <ul style="list-style-type: none"> penalise contradictions if the attempt at the correct formula is incorrect, ignore it and credit correct name for the mark unless contradictory if the attempt at the correct name is incorrect, ignore it and credit correct formula for the mark unless contradictory
(c)	NaClO OR NaOCl	1	Ignore name (even when incorrect) The correct formula must be clearly identified if an equation is written
(d)	Br₂ (ONLY)	1	Only the correct formula scores; penalise lower case "b", penalise upper case "R", penalise superscript Ignore name The correct formula must be clearly identified if an equation is written
(e)	M1 S OR S ₈ OR S ₂ M2 I ₂ (ONLY)	2	Ignore names penalise lower case "i" for iodine, penalise superscripted numbers Mark independently The correct formula must be clearly identified in each case if an equation is written
(f)(i)	CH ₃ CH ₂ CH=CH ₂	1	Structure of but-1-ene. Ignore name Credit "sticks" for C-H bonds
(f)(ii)	CH ₃ CH ₂ CH ₂ CH ₂ OH	1	Structure of butan-1-ol. Ignore name Credit "sticks" for C-H bonds
(f)(iii)	CH ₃ CH ₂ CH ₃	1	Structure of propane. Ignore name Ignore calculations and molecular formula Credit "sticks" for C-H bonds Ignore the molecular ion
(f)(iv)	CH ₃ CH ₂ Br or C ₂ H ₅ Br	1	Structure of bromoethane. Ignore name and structure of nitrile Credit "sticks" for C-H bonds

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Question	Marking Guidance	Mark	Comments
3 (a)(i)	$2\text{MoS}_2 + 7\text{O}_2 \longrightarrow 2\text{MoO}_3 + 4\text{SO}_2$ OR $\text{MoS}_2 + 3\frac{1}{2}\text{O}_2 \longrightarrow \text{MoO}_3 + 2\text{SO}_2$	1	Allow multiples Ignore state symbols
(a)(ii)	M1 Environmental problem Acid rain OR An effect either from acid rain or from an acidic gas in the atmosphere. M2 Use SO ₂ could be used <u>to make / to form / to produce</u> (or wtte) H ₂ SO ₄ / sulfuric acid OR <u>To make / to form / to produce</u> (or wtte) gypsum / CaSO ₄ or plaster of Paris / plaster board	2	Ignore references to the greenhouse effect Penalise reference to the ozone layer using the list principle
(a)(iii)	$\text{MoO}_3 + 3\text{H}_2 \longrightarrow \text{Mo} + 3\text{H}_2\text{O}$	1	Allow multiples Ignore state symbols
(a)(iv)	One from H ₂ is <ul style="list-style-type: none"> • explosive • (in)flammable • easily ignited 	1	Ignore "burns"
(b)(i)	To allow <u>ions to move</u> (when molten) OR <u>Ions cannot move in the solid</u>	1	
(b)(ii)	$\text{Ca}^{2+} + 2\text{e}^- \longrightarrow \text{Ca}$	1	Or multiples Ignore state symbols Ignore charge on the electron unless incorrect and accept loss of two electrons on the RHS
(b)(iii)	(High) <u>electricity</u> / <u>electrical energy</u> (cost)	1	Ignore "energy" and ignore "current"
Question	Marking Guidance	Mark	Comments
6 (a)	<u>Pentan-2-one</u>	1	ONLY but ignore absence of hyphens
(b)	<u>Functional group</u> (isomerism)	1	Both words needed
(c)(i)		1	Award credit provided it is obvious that the candidate is drawing the Z / <u>cis isomer</u> The group needs to be CHOHCH ₃ but do not penalise poor C-C bonds or absence of brackets around OH Trigonal planar structure not essential
(c)(ii)	Restricted <u>rotation</u> (about the C=C) OR No (free) <u>rotation</u> (about the C=C)	1	

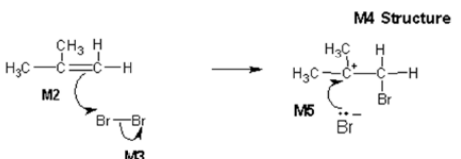
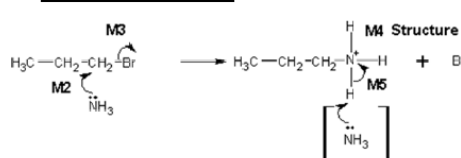
