A Level AQA Chemistry

Chapter 16 – answers

OXFORD Revise

Question	Answers	Extra information	Mark	AO Spec reference
01.1	from C—Cl to C—I, the bond gets less polar This means that the carbon (in the C—X bond) is less electron deficient The nucleophile feels less attraction to the electron-deficient carbon and the reaction is slower.		1 1 1	AO1
01.2	• Choose halogenoalkanes with similar structures. For example, 1-chlorobutane, 1-bromobutane, etc. IGNORE any investigation into the effect of primary, secondary etc haloalkanes • Mix silver nitrate solution with ethanol/alcohol in separate test tubes. • The ethanol acts as a solvent for the silver nitrate and the halogenoalkane or words to that effect • The silver ions will react with any halide ions formed in the reaction to give a precipitate (of the silver halide). Allow equations • Warm the mixtures in beakers of warm water. • Add equal amount/drops/volume/mass) of halogenoalkane to each tube and time how long it takes for a precipitate to appear.	This is for a fair test. Avoid selection of primary and secondary/ tertiary halogenoalkanes because a mixture of these will have their own effect on the rate. Their molar volumes are very similar and therefore adding equal volumes is acceptable.	1×6	AO3 PS 2.4; PS 4.1;
01.3	The precipitate will be formed most quickly with the iodoalkane Because the C—I bond is the weakest / C—I breaks more easily		1 1	AO1 3.3.3.1 AO3 3.3.3.1
02.1	Electron-pair donor		1	AO1 3.3.3.1

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02.2	Lone-pair electrons and negative charge on the 'OH'. Dipole on C—Cl bond, i.e. $C^{\delta+}—Cl^{\delta-}$ Curly arrow from either lone-pair on 'OH'. Onto $C^{\delta+}$ Curly arrow from C—Cl bond onto Cl One product is $CH_3CH(OH)CH_3$ (or displayed formula) Cl^- other product	Both electron pair and charge on $Cl:^-$ are necessary to 'balance' the mechanism.	1 1 1 1 1 1	AO1 3.3.3.1
02.3	$CH_2BrCH_2Br + 2NaOH \rightarrow HOCH_2CH_2OH + 2NaBr$ $CH_3CHBrCH_2Br + 2NH_3 \rightarrow CH_3CH(NH_2)CH_2NH_2 + 2HBr$	1 for correct products and 1 for balancing. 1 for correct products and 1 for balancing. For second equation accept $4NH_3$ on LHS and $2NH_4Br$ on RHS	2 2	AO2 3.3.3.1; 3.3.11.1
03.1	Butan-1-ol		1 1	AO3 PS 1.2;
03.2	Sulfuric acid $H_2SO_4 + Na_2CO_3 \rightarrow Na_2SO_4 + H_2O + CO_2$		1 1	AO2 PS 1.2; ATd;
03.3	Continuous evaporation and condensation owtte		1	AO2 AT g
03.4	The bromobutane and the aqueous mixture are immiscible The bromobutane is denser than the aqueous layer so sinks to the bottom and can be run off.		1 1	AO2 PS 1.2

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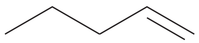
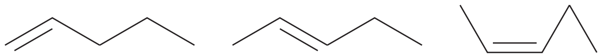
03.5	M_r (butan-1-ol) = 74 and M_r (1-bromobutane) = 136.9 No. of moles of butan-1-ol = 4.8/74 = 0.0649 No. of moles of 1-bromobutane = 5.75/136.9 = 0.0420 mol Percentage yield = (0.0420/0.0649) × 100% = 64.7%	If the relative molecular masses are incorrect then allow ecf	1 1 1 1	AO2 3.1.2.5; PS 3.2
04.1	Curly arrow from lone-pair or negative charge on OH^- to nearest hydrogen. Curly arrow from the C—H bond to end on bond between 2 carbons Curly arrow from C—Cl bond to end on chlorine Product: Cl^-		1 1 1 1	AO1 3.3.3.2
04.2	 From A just 1 product  From B - 3 products - pent-1-ene, E-pent 2-ene and Z-pent-2-ene From C there are no products of elimination because there are nc hydrogens on the carbon next to carbon attched to bromine	5 marks – 4 for the 4 structures and 1 for the zero products for C	5	AO2 3.3.1.2; 3.3.1.3
05.1	$CF_3CH_2Cl \rightarrow CF_3CH_2\bullet + Cl\bullet$		1	AO1 3.3.3.3
05.2	The C—F bond is strong/too strong		1	AO1 3.3.3.3
05.3	$O_3(g) \rightarrow O_2(g) + O$ X = O $Cl\bullet + O \rightarrow ClO\bullet$ Y = $ClO\bullet$ $ClO\bullet + O_3 \rightarrow Cl\bullet + 2O_2$ Z = $Cl\bullet$ The $Cl\bullet$ is regenerated	There are no alternatives	1 1 1 1	AO2 3.3.3.3
05.4	Number of moles of CFC in 1 kg = 1000/118.5 = 8.44 mol Number of moles of O_3 removed = 8.44×10^5 Mass of O_3 removed = $8.44 \times 10^5 \times 48$ 4.05×10^7g = 4.05×10^4 kg or 40 050 kg	1 for M_r 1 for calculation	1+1 1 1 1	AO2 and AO3 3.1.2.2; 3.1.2.4 3.1.2.5

Question	Answers	Extra information	Mark	AO Spec reference
06.1	ethanoate (CH_3COO^-) ion.		1	AO2 3.3.3.2
06.2	Lone pair and negative charge on ethanoate ion Curly arrows onto electron deficient carbon and from C—Br bond onto Br dipoles on carbon and bromine Correct products including Br:-		1 1 1 1	AO1 and AO3 3.3.3.2
06.3	$CH_3COO^-Ag^+(aq) + CH_3CH_2Br\ (l)$ $\rightarrow CH_3COOCH_2CH_3(l) + AgBr(s)$	1 for balanced symbol equation 1 for state symbols	1 1	AO2 3.2.3.1
06.4	The AgBr is the only solid present and can be filtered off from the other substances		1 1	AO3 3.2.3.1; AT d; PS 1.2

Skills box answers:

1. $m = \frac{y - c}{x}$
2. $s = P - qr^2$
3. $[D] = \frac{[A][B]}{[C]K_c}$
4. $p(Y) = \sqrt[3]{\frac{p(Z)K_p}{p(x)^2}}$
5. $[H^+] = \frac{[HA]}{[A^-]}10^{-pK_a}$