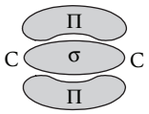
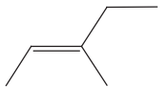
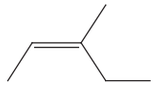
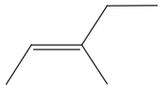
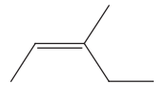
A Level OCR Chemistry

Chapter 11 – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)		**1** mark for each bond The shapes must match those in the diagram	1 1	AO1 4.1.3a
1(b)(i)	 *E*-3-methylpent-2-ene  *Z*-3-methylpent-2-ene Correct skeletal formulae Correct names The ethyl group having priority over the methyl group	If the methyl group is given priority over the ethyl group (see below), then **2** marks only. If the number of carbons is wrong then **0** marks.  *Z*-3-methylpent-2-ene  *E*-3-methylpent-2-ene	1 1 1	AO2 4.1.1b; 4.1.3c
1(b)(ii)	There is no free rotation about the C=C double bond Each carbon in the C=C bond is attached to 2 different groups or atoms $(CH_3)_2C=C(CH_3)_2$ each carbon in the C=C is attached to 2 identical groups.	No alternatives except atoms only or groups is acceptable	1 1 1	AO2 4.1.3c
1(c)(i)	Optical A and D *E*/*Z* B and D	Both letters essential for each mark	1 1	AO2/AO3 4.1.3c; 6.2.2c
1(c)(ii)	E-4-chloropent-2-ene Give 1 for E and 1 for -3-chloropent-2-ene		1 1	AO2 4.1.1a; 4.1.3c
2(a)		No alternatives	1	AO1 4.1.1a

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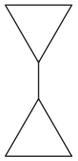
2(b)	$C_3H_6 + Cl_2 \rightarrow C_3H_5Cl + HCl$	**1** mark for reactants **1** mark for products	1 1	AO2 4.1.1f 4.1.1g4.1.2f
2(c)	$Cl_2 \xrightarrow{UV} 2Cl\bullet$ 1 for conditions (UV)		1 1	AO1 4.1.2f
2(d)(i) **2(d)(ii)**	There is always 1 radical on each side of the equation (for a propagation step) $C_3H_6 + Cl\bullet \rightarrow C_3H_5\bullet + HCl$ $C_3H_5\bullet + Cl_2 \rightarrow C_3H_5Cl + Cl\bullet$	The question stated the use of molecular formulae.	1 1 1	AO3 4.1.2f
2(e)(i)	The combination of 2 radicals to form a molecule		1	AO1 4.1.2f
2(e)(ii)		The molecule can be on its side	1	AO3 4.1.2f
2(e)iii)	1 from the following: $Cl\bullet + Cl\bullet \rightarrow Cl_2$ $Cl\bullet + C_3H_5\bullet \rightarrow C_3H_5Cl$		1	AO2 4.1.2f
3(a)	Number of moles = mass /M_r = $1000 \times 10^3/44$ 2.27×10^4 mol		1	AO2 2.1.3a
3(b)(i)	$C_{10}H_{22}$		1	AO1 4.1.2a
3(b)(ii)	$C_{10}H_{22} + 15½O_2 \rightarrow 10CO_2 + 11H_2O$ $n_{decane} = 1/10\ n_{carbon\ dioxide} = 2.27 \times 10^3$ (mol)		1 1	AO2 4.1.2e 2.1.3a