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(d)	<table border="1"> <tbody> <tr> <td data-bbox="368 226 611 432"> M1 Tollens' (reagent) <i>(Credit ammoniacal silver nitrate OR a description of making Tollens')</i> <i>(Do not credit Ag⁺, AgNO₃ or [Ag(NH₃)₂⁺] or "the silver mirror test" on their own, but mark M2 and M3)</i> </td> <td data-bbox="611 226 852 432"> M1 Fehling's (solution) / Benedict's <i>(Penalise Cu²⁺(aq) or CuSO₄ but mark M2 and M3)</i> </td> </tr> <tr> <td data-bbox="368 432 611 568"> M2 <u>silver mirror</u> OR <u>black solid or black precipitate</u> </td> <td data-bbox="611 432 852 568"> M2 <u>Red solid/precipitate</u> <i>(Credit orange or brown solid)</i> </td> </tr> <tr> <td data-bbox="368 568 611 734"> M3 (stays) colourless OR no (observed) change / no reaction </td> <td data-bbox="611 568 852 734"> M3 (stays) blue OR no (observed) change / no reaction </td> </tr> </tbody> </table>	M1 Tollens' (reagent) <i>(Credit ammoniacal silver nitrate OR a description of making Tollens')</i> <i>(Do not credit Ag⁺, AgNO₃ or [Ag(NH₃)₂⁺] or "the silver mirror test" on their own, but mark M2 and M3)</i>	M1 Fehling's (solution) / Benedict's <i>(Penalise Cu²⁺(aq) or CuSO₄ but mark M2 and M3)</i>	M2 <u>silver mirror</u> OR <u>black solid or black precipitate</u>	M2 <u>Red solid/precipitate</u> <i>(Credit orange or brown solid)</i>	M3 (stays) colourless OR no (observed) change / no reaction	M3 (stays) blue OR no (observed) change / no reaction	3 If M1 is blank CE = 0, for the clip Check the partial reagents listed and if M1 has a <u>totally incorrect</u> reagent, CE = 0 for the clip Allow the following alternatives M1 (acidified) potassium dichromate(VI) (solution); mark on from incomplete formulae or incorrect oxidation state M2 (turns) green M3 (stays) orange / no (observed) change / no reaction OR M1 (acidified) potassium manganate(VII) (solution); mark on from incomplete formulae or incorrect oxidation state M2 (turns) colourless M3 (stays) purple / no (observed) change / no reaction In all cases for M3 Ignore "nothing (happens)" Ignore "no observation"
M1 Tollens' (reagent) <i>(Credit ammoniacal silver nitrate OR a description of making Tollens')</i> <i>(Do not credit Ag⁺, AgNO₃ or [Ag(NH₃)₂⁺] or "the silver mirror test" on their own, but mark M2 and M3)</i>	M1 Fehling's (solution) / Benedict's <i>(Penalise Cu²⁺(aq) or CuSO₄ but mark M2 and M3)</i>							
M2 <u>silver mirror</u> OR <u>black solid or black precipitate</u>	M2 <u>Red solid/precipitate</u> <i>(Credit orange or brown solid)</i>							
M3 (stays) colourless OR no (observed) change / no reaction	M3 (stays) blue OR no (observed) change / no reaction							
(e)(i)	Spectrum is for Isomer 1 or named or correctly identified	1 The explanation marks in 6(e)(ii) depend on correctly identifying Isomer 1. The identification should be unambiguous but candidates should not be penalised for an imperfect or incomplete name. They may say "the alcohol" or the "alkene" or the "E isomer"						
