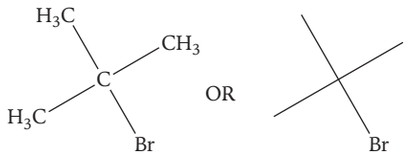
A Level OCR Chemistry

Chapter 13 – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)	Atom economy = $\frac{82}{100} \times 100\% = 82\%$	If give 82% without showing working then award **1** mark	1	AO1 2.1.3h
1(b)(i)	Is a catalyst	No need to enlarge upon this	1	AO1 4.2.1d
1(b)(ii)	With gentle heating only reach boiling point of cyclohexene	Alternative: If raise temperature too high then cyclohexanol would boil over	1	AO2 4.2.3a)ii)
1(b)(iii)	Drying agent	To remove water	1	AO1 4.2.3a) ii)
1(b)(iv)	The boiling point of cyclohexene is 83 °C which is in the middle of this range	Allow it covers the boiling point of cyclohexene 83 °C is in the middle of the range.	1	AO3 2.1.3h; 1.2.2d
1(c)	Mass of cyclohexene = volume × density = 9.50 × 0.779g = 7.40g Number of moles of cyclohexanol = 20.0/100 = 0.200 mol Number of moles of cyclohexene = 7.40/82 = 0.0902 mol Percentage yield = $\frac{0.0902}{0.200} \times 100\% = 45.1\%$	If they show their working then any indication that the mass of the cyclohexene is 740 g is **1** mark	1 1 1 1	AO3 MO.2 2.1.3h 2.1.3a and b
2(a)	Place condenser vertically above and into the reaction vessel Water is passed through condenser	Placed above is not sufficient	1 1	AO1 4.2.3a PAG5
2(b)(i)	Number of moles of $NaOH_{start} = 50.0 \times 10^{-3} \times 0.2 = 0.0100$ mol	Working not necessary.	1	AO2 M2.2
2(b)(ii)	Number of moles of $NaOH_{react} = n(NaOH \text{ at start}) - n(NaOH \text{ remaining})$ = 0.0100 — (0.015 × 0.40) = 0.00400 mol (4×10^{-3})	If give 0.0400 mol only then **2** marks	1 1	AO3 2.1.3a; 2.1.3g

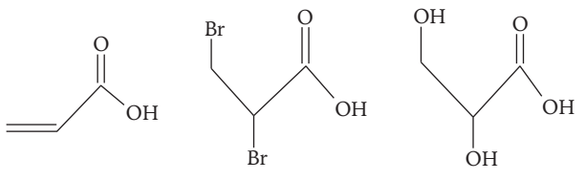
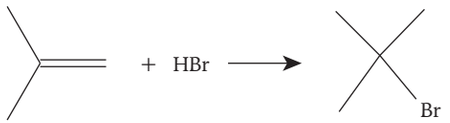
A Level OCR Chemistry

Chapter 13 – answers

Question	Answers	Extra information	Mark	AO Spec reference
2(b)(iii)	No. of moles of RBr = No. of moles of $NaOH_{react}$ = 0.00400 (4×10^{-3}) $M_r = \frac{m}{n}$ = 0.548/0.00400 = 137 g mol^{-1}		1 1	AO2 2.1.3a; 2.1.3g
2(b)(iv)	The bromine accounts for 79.9 of the 137; remainder = 57.1 (57) Divide by 12 (for carbon) = 4 remainder 9 i.e. C_4H_9 The alcohol is a tertiary alcohol because it is not oxidised by acidified dichromate Therefore, alcohol is $(CH_3)_3COH$ or methylpropan- 2-ol Therefore, bromoalkane is $(CH_3)_3CBr$ or 2-bromomethylpropane	Owtte Allow  	1 1 1 1 1	AO3 2.1.3b 4.2.1c
2(c)	$(CH_3)_3CBr + NaOH(aq) \rightarrow (CH_3)_3COH + NaBr(aq)$	Allow skeletal or partially skeletal formulae as above.	1	AO1 4.2.2a
3(a)(i)	2-hydroxypropanoic acid		1	AO2 4.1.1a
3(a)(ii)	Carboxylic acid / carboxyl Secondary alcohol / hydroxyl	Do not accept -COOH Accept 2° alcohol Do not accept alcohol or hydroxyl group	1 1	AO1 4.1.1c
3(a)(iii)	$HOCH_2CH_2COOH$	Accept $HO(CH_2)_2COOH$ Do not accept HOC_2H_4COOH Do not accept $OHCH_2CH_2COOH$	1	AO2 4.1.1e;4.2.3b)i)
3(a)(iv)	Optical isomerism	It contains a chiral centre / it contains a carbon with four different groups	1 1	4.1.3c-d

