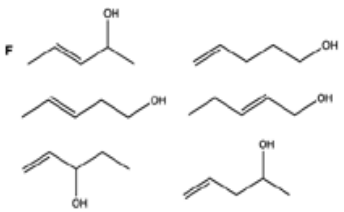
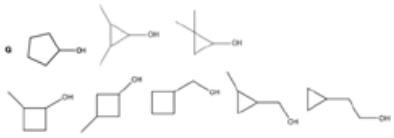
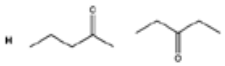
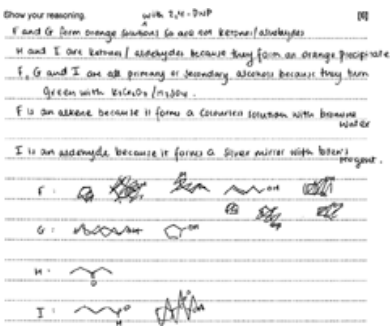
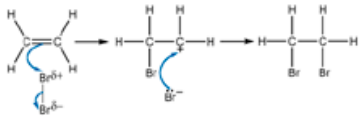
Mark scheme

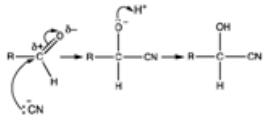
Question			Answer/Indicative content	Marks	Guidance
1		i	Green solution Cr^{3+} **OR** $[Cr(H_2O)_6]^{3+}$ ✓ Orange solution $Cr_2O_7^{2-}$ ✓ Formulae **AND** charges must be correct	2	**Green solution** **IGNORE** H^+ **ALLOW** $Cr_2(SO_4)_3$ **OR** $CrCl_3$ **OR** Cr^{+3} Orange solution **IGNORE** H^+ **ALLOW** $K_2Cr_2O_7$ **OR** $Na_2Cr_2O_7$ **DO NOT ALLOW** Cr^{6+} **ALLOW** 1 mark for correct formulae but wrong way round **Examiner's Comments** Although high attaining candidates responded with the formulae of chromium-containing species, it was common to see organic compounds being suggested. Consequently, a large proportion of candidates did not score either of the 2 marks. Many candidates seem to expect to only give organic species in their responses on this paper and would benefit from understanding that inorganic species may also need to be provided.
		ii	**Level 3 (5-6 marks)** Reaches a comprehensive conclusion to determine possible correct structures for **ALL** of **F**, **G**, **H** and **I** **AND ALL** functional groups of **F**, **G**, **H** and **I** *There is a well-developed line of reasoning which is clear and logically structured.* *The information presented is relevant and substantiated.*	6	Indicative scientific points may include: **Identity of F, G, H and I showing CORRECT structures** 

			Level 2 (3-4 marks) Reaches a conclusion to determine possible **correct** structures for two of **F**, **G**, **H** and **I** **AND most** functional groups of **F**, **G**, **H** and **I** *There is a line of reasoning presented with some structure.* *The information presented is relevant and supported by some evidence.* **Level 1 (1-2 marks)** Reaches a simple conclusion to determine a possible correct structure for one of **F**, **G**, **H** and **I** **OR** some functional groups of **F**, **G**, **H** and **I** *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*		**ALLOW** enols for F, e.g.  For **G**, **DO NOT ALLOW** tertiary -OH. e.g.  For **G, DO NOT ALLOW** tertiary -OH. e.g.    **IGNORE** names, even if incorrect For communication, a typical 'logical structure' would link functional groups to **SOME** of the test results, e.g. **2,4-DNP** **H** and **I** have carbonyl group/aldehyde or ketone **$H^+/Cr_2O_7^{2-}$** **F**, **G** and **I** are primary or secondary alcohols or aldehydes **Bromine** **F** is unsaturated/has C=C **Tollens** **I** is aldehyde ***Correct functional groups may be shown in correct structures*** **Examiner's Comments**