(e)(ii)	If Isomer 1 is correctly identified, award <u>any two</u> from <ul style="list-style-type: none"> (Strong / broad) absorption / peak in the range 3230 to 3550 cm⁻¹ or specified value <u>in this range or marked correctly</u> on spectrum and (characteristic absorption / peak for) OH group / alcohol group No absorption / peak in range 1680 to 1750 cm⁻¹ or absence <u>marked correctly</u> on spectrum and (No absorption / peak for a) C=O group / carbonyl group / carbon-oxygen double bond Absorption / peak in the range 1620 to 1680 cm⁻¹ or specified value <u>in this range or marked correctly</u> on spectrum and (characteristic absorption / peak for) C=C group / alkene / carbon-carbon double bond 	2 If 6(e)(i) is incorrect or blank, CE=0 Allow the words "dip" OR "spike" OR "trough" OR "low transmittance" as alternatives for absorption. Ignore reference to other absorptions e.g. C-H, C-O						
Question	Marking Guidance	Mark	Comments					
5 (a)(i)	$\text{CH}_4 + 3\text{F}_2 \rightarrow \text{CHF}_3 + 3\text{HF}$	1						
(a)(ii)	M1 Initiation $\text{F}_2 \rightarrow 2\text{F}\cdot$ M2 First propagation $\text{F}\cdot + \text{CHF}_3 \rightarrow \cdot\text{CF}_3 + \text{HF}$ M3 Second propagation $\text{F}_2 + \cdot\text{CF}_3 \rightarrow \text{CF}_2\text{F}\cdot + \text{F}\cdot$ M4 Termination (must make C₂F₆) $2 \cdot\text{CF}_3 \rightarrow \text{C}_2\text{F}_6 \text{ or } \text{CF}_3\text{CF}_3$	4	Penalise absence of dot once only. Radical dot on $\cdot\text{CF}_3$ can be anywhere but if the structure is drawn out, the dot must be on the carbon atom. Penalise this error once only. Penalise once only for a line and two dots to show a bond. Penalise each of "F" and lower case f, once only in this clip					
(b)(i)	Displayed formula e.g. 	1	<u>All bonds</u> must be drawn out. Ignore bond angles. Penalise "sticks"					

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(b)(ii)	<p>M1 C—Cl bond OR <u>carbon-chlorine bond</u></p> <p>M2 <u>chlorine atom</u> OR <u>chlorine (free) radical</u></p> <p>M3 $2\text{O}_3 \longrightarrow 3\text{O}_2$</p>	3	<p>M1 NOT carbon-halogen</p> <p>Penalise incorrect spelling of chlorine <u>once only</u> in this clip</p> <p>M2 ignore formulae</p> <p>Ignore Cl_2 or $\text{Cl}\cdot$ or $\text{ClO}\cdot$ balanced on <u>both</u> sides of the equation</p> <p>Ignore other equations leading to the overall equation</p>
Question	Marking Guidance	Mark	Comments
6 (a)(i)	<p>M1 (yellow precipitate is) silver iodide OR AgI (which may be awarded from the equation)</p> <p>M2 $\text{Ag}^+ + \text{I}^- \longrightarrow \text{AgI}$ (Also scores M1 unless contradicted)</p> <p>M3 sodium chloride OR NaCl</p>	3	<p>For M2</p> <p>Accept multiples</p> <p>Ignore state symbols</p> <p>Allow crossed out nitrate ions, but penalise if not crossed out</p>
(a)(ii)	<p>The silver nitrate is acidified to</p> <ul style="list-style-type: none"> react with / remove <u>ions that would interfere</u> with the test prevent the formation of other <u>silver precipitates / insoluble silver compounds</u> that would interfere with the test remove (other) <u>ions that react</u> with the silver nitrate react with / remove carbonate / hydroxide / sulfite (ions) 	1	Ignore reference to "false positive"
(a)(iii)	<p>M1 and M2 in either order</p> <p>M1 <u>Fluoride</u> (ion) OR <u>F⁻</u></p> <p>M2</p> <ul style="list-style-type: none"> <u>Silver fluoride / AgF</u> is soluble / dissolves (in water) <u>no precipitate</u> would form / <u>no visible / observable</u> change 	2	<p>Do not penalise the spelling "flouride",</p> <p>Penalise "fluoride" once only</p> <p>Mark M1 and M2 independently</p>