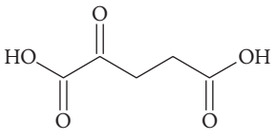
A Level OCR Chemistry

Chapter 13 – answers

Question	Answers	Extra information	Mark	AO Spec reference
3(b)(i)	 B C D	**1** mark for each correct formula. D the carboxylic acid group could react with sodium hydroxide	1 1 1	AO3 4.2.3b-c; 4.2.1d; 4.1.3f(ii); 4.2.2a
3(b)(ii)	**B** is converted to **C:** dehydration / elimination **C** is converted to **D:** Nucleophilic substitution		1 1	AO1 4.1.3(f-h);4.2.2a
4(a)	Add bromine water and shake Colour changes from orange to colourless	 Accept decolourised	1 1	AO1 4.1.3f; PAG7
4(b)	2-bromo-2-methylpropane	Dashes can be left out could have other halogens	1	AO3 4.2.3c
4(c)(i)	HBr or HCl in cold (room temperature)	HI is acceptable but practically difficult	1 1	AO3 4.1.3f
4(c)(ii)	Reflux with aqueous sodium hydroxide solution	Accept aqueous KOH	1 1	AO3 4.2.2a
4(d)(i)	$(CH_3)_2C{=}CH_2 + HBr \rightarrow (CH_3)_3CBr$	HCl is alternative Accept skeletal or displayed formulae; e.g. 	1	AO2 4.1.3f
4(d)(ii)	$(CH_3)_3CBr + NaOH \rightarrow (CH_3)_3CBr + NaBr$	KOH is alternative Accept skeletal or displayed formulae	1	AO2 4.2.2a

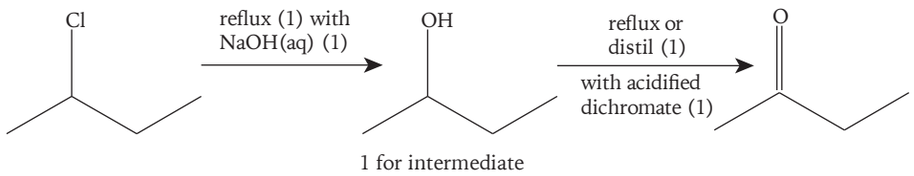
A Level OCR Chemistry

Chapter 13 – answers

Question	Answers	Extra information	Mark	AO Spec reference
5(a)(i)	Primary alcohol / hydroxyl Ketone / carbonyl aldehyde	Accept 1° alcohol; do not accept alcohol	1 1 1	AO2 4.1.1c
5(a)(ii)	$HOCH_2COCH_2CH_2CHO$ $C_5H_8O_3$		1 1	AO1 4.1.1b
5(b)(i)		No alternatives	1	AO2 4.2.1c; 6.1.2a
5(b)(ii)	Orange to green		1	AO1 4.1.2c; 6.3.1c
5(b)(iii)	$HOCH_2COCH_2CH_2CHO + 3[O] \rightarrow HOOCCOCH_2CH_2COOH + H_2O$	**1** mark for reactants **1** mark for products	1 1	AO3 4.1.2c
6(a)	Reaction 1 There is only 1 product	Both required for **1** mark	1	AO1 2.1.3h
6(b)	2-chlorobutane is the major product formed because it forms the more stable intermediate carbocation 1-chlorobutane is a minor product but is still formed	Allow: Markovnikoff addition means that 2-chlorobutane is the major product	1 1	AO2 4.1.3h
6(c)	This is a free-radical reaction which is a chain reaction Several products can be formed		1 1	AO2 4.1.2g

A Level OCR Chemistry

Chapter 13 – answers

Question	Answers	Extra information	Mark	AO Spec reference
6(d)	 1 for intermediate	The formulae can be displayed or structural e.g $CH_3CH(OH)CH_2CH_3$	5	

Skills box answers:

a) (i) To ensure the sodium carbonate (solution) is mixed thoroughly.
(ii) To release the pressure from the build-up of CO_2 / to release CO_2.
b) (i) To remove any excess calcium chloride.
(ii) To remove water (when it is clear there are no droplets of water in the solution).