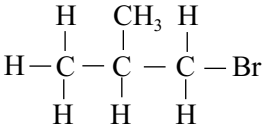
# Answers to examination-style questions

| Answers | Marks | Examiner's tips |
|---|---|---|
| **1 (a)** prevents ultraviolet rays harming people, etc. | **1** | |
| **(b)** $Cl\cdot + O_3 \rightarrow ClO\cdot + O_2$ | **1** | |
| $ClO\cdot + O_3 \rightarrow Cl\cdot + 2O_2$ | **1** | |
| **(c)** solvents | **1** | |
| **2 (a)** 1-bromobutane | **1** | |
| correct structure for 1-bromo-2-methylpropane | **1** | Don't forget to put the numbers into the names. |
|  | | |
| **(b)** elimination | **1** | If you put other words, e.g. nucleophilic, before elimination this is wrong. It is actually elimination following the reaction of a base. |
| correct structure | **1** | |
| curly arrow from lone pair of electrons on oxygen of hydroxide ion | **1** | You must put the lone pair of electrons on the oxygen atom and a negative charge. |
| curly arrow from the middle of the C–H bond to the middle of the C–C bond | **1** | You can only score this if a good attempt has been made at third mark. You must show all the H atoms. |
| **(c)** nucleophile *or* electron pair donor | **1** | This is not acting as a base here. |
| $CH_3CH_2CH_2CH_2Br + 2NH_3 \rightarrow CH_3CH_2CH_2CH_2NH_2 + NH_4Br$ | **2** | You will get one mark for the correct organic product if you cannot do the equation. You will be penalised if you put $C_4H_9NH_2$ since you should show this is a straight chain molecule. |
| (1-)butylamine | **1** | The number 1 here is optional. The amine group can only go on the end C atom. |
| **3 (a) (i)** free radical substitution | **1** | |
| **(ii)** ultraviolet light | **1** | You could put sunlight or high temperature. |
| **(iii)** propagation | **1** | |
| **(iv)** termination | **1** | |
| $\cdot CH_2CH_3 + Br\cdot \rightarrow CH_3CH_2Br$ *or* $2\ \cdot CH_2CH_3 \rightarrow C_4H_{10}$ | **1** | Make sure the dot is on the $CH_2$ not the $CH_3$. |
| **(b) (i)** fractional distillation or fractionation | **1** | |
| **(ii)** $CH_3CH_3 + 6Br_2 \rightarrow C_2Br_6 + 6HBr$ | **1** | |

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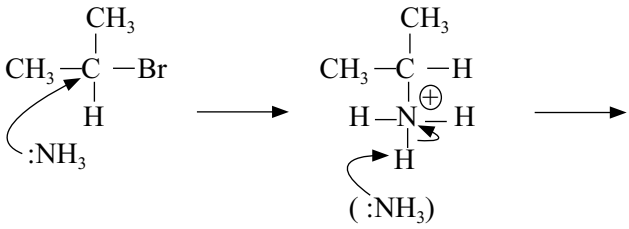
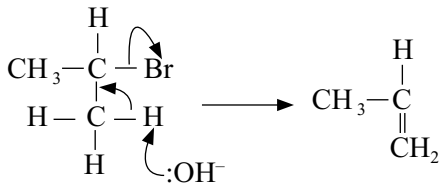
| **(c)** correct structure for $CF_2BrCF_2Br$ drawn out | **1** | Remember fluorine is F. Quite a number of candidates think it is Fl!<br>When drawing the structure you need to 'display it' by showing all the atoms and bonds. |
| **(d) (i)** 2-bromo-2-chloro-1,1,1-trifluoroethane *or* 1-bromo-1-chloro-2,2,2-trifluoroethane | **1** | Remember to number the C chain first. (See Topic 5.2 Nomenclature.) |
| **(ii)** 197.4 only | **1** | This is revision of Unit 1 but it will be assumed you know it for Unit 2. |
| **(iii)** (57/197.4 × 100) = 28.9% or 28.88% | **1** | |
| **4 (a)** *name of mechanism:* nucleophilic substitution | **1** | Any other substitution is wrong. |
| *mechanism:*  | **4** | Note: not necessary to show $NH_3$ therefore it is in brackets.<br>If you use a wrong dipole then this loses a mark, i.e.<br>$\overset{\delta-}{C}-\overset{\delta+}{Br}$ *or* $\overset{+}{C}-Br$ |
| **(b)** *role of potassium hydroxide:* base | **1** | The curly arrows show the movement of a pair of electrons. You must show the lone pair on the O of $OH^-$ and show the pair of electrons going to the H. The electrons then move from the middle of the C–H bond to the middle of the C–C bond, then from the middle of the C–Br bond to the Br atom to eliminate it as an ion. |
| *mechanism:*  | **4** | |
| **5 (a) (i)** *mechanism:* free radical substitution | **1** | Both words required for this mark. |
| *initiation:* $Cl_2 \rightarrow 2Cl\cdot$ | **1** | Don't forget to show the dots clearly. |
| *first propagation step:* $CH_3Cl + Cl\cdot \rightarrow \cdot CH_2Cl + HCl$ | **1** | |
| *second propagation step:* $CH_2Cl + Cl_2 \rightarrow CH_2Cl_2 + Cl\cdot$ | **1** | The dots must be on the Cl and the C of the $CH_2$. |
| **(ii)** $CH_3Cl + Cl_2 \rightarrow CH_2Cl_2 + HCl$ | **1** | |
| **(b)** moles of C = 10.1 / 12.0 = 0.842 | | |
| and moles of Cl = 89.9 / 35.5 = 2.53 | **1** | If you get the right answer you get all 3 marks. If it is not correct then the examiner goes back to find how many marks you can be awarded. |
| ratio 1 : 3 *or* $CCl_3$ | **1** | |
| 237.0/$M_r$ of $CCl_3$ = 237.0 / 118.5 = 2, | | |
| therefore $C_2Cl_6$ | **1** | |

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| **(c)** *any two from*: $CHBr_3$ *or* $CBr_4$ *or* $C_2H_2Br_4$ (*or* $CHBr_2CHBr_2$) *or* $C_2Br_6$ (*or* $CBr_3CBr_3$) | **2** | Remember HBr is not organic therefore does not score as an answer. |
| **6 (a) (i)** ultraviolet light *or* sunlight *or* $T \geq 450$ °C | **1** | This is not high temperature. |
| **(ii)** free radical substitution | **1** | |
| **(iii)** $CCl_4$ | **1** | |
| **(b) (i)** $CH_3Cl + KCN \rightarrow CH_3CN + KCl$ | **1** | You can use $CN^-$ and $Cl^-$ in the equation if you wish. |
| **(ii)** nucleophilic substitution | **1** | |
| **(iii)** C–Br bond is weaker than C–Cl bond | **1** | You can say the C–Br bond enthalpy is less than that for C–Cl. |