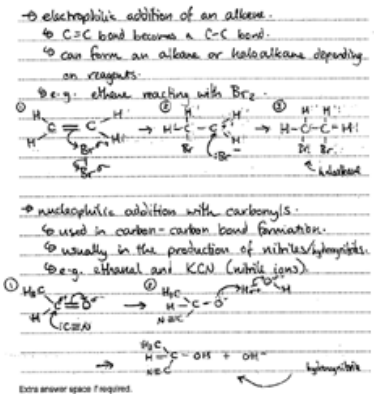
					This Level of Response question was answered well with many candidates identifying compounds **F-I** correctly to reach Level 3. Structures were usually shown skeletally and this practice is to be recommended. Not only is it far quicker and clearer, it eliminates writing every atom in a displayed or structural formula. Some candidates were not given marks for missing hydrogen atoms or for 'sticks' being shown. In these structures, the chemical meaning of a stick is a terminal CH_3 group. Candidates were also asked to show how the results of the chemical tests helped the identification of the unknown compounds and this formed the basis of the communication strand of the LOR mark. Candidates answered this part of the analysis extremely well and most were given marks for their good communication skills. This question differentiated very well between well-prepared and less confident candidates. The latter often did not know how the results of these organic tests can be used to identify the functional groups present. It was common for such candidates to identify only one of the four compounds, scoring within Level 1 only. **OCR Support** To better prepare candidates, we recommend using either the digital multiple choice quizzes on Teach Cambridge or creating targeted practise materials using ExamBuilder. If you are unsure of how to access these or ways to make the most of them, get in touch via science@ocr.org.uk.

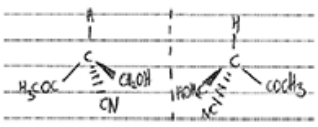
					Exemplar 3  This exemplar is concise and very clear. The candidate has clearly linked the result of each test to the functional groups that must be present. The candidate has drawn skeletal formulae and clearly has experimented with many possible structures before deciding on which must be correct. Notice that the candidate has crossed out the structures that they have rejected. This is an important exam technique - if two structures are drawn, with one correct and the other incorrect, the correct structure cannot be given marks. The response is clearly at Level 3 for the four correct structures and the good communication ensures that the communication strand can be given. This response received all 6 marks.
			Total	**8**	
2			*Refer to marking instructions on page 5 of mark scheme for guidance on marking this question.* **Level 3 (5-6 marks)** Describes addition reactions including the mechanisms of **one** alkene **AND one** carbonyl compound **AND** some additional details *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*	6	**Indicative scientific points may include:** **<u>Reaction of alkene and mechanism</u>** • Suitable reaction, e.g. alkene and Br_2 **OR** X_2 **OR** HX **OR** H_2O **OR** H_2 **OR** polymerisation *May be shown within mechanism* • Mechanism, e.g.

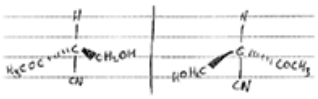
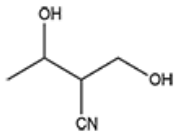
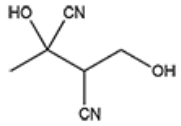
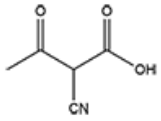
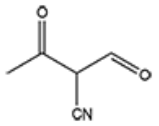
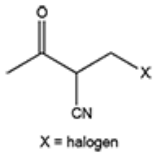
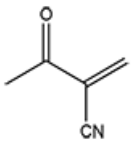
			Level 2 (3-4 marks) Describes an addition reaction including the mechanism of **one** alkene **OR one** carbonyl compound **AND** some additional details **OR** Describes addition reactions including an attempt to give the mechanisms of **one** alkene **AND one** carbonyl compound *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1-2 marks)** Selects suitable reagents for addition reactions of **one** alkene **AND one** carbonyl compound. **OR** Attempts to describe an addition reaction including an attempt to give the mechanism of **one** alkene **OR one** carbonyl compound. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*		 **ALLOW** mechanism for H_2 **AND** H_2O to be shown as electrophilic addition even though incorrect - consider impact on communication statement. **ALLOW** suitable non-specification alternative e.g. HCN **Additional details (NOT INCLUSIVE)** • Electrophilic addition • Systematic names of reactants and/or products • Details of functional group interconversion e.g. alkene to dibromo • Details on reagents required e.g. - H_2 with Ni Catalyst - $H_2O(g)$ with H_3PO_4 catalyst • Explanation of major and minor product from electrophilic addition of HX with unsymmetrical alkene • Explanation of carbocation intermediate stability • Heterolytic fission **<u>Reaction of carbonyl compound and mechanism</u>** Suitable reactions, e.g. • Aldehyde or ketone and HCN **OR** H^- e.g. RCHO + HCN → RCH(OH)CN *May be shown within mechanism* • Mechanisms, e.g.

