ANSWERS: **Reaction schemes**

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| **2017** | **Evidence** | **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| (a) |  | • ONE correct reagent and one reaction type.  • TWO correct structures. | • SEVEN correct.  OR  All correct showing understanding of the chemistry but with repeated error. | • ALL NINE correct, including  identification of both minor and major products. |

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| **2016** | **Evidence** | **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| (a) | Structures:  **S1:** CH3COOCH2CH2CH3  **S2:** CH3CH2CH2OH  **S3:** CH3CH=CH2  **S4:** CH3CH2CH2Cl  **S5:** CH3CH(Cl)CH3  **S6:** CH3COCl  **S7:** CH3CONHCH2CH2CH3  Reagent **1** = H2O / H+ (dilute acid)  Reagent **2** = conc. H+ (H­2SO4 or H3PO4)  Reagent **3** = NH3 (*alc*) or conc. | * Any THREE correct structures. * Any ONE fully correct reagent. | * At least SEVEN correct including ONE fully correct reagent. | * All structures and reagents correct. |
| (b) | Step 1: **Butan-1-ol to but-1-ene.**  Dehydration reaction (elimination reaction) using conc H2SO4.    Step 2: **But-1-ene to butan-2-ol.**  Hydration reaction (addition reaction) using dil. H2SO4 (H+/H2O)    Step 3: **Butan-2-ol (Major product) to butan-2-one**.  Oxidation reaction of secondary alcohol to from a ketone using Cr2O72– / H+ under reflux.    Other workable scheme are possible. | * ONE correct reagent. * ONE correct conversion step. | * Workable scheme, with at least one fully correct reagent. | * All correct with full understanding. |

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| **2015** | **Structures**  A = CH3CH2CH2NH2  B = CH3CH2CH2OH  C = CH3CH2CHO OR CH3CH2COOH  D = CH3CH2COOCH2CH3  E = CH3CH2COCl  **Reagents**  1 = NaOH(*aq*) OR KOH(*aq*)  2 = Cr2O72– / H+ or MnO4– / H+  3 = NaBH4 OR LiAlH4  4 (i) = CH3CH2OH or ethanol  4 (ii) = concentrated H2SO4  5 = NH3 (alcoholic / gas / conc). | * Any THREE correct structures. * Any THREE correct reagents. | * Any EIGHT correct structures / reagents. | * ALL structures and reagents correct.   (Note: One error or omission – E7). |

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| **2014** | **Evidence** | **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| (a) | **A** = Propan-2-ol  91391assq3a1b  **B** = Propan-1-ol  **91391assq3a2b**  **C** = Propanone  91391assq3a3b  **D** = Propanoic acid  91391assq3a4b  **E** = Propanoyl chloride  91391assq3a5b  **F** = Propanamide  91391assq3a8  **G** = Propyl propanoate  91391assq3a6b  **H** = Methyl ethyl propanoate (not required)  91391assq3a7 | * FIVE correct structures. * FIVE correct names. | * ELEVEN structures or names correct. | * FOURTEEN structures or names correct.   (*Penalise once for –HO / –H2N.*) |

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| **2013** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
|  | **1** SOCl2  (Accept PCl3, PCl5 or conc HCl / ZnCl2) | * ONE correct | * ALL correct |  |

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| **2012** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| 1. |  | Two correct structural  formula WITH names. | THREE correct structural formula with names. | ALL formulae and names correct. |

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| 2. |  | Any TWO reactions  correct including  reagents.  (States and / or  conditions not  required.) | Any THREE reactions  correct including  reagents.  (States and / or  conditions ARE  required.) | ALL reactions correct .  *(Allow one reaction*  *error.)*  (States and / or  conditions ARE  required.) |