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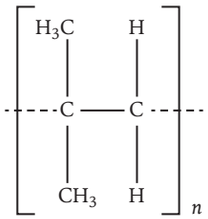
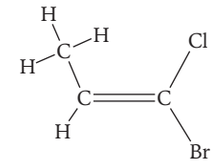
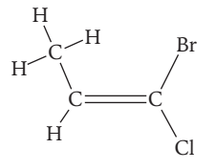
3(c)(i)	$\Delta_{r/c}H = \sum\Delta_f H(\text{products}) - \sum\Delta_f H(\text{reactants})$ $\Delta_{r/c}H = -3935 - 3145 + 556.6$ $= -6523\ \text{kJ mol}^{-1}$		1 1 1	AO2 3.2.1g
3(c)(ii)	Heat generated = $-6523 \times 2.27 \times 10^3$ 14.8 MJ or 14 800 kJ		1 1	AO3 3.2.1d
4(a)(i)		**1** mark for C—C single bond and lines on either side and **1** mark for correct groups on both carbons The '*n*' outside the brackets is not essential.	1 1	AO2 4.1.3j
4(a)(ii)	The bromine is decolourised By the 2–methylpropene but not by addition polymer	OR from orange to colourless	1 1	AO3 PAG7 4.1.3f
4(a)(iii)	Adding bromine is a test for unsaturation The 2-methylpropene is unsaturated, the polymer is not so no reaction $(CH_3)_2C{=}CCH_2 + Br_2 \rightarrow CH_3)_2CBrCCH_2Br$	Displayed or skeletal formulae are acceptable	1 1 1	AO1 4.1.3f
4(b)(i) **4(b)(ii)**	 *E*-1-bromo-1-chloropropene  *Z*-1-bromo-1-chloropropene	**1** mark for correct alkene i.e. 1-bromo-1-chloropropene **1** mark for identifying that they are E/Z isomers **1** mark for correct use of Cahn-Ingold-Prelog prioritising **1** mark for each correct name Accept 1-chloro-1-bromopropene	1 1 1 1 + 1	AO3 4.1.3j 4.1.3c

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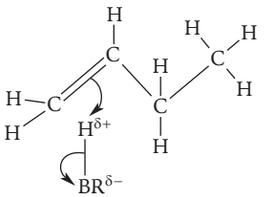
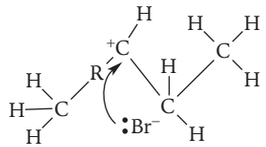
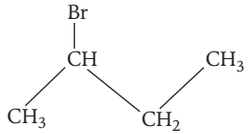
5(a)	 1 for dipoles 1 for curly arrows  1 for curly arrow from lone-pair of Br^- or from negative charge 1 for carbocation  1 for correct product	Marks given on diagram. The arrows have to be as shown.	1 1 1 1 1	AO2 4.1.3h
5(b)(ii)	$CH_3CH_2C^+H_2$ and $CH_3C^+HCH_3$ OR $CH_3C^+HCH_3$		1 + 1	AO1 4.1.3i
5(b)(iii)	$(CH_3)_2C(OH)CH_3$ OR $(CH_3)_3COH$ MAJOR PRODUCT $(CH_3)_2CHCH_2OH$ MINOR PRODUCT	**1** mark for identifying major and minor **1** mark for each correct product	1 1 + 1	AO2 4.1.3f 4.1.3i
6(a)(i)	$C_8H_{18} + 8½O_2 \rightarrow 8CO + 9H_2O$	Allow multiples	1	AO2 2.1.2b 4.1.2e
6(a)(ii)	$C_8H_{18} + 4½O_2 \rightarrow 8C + 9H_2O$	Allow multiples	1	AO2 2.1.2b 4.1.2e
6(b)	1kg = 1000/114 moles of C_8H_{18} = 8.77 mol Number of moles of CO = 8 × 8.77 = 70.2 Volume of CO formed = 70.2 × 24 dm^3 = 1684 dm^3	If give the answer without working give **3** marks But if answer not exactly same give **0** marks	1 1 1	AO3 2.1.3a
6(c)(i)	$N_2 + O_2 \rightarrow 2NO$		1	AO2 2.1.2b

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6(c)(ii)	$2CO + 2NO \rightarrow 2CO_2 + N_2$		1	AO1 2.1.2b
6(c)iii)	The oxidation number of the nitrogen decreases from +2 to 0, therefore reduced The oxidation number of the carbon increases from +2 to +4, therefore oxidised	Numbers essential	1 1	AO2 2.1.5f
6(c)(iv)	The reaction has a high activation energy (even with catalyst) When the car warms up, more molecules have energy greater than the activation energy and therefore can react.		1 1	AO2 3.2.1c

Skills box answers:

a) $m = \frac{y - c}{x}$

b) $s = p - qr^2$

c) $[D] = \frac{[A][B]}{[C]K_c}$

d) $p[Y] = \sqrt[3]{\frac{p[Z]K_p}{p[X]^2}}$

e) $[H^+] = \frac{[HA]10^{-pK_k}}{[A^-]}$