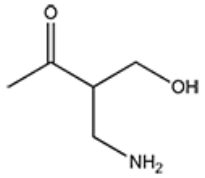
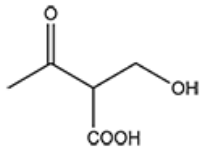
					 **OR** H_2O instead of H^+ for 2nd stage **ALLOW** suitable non-specification alternative e.g. H_2O, NH_3, 1° amine **IGNORE** reactions with carboxylic acids (or derivatives) i.e. addition-elimination mechanism (condensation reaction) **Additional details (NOT INCLUSIVE)** • Nucleophilic addition • Systematic names of reactants and/or products • Details of functional group interconversion e.g. aldehyde to hydroxynitrile • In reduction, aldehydes form 1° alcohols and ketones form 2° alcohols • Details on reagents required e.g. - formation of hydroxynitriles with $NaCN/H^+(aq)$ - formation of alcohols with $NaBH_4$ • Heterolytic fission Aspects of the **communication statement** being met might typically include: • Curly arrows starting from lone pairs / negative charges / bonds. • All reactants and intermediates have relevant charges and dipoles. • Mechanisms given are chemically feasible for the reactions.

					• No additional incorrect reactants have been included. **Examiner's Comments** A very good proportion of candidates scored all 6 marks, giving well-drawn mechanisms with some additional details such as mechanism names, functional group interconversions or other additional reaction information. Some attempted to 'describe' the mechanism using only words rather than drawing it out with a conventional curly arrow mechanism. Candidates may need more clarity on what 'describe' means in an organic chemistry context. Equally, a few gave just the mechanisms with no additional details, limiting themselves to Level 2. Candidates were usually more confident with the addition to alkenes using an electrophilic addition mechanism. Some gave additional details about major and minor products, although not always relevant as for a symmetrical alkene. Some represented the addition of hydrogen or water to alkenes via an electrophilic addition mechanism. While not correct it showed an understanding of mechanisms and a correct addition reaction for alkenes, so credit was given. Some candidates included incorrect reagents for reactions, such as acid catalysts with addition of a hydrogen halide, or incorrect conditions, such as the requirement for ultraviolet light on addition of a halogen. The addition to carbonyl compounds was not always as well-described. Some candidates struggled to identify carbonyl compounds, selecting carboxylic acids or their derivatives, with attempts at addition-elimination mechanism i.e.