(b)	<p>M1 $\text{Ba}^{2+} + \text{SO}_4^{2-} \longrightarrow \text{BaSO}_4$ (or the ions together)</p> <p>M2 <u>white precipitate / white solid / white suspension</u></p> <p>M3 Barium meal or (internal) X-ray or to block X-rays</p> <p>M4 <u>BaSO₃ / barium sulfate is insoluble</u> (and therefore not toxic)</p>	4	<p>For M1, ignore state symbols</p> <p>Allow crossed out sodium ions, but penalise if not crossed out</p> <p>For M2, ignore "milky"</p> <p>If BaSO₃ OR BaS used in M1 <u>and</u> M4, penalise once only</p> <p>For M3 Ignore radio-tracing</p> <p>For M4 NOT barium ions</p> <p>NOT barium</p> <p>NOT barium meal</p> <p>NOT "it" unless <u>clearly</u> BaSO₄</p>
(c)	<p>M1 $2(12.00000) + 4(1.00794) = 28.03176$</p> <p>M2 Ethene and CO or "they" have an imprecise M_r of 28.0 / 28 OR Ethene and CO or "they" have the <u>same M_r to one d.p.</u> OR These may be shown by two clear, simple sums identifying both compounds</p> <p>M3 $\text{C}_2\text{H}_4 + 2\text{O}_2 \longrightarrow 2\text{CO} + 2\text{H}_2\text{O}$ ($\text{H}_2\text{C}=\text{CH}_2$)</p> <p>M4 <u>Displayed formula</u></p> $\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C} - \text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array}$ <p>M5 Type of polymer = <u>Addition</u> (polymer)</p>	5	<p>M1 must show working using 5 d.p. for hydrogen</p> <p>Penalise "similar" or "close to", if this refers to the <u>imprecise value in M2</u>, since this does not mean "the same"</p> <p>For M3, accept $\text{CH}_2=\text{CH}_2$ OR CH_2CH_2</p> <p>For M4, <u>all bonds</u> must be drawn out including those on either side of the unit.</p> <p>Penalise "sticks"</p> <p>Ignore brackets around <u>correct</u> repeating unit but penalise "n"</p> <p>Penalise "additional"</p>

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(b)	<p>M1 Electrophilic addition</p>  <p>M2 must show an arrow from the double bond towards the Br atom of the Br-Br molecule</p> <p>M3 must show the breaking of the Br-Br bond.</p> <p>M4 is for the structure of the tertiary carbocation with Br on the correct carbon atom.</p> <p>M5 must show an arrow from the lone pair of electrons on the negatively charged bromide ion towards the positively charged carbon atom.</p> <p>N.B. These are double-headed arrows</p>	<p>5</p> <p>For M1, both words required.</p> <p>For the mechanism</p> <p>M2 Ignore partial negative charge on the double bond.</p> <p>M3 Penalise partial charges on Br-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><u>Max any 3 of 4 marks for the mechanism</u> for wrong organic reactant or wrong organic product (if shown) or primary carbocation.</p> <p>If HBr is used, max 2 marks for their mechanism</p> <p>Accept the correct use of "sticks"</p>
(c)	<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 C atom.</p> <p>M3 must show the movement of a pair of electrons from the C-Br bond to the Br atom. M3 is independent provided it is from their <u>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>N.B. These are double-headed arrows</p>	<p>5</p> <p>For M1, both words required.</p> <p>Penalise M2 if NH₃ is negatively charged.</p> <p>Penalise M3 for formal charge on C or incorrect partial charges</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><u>Max any 3 of 4 marks for the mechanism</u> for wrong organic reactant (or wrong organic product if shown)</p> <p>Accept the correct use of "sticks"</p>