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| **2011** | A  90698assq4a1  propyl propanoate  B  sodium propanoate  C  90698assq4a2  propan-1ol (1-propanol)  D  90698assq4a3  propanoic acid propanoyl chloride    OR methylpropanoate  E  90698assq4a4  propanal propanoic acid  F  90698assq4a5 | Reagent 1 = NaOH(*aq*)  Reagent 2 = NaOH(*aq*), accept NaOH(*alc*) if D = acid chloride, Na2CO3 (*aq*).  Reagent 3 = PCl5 / SOCl2 / PCl3.  Reagent 4 = Cr2O72– / H+ or MnO4– / (H+) / Fehling / Benedicts/ Tollens  or if D is given as acid chloride, accept PCl5 / SOCl2 / PCl3./ methanol or other alcohol + acid to give ester in D. | THREE correct consecutive structures. OR  names  PLUS  one linking condition. | No more than two errors.  (Allow incorrect structure with its correct name as one error.) | Correct.  One minor error.  Eg reagent 2 NaOH without (aq).  Eg propanol without 1. |

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| **2010** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **1**. | 90698q4aass    Substitution.  The alcohol group is removed and substituted with the chlorine side chain. | * Correct equation.   AND  Reaction type with reason | * Correct equation.   AND Reaction type with reason. | • Correct equation.  AND Reaction type with reason. |

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| **2.** | PRODUCTS (letters) REAGENTS (numbers)  **1** Cr2O72– / H+ (or MnO4– / H+)  **A**  90698q2aass  **B**  90698q2bass  **2**  90698q2fass   1. conc. H2SO4   **C**  90698q2cass  **D**  90698q2dass   1. KOH / NaOH   **E**  90698q2eass  **5** Cr2O72– / H+ (or MnO4– / H+) | Any FOUR answers correct. | SIX answers correct including at least TWO reagents. | Correct pathways (only ONE error allowed). |

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| **2009** | Reagent 1 H+ / Cr2O72– OR MnO4– / H+ OR MnO4–  Reagent 2 PCl3 / PCl5 / SOCl2 OR HBr OR SOBr2  Reagent 3 PCl3 / PCl5 / SOCl2 / conc HCl with ZnCl2 (not just conc HCl)  Reagent 4 NH3 (alcohol not required)  90698q4aass  Alternative answer:  Reagent 1 (as above) and Reagent 2 = Reagent 1 OR Tollens / Benedicts / Fehlings  90698q4bass | * TWO reagents and TWO structures correct. | * Scheme has no more than TWO errors. | * Scheme correct. |

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| **2008** | |  |  | | --- | --- | | **Reagent** | **Formula** | | 1 | PCl3, or PCl5, or SOCl2, or HCl | | 2 | NH3 | | 3 | Cr2O72– / H+ or MnO4-/H+ | | 4 | PCl3, or PCl5, or SOCl2 | | 5 | CH3NH2 |  |  |  | | --- | --- | | **Product** | **Name or formula** | | 1 |  | | 2 |  | | 3 |  | |  |  |   OR   |  |  | | --- | --- | | **Reagent** | **Formula** | | 1 | PCl3, or PCl5, or SOCl2, or conc HCl | | 2 | NH3 | | 3 | Cr2O72–/H+ or MnO4-/H+ | | 4 | Cr2O72– / H+ or MnO4-/H+ | | 5 | CH3NH2 |  |  |  | | --- | --- | | **Product** | **Name or formula** | | 1 |  | | 2 |  | | 3 | 90698assq5 | |  |  |  |  |  | | --- | --- | | **Reagent** | **Formula** | | 1 | PCl3, or PCl5, or SOCl2, or conc HCl | | 2 | NH3 | | 3 | Cr2O72– / H+ or MnO4-/H+ | | 4 | PCl3, or PCl5, or SOCl2 NOT conc HCl | | 5 | CH3NH2 | | In the blank boxes provided:  Either  Two correct products and the reagents that form them (may omit H+)  OR  three consecutive boxes correct. | In the blank boxes provided:  EITHER  Two series of 3 consecutive boxes correct  OR  all correct except for one of the reagents. | Scheme correct. |

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