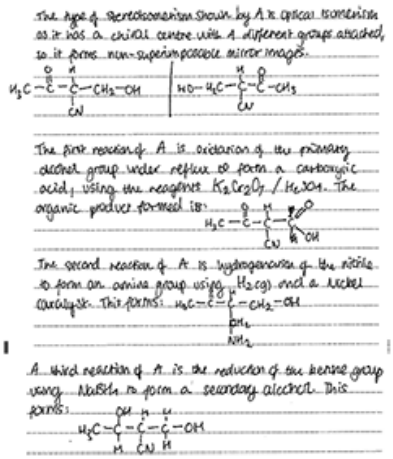
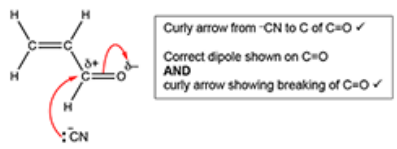
					condensation reactions. Some gave incorrect reagents for carbonyls, including H_2O and HBr. However, some used off-specification reactions such as the addition of H_2O to form a geminal diol which was given but as the mechanism differs from the nucleophilic addition mechanism taught in this specification, full credit was rarely achieved. Some also considered oxidation of aldehyde or ketone to be an addition reaction. Most who presented a correct mechanism for addition to a carbonyl used the reaction with cyanide rather than reduction with $NaBH_4$. Common errors included arrows coming from the N of CN^-, a lack of putting dipoles on carbonyl bonds, missing charges on O in intermediates or showing the wrong direction of arrows. **OCR support** The OCR Guide to Level of Response questions can be found on Teach Cambridge and can be used to help your students better understand this type of question. Exemplar 1  Level 3 – 6 marks Two correct addition mechanisms have been shown, one for an alkene

					and one for a carbonyl compound. Additional details include the names of the mechanisms, names of the functional groups in the products, and the fact that a C-C bond is formed in the second mechanism. All curly arrows, charges and dipoles are correctly positioned so this response was also given the communication mark.
			Total	**6**	
3			**C**	1	**Examiner's Comments** The majority of candidates were able to correctly identify the two functional groups and the correct corresponding test i.e. alkene using bromine water and primary alcohol using 2,4-dinitrophenylhydrazine. The most common incorrect response was B.
			Total	**1**	
4			**Level 3 (5–6 marks)** Suggests **ALL** of the following • Reagents and conditions for **3** functional groups • Products for **3** functional groups • Optical isomerism with description and 3D optical isomers shown *There is a well-developed line of reasoning which is clear and logically structured.* *The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Suggests **two** of the following • Reagents and conditions for **2** functional groups • Products for **2** functional groups • Optical isomerism with description **OR** an attempt to show 3D optical isomers *There is a line of reasoning presented with some structure.* *The information presented is relevant and*	6 (AO 3.1 ×3) (AO 3.2 ×3)	**CHECK TOP OF QUESTION FOR RESPONSES** --- *Indicative scientific points may include:* **Stereoisomerism** • Optical isomerism identified with description: e.g. chiral centre /non-superimposable mirror images • 3D Optical isomers drawn, e.g.  *Description is subsumed in 3D diagrams* **Reactions of ketone/carbonyl e.g.** $NaBH_4$

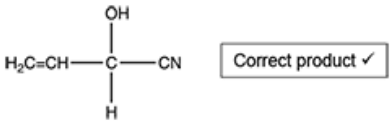
			supported by some evidence. **Level 1 (1–2 marks)** Suggests **two** of the following • Reagents and conditions for **1** functional group • Products for **1** functional group • Identifies optical isomerism with description **OR** an attempt to show 3D optical isomers *There is an attempt at a logical structure with a line of reasoning.* *The information is in the most part relevant.* **0 mark** *No response or no response worthy of credit.* **Key points to check** *CHECK TOP OF QUESTION for responses* *IGNORE CONNECTIVITY* *in 3D isomer structures* • *IGNORE bond angles* • *Wedges needed* • *ALLOW*  Some responses will not fit into this exact pattern and a best-fit match may be needed **Clear communication** Focus on • Clear diagrams of 3D optical isomers • Diagrams of unambiguour structures • Reagents and functional group formed are linked • Communication is more a general feel for the quality of theresponses.		 HCN **OR** CN^-/H^+ (e.g. $NaCN/H^+$)  **Reactions of –OH, e.g.** $H^+/Cr_2O_7^{2-}$ **OR** $H_2SO_4/K_2Cr_2O_7$ reflux  $H^+/Cr_2O_7^{2-}$ **OR** $H_2SO_4/K_2Cr_2O_7$ distil  NaBr/KBr/Br^- **AND** acid/H^+ **OR** HBr  Acid/H^+ (catalyst) (e.g. H_2SO_4)  **Reactions of C–CN, e.g.**

			Slips and minor errors in structures • Do not penalise the odd slip or omission, e.g. An extra C in a chain; a C short in a chain, C shown instead of CH_2 or skeletal • You need to judge the extent of any slip based on the whole response. Remember that each candidate		H_2 **AND** metal catalyst e.g. Ni, Pt, Pd  H^+/H_2O e.g. HCl(aq) or H_2SO_4(aq)  **OTHER REAGENTS, CONDITIONS AND PRODUCTS** **e.g. $LiAlH_4$ as reagent** **Check with Team Leader** **Examiner's Comments** Overall, candidates performed well when answering this question. They were required to identify that compound **A** shows optical isomerism and to choose a reaction for each of the three functional groups. Candidates were also expected to use structures for the organic products. To achieve the highest level of response, a description of optical isomerism should be accompanied by 3D diagrams of the optical isomers. Optical isomerism was usually identified, with associated diagrams with almost all candidates identifying the chiral centre. Most attempted 3D diagrams but candidates do need to take care that the groups attached to the chiral C atom are those in compound A and that no parts of chains are omitted. Optical isomers do also require use bold and dashed wedges to be used.

					Most candidates showed good knowledge and understanding of reactions for the three functional groups. • For the primary alcohol, most chose $H^+/Cr_2O_7^{2-}$, with distil (→ aldehyde) or reflux (→ carboxylic acid); a significant number chose a concentrated acid (→ alkene) or Br–-/H+ (→ haloalkane) • For the ketone, most chose $NaBH_4$ (→ secondary alcohol) • For the nitrile, most chose either H_2/Ni (→ amine) or H^+(aq) (→ carboxylic acid). Clear diagrams of the products were usually seen although many omitted a CH_2 from the amine branch for hydrolysis of the nitrile or an extra CH_2 in the aldehyde or carboxylic acid branch from oxidation of the primary alcohol. Some candidates chose 2,4-DNP for a reaction of the ketone and treated the question as one requiring tests, and then proving that the compound was a ketone from no reaction with Tollens' reagent. The question asked for the organic product and the 2,4- DNP product is beyond the demands of this specification (although this was seen very rarely). Candidates adopting this reaction were limiting the extent of their response and candidate should have considered this requirement before selecting 2.4-DNP. Exemplar 2

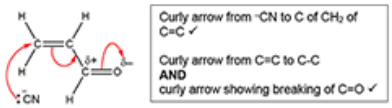
					 This exemplar shows a good response that lacks 3D diagrams for the optical isomers. The candidate has clearly given reagents and conditions and has shown the organic products. In the response, you can see that the candidate initially showed an extra CH_2 in the –COOH branch, and a mistake in the amine branch. The absence of 3D structures limits the response to Level 2 and 4 marks have been awarded for choosing correct and relevant reagents and conditions, and for the clear communication of the structures.
			Total	**6**	
5	a	i	**NOTE**: curly arrows can be straight, snake-like, etc. but **NOT** double headed or half headed arrows --- **Nucleophilic attack** *2 marks*  Curly arrow from $^-$CN to C of C=O ✓ Correct dipole shown on C=O **AND** curly arrow showing breaking of C=O ✓ --- **Intermediate** *1 mark*	4 (AO1.2 ×2) (AO2.5 ×2)	**ANNOTATIONS MUST BE USED** --- **1st curly arrow must** • go to the C atom of C=O **AND** • start from, **OR** be traced back to any point across width of lone pair on C of $^-$ **:**CN **OR** **:**CN^- • **OR** start from – charge on C of $^-$CN (then lone pair on CN^- does not need to be shown) 

Product *1 mark*

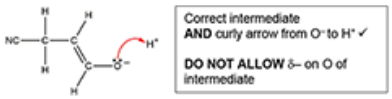


Possible alternative 1,4 (conjugate) addition can be credited as follows (not in specification):

Nucleophilic attack *2 marks*



Intermediate *1 mark*



Product *1 mark*

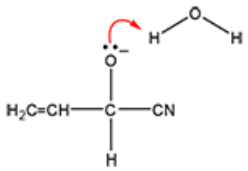
2nd curly arrow must

- start from, **OR** be traced back to any part of $^{\delta+}C{=}O\ ^{\delta-}$ bond
  AND
- go to $O^{\delta-}$ (across width of $O^{\delta-}$)

3rd curly arrow must

- go to H^+
  AND
- start from, **OR** be traced back to any point across width of lone pair on $:O^-$
- **OR** start from – charge of O^- of intermediate (then lone pair on O^- does not need to be shown)

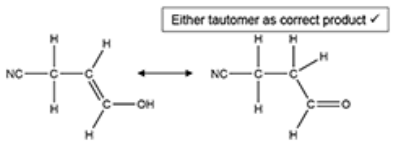
NOTE: For arrow to H^+
ALLOW arrow to H of H_2O
i.e.

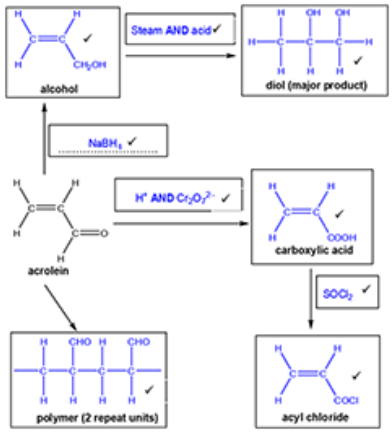


IGNORE attempt to draw curly arrow showing breaking of H–O in H_2O

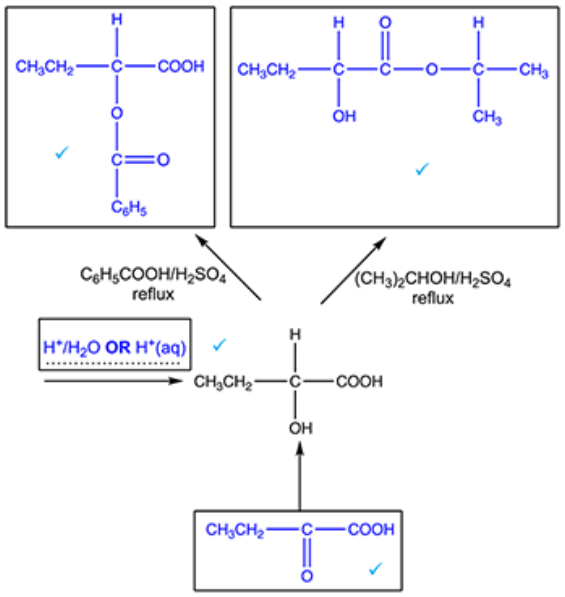
IGNORE lack of dipole on H_2O

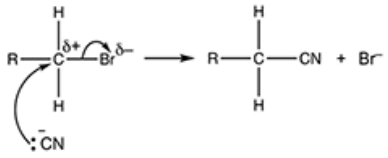
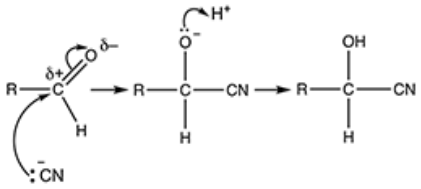
IGNORE absence of OH^- as 2nd product
Otherwise this more difficult mechanism could cost 2 marks

					**Product mark can only be given here if clear from mechanism that there is nucleophilic attack of CH_2 in C=C.** Same product could be seen with an attempt at electrophilic addition across C=C. **Examiner's Comments** There were many excellent examples of precisely drawn mechanisms for the reaction of acrolein with sodium cyanide in acidic conditions and so most candidates gained at least 3 marks. The importance of accuracy when drawing curly arrows needs to be emphasised when teaching mechanisms - arrows must start at lone pairs or negative charges or come from bonds. Many candidates lost marks due to incorrect arrows. Common errors included the use of NaCN or HCN rather than the cyanide ion, the first curly arrow coming from the N of CN-, omission of partial charge across the C=O double bond and addition of partially charges to hydrogen or oxygen. Lower scoring responses often included an intermediate and/or product containing sodium. Some attempted electrophilic addition using HCN across the double bond. A few gained some credit for the mechanism for a competing reaction with nucleophilic addition on CH_2 of C=C. This is not covered in the A Level specification and no candidates scored full marks for this alternative.
		ii	Nucleophilic addition ✓	1 (AO1.1)	**IGNORE** just 'addition' **Examiner's Comments** Most candidates were able to recall the correct response here, especially

					for those more confident with drawing out the mechanism. The most common incorrect response was nucleophilic substitution. Some suggested reduction or nucleophilic addition elimination. Misspellings of 'nucleophilic' were often seen.
	b		 **Only possible alternative that can gain credit:** Reaction with $NaCN/H^+$ 	9 (AO1.2 ×4) (AO2.5 ×5)	**ALLOW** any combination of skeletal **OR** structural **OR** displayed formula as long as unambiguous **ALLOW** Correct names instead of formula for all reagents throughout e.g. For H^+ and $Cr_2O_7^{2-}$, **ALLOW** acidified dichromate For Steam and acid • For steam, **ALLOW** $H_2O(g)$ **OR** H_2O with T ≥ 100°C • For acid, **ALLOW** H^+ **OR** H_2SO_4 **OR** H_3PO_4 • Note both needed for 1 mark. **ALLOW** either way round. For $NaBH_4$ • **IGNORE** water / aqueous /acid • **ALLOW** $LiAlH_4$ For $SOCl_2$, **ALLOW** PCl_5 **OR** $COCl_2$ • **IGNORE** H^+ OR HCl For H^+ and $Cr_2O_7^{2-}$, **ALLOW** H_2SO_4 **AND** $K_2Cr_2O_7$ **OR** $Na_2Cr_2O_7$ **ALLOW** Tollens' reagent **IGNORE** connectivity except **DO NOT ALLOW** -COH for aldehyde For polymer **ALLOW** alternating side chains. **IGNORE** brackets and use of 'n' 'End bonds' **MUST** be shown (solid or dotted) **IF** $NaCN/H^+$ reacted with acrolein instead of $NaBH_4$

					• No mark for NaCN/H+ **OR** HCN • Unsaturated alcohol award mark for product as shown • Final product must have CN hydrolysed as shown **Examiner's Comments** This question discriminated well. Many candidates were able to demonstrate an excellent knowledge of organic reactions and it was not uncommon to see scores of at least 7 marks. This question identified which candidates had learned their synthetic routes including necessary reagents and conditions. Marks were often lost for small details such as missing Hs (check all Cs have four bonds) or not specifying that steam is required for hydration of alkenes or missing the acid needed for oxidation. Many suggested the use of NaOH or just a mixture of acids to product the diol. The minor 1,3-diol or 1,1-diol product was often seen. The sequence leading to an acyl chloride from acrolein was usually the most well answered. However, quite a few tried to use HCl to make the acyl chloride. Many lost marks for the polymer for incorrect connectivity on the aldehyde, e.g. -COH or attempting to make a polymer via connection of the aldehyde group. **OCR support** This topic guide provides a summary of synthetic routes. Copies of the summary posters without the conditions can be found on Teach Cambridge. This should be used in conjunction with the organic synthesis topic exploration pack.
			Total	**14**	

6			**A**	1 (AO1.2)	**Examiner's Comments** Drawing out the structures often helped candidates to identify each functional group and therefore spot the ketone which is key to correctly answering this question.
			Total	**1**	
7				4 (AO2.5×4)	**ALLOW** any combination of skeletal **OR** structural **OR** displayed formula as long as unambiguous **ALLOW** any vertical bond to the OH group e.g. **ALLOW** **OR** **IGNORE** connectivity of CH_3CH_2 group **IGNORE** inorganic by-products **ALLOW** HCl/H_2O, H_2SO_4/H_2O **IGNORE** dilute **Examiner's Comments** The majority of candidates were able to identify at least one of the structures. A significant number of candidates did not check the number of bonds of each atom in their structures and frequently had too many or too few hydrogen atoms attached. Most candidates identified that acidic conditions were required but some missed the aqueous condition that was also required for the mark.
			Total	**4**	
8			**Level 3 (5–6 marks)** Describes, in detail, reactions of **two** aliphatic compounds that form a C–C bond **AND** mechanisms for the **two** aliphatic	6 (AO1.2×4) (AO2.5×2)	**Indicative scientific points may include:** **Reactions of aliphatic compounds**

			reactions. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Describes a reaction of **one** aliphatic compound that forms a C–C bond with few omissions/errors. **AND** mechanism for **one** aliphatic reaction. **OR** Describes reactions of **two** compounds that forms a C–C bond **AND** attempts a mechanism for **one** of the reactions *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Selects suitable reagents for reactions of **two** compounds that form a C–C bond. **OR** Attempts to describe a reaction and mechanism of **one** compound that forms a C–C bond, with omissions/errors. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit*.		**and mechanisms** • Haloalkane, RX and CN^- → RCN + X^- Reagents: NaCN and ethanol Reaction: Nucleophilic substitution Mechanism:  • Aldehyde or ketone and HCN e.g. RCHO + HCN → RCH(OH)CN Reagents: NaCN and H^+ Reaction: Nucleophilic addition Mechanism:  OR H_2O instead of H^+ for 2nd stage **If alternative reactions are shown contact your TL** **e.g. radical substitution, polymerisation** **Examiner's Comments** This question differentiated well. Candidates who were given Level 3 (5-6 marks) understood the term aliphatic and were able to provide two different mechanisms that produced a C-C bond. The most

					common responses seen involved the nucleophilic substitution of a halogenoalkane and a cyanide ion and the nucleophilic addition of a carbonyl with a cyanide ion. Some candidates offered radical substitution mechanisms, detailing initiation, propagation and termination steps, with the termination step producing a C-C bond. Candidates who scored Level 2 (3-4 marks) frequently detailed a reaction involving aromatic compounds or polymerisation of alkenes for which they were unable to give a mechanism.
			Total	**6**	
9		i	(Add) 2,4-dinitrophenylhydrazine **AND** orange/yellow/red precipitate ✓ Take melting point (of crystals) ✓ Compare to known values/database ✓	3 (AO1.2 × 3)	**ALLOW** errors in spelling **ALLOW** 2,4(-)DNP **OR** 2,4(-)DNPH **ALLOW** Brady's reagent or Brady's Test **ALLOW** solid **OR** crystals **OR** ppt as alternatives for precipitate **Mark second and third points independently of response for first marking point** **DO NOT ALLOW** 2nd and 3rd marks for taking and comparing boiling points **OR** chromatograms
		ii	Tollens' (reagent) **AND** Silver (mirror/precipitate/ppt/solid) ✓	1 (AO1.2)	**ALLOW** ammoniacal silver nitrate **OR** Ag^+/NH_3 **ALLOW** black ppt **OR** grey ppt **ALLOW** $Cr_2O_7^{2-}/H^+$ **AND** Turns green ✓ **IGNORE** reference to conditions, e.g. Heat or reflux **----------** **IF** other reagents are seen e.g. Fehling's or Benedict's, contact your Team Leader

					Examiner's Comments The use of 2,4-dinitrophenylhydrazine as a test for the carbonyl group is well known by candidates at this level. The majority of the cohort correctly identified this test and the subsequent analysis of the melting point of the products as a method of identifying each compound. Lower ability candidate responses made reference to analysis of the boiling points or omitted the reference to analysis of the melting points. Almost all candidates were able to correctly describe the use of Tollens' reagent as a test for an aldehyde fictional group
			Total	**4**	