A Level AQA Chemistry

Chapter 15 – answers

Question	Answers	Extra information	Mark	AO Spec reference
01.1	Crude oil is a mixture. The different fractions have different boiling points.	Marks are independent of each other	1 1	AO1 3.3.2.1
01.2	As the (crude oil) vapour rises, some fractions condense and are run off. The remaining fractions continue as gases/vapours.		1 1	AO1 3.3.2.1
01.3	A hexane B 2-methylpentane C 2, 2-dimethylbutane		1 1 1	AO2 3.3.1.1
01.4	C Because it is more branched structure with fewer points of contact between molecules Fewer van der Waal's intermolecular forces Lower boiling point	Allow lower surface area	1 1 1	AO3 3.1.3.7
01.5	2 molecular formulae dodecane = $C_{12}H_{26}$ hexane = C_6H_{14} Line from methane to petroleum gases Line from dodecane to paraffin and line from hexane to petrol	Maximum of 2 marks – if 1 line wrong give 1 mark. 0 marks for 2 lines wrong.	1 1 1 + 1	AO3 3.1.3.7

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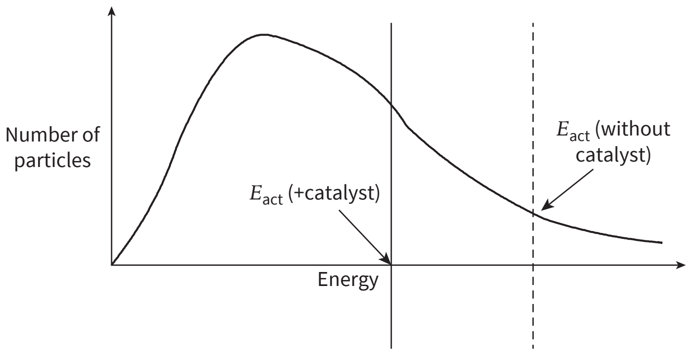
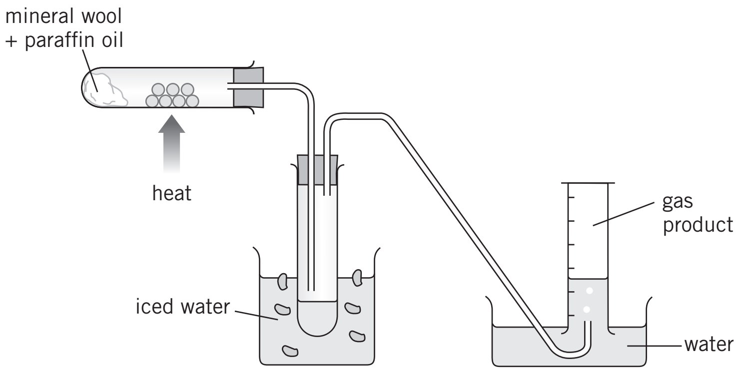
02.1	 2 vertical lines with some labelling as to the catalyst having a lower activation energy With catalyst greater proportion of molecules have energy equal to or greater than activation energy. Shown by area under curve/shaded area	There must be 2 vertical lines. These must be labelled Some reference to the curve is necessary and the area under it for the catalysed and uncatalysed reactions	1 + 1 1 1	AO1 and AO2 3.1.5.2; 3.1.5.5
02.2	Identify C_3H_6 as other compound. $C_9H_{20} \rightarrow C_6H_{14} + C_3H_6$	Ignore state symbols	1 1	AO2 3.3.2.2
02.3	See both diagrams for mark scheme 		3	AO3 PS1.1

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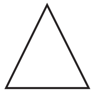
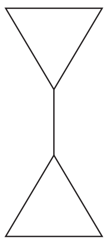
02.4	Test is bromine water Colour changes from orange to colourless	Allow decolorised	1 1	AO1 PS4.1; 3.3.4.2
03.1			1	AO1 3.3.1.1
03.2	$C_3H_6 + Cl_2 \rightarrow C_3H_5Cl + HCl$	1 for reactants 1 for products	1 + 1	AO2 3.3.1.2; 3.3.2.4
03.3	$Cl_2 \xrightarrow{UV} 2Cl$ 1 balanced equation UV (light) on arrow	Allow hv	1 1	AO1 3.3.2.4
03.4	There is always 1 radical on each side of the equation (for a propagation step)		1	AO1 3.3.2.4
03.5	$C_3H_6 + Cl\bullet \rightarrow HCl + C_3H_5\bullet$ $C_3H_5\bullet + Cl_2 \rightarrow C_3H_5Cl + Cl\bullet$	allow other valid options	1 1	AO2 3.3.2.4
03.6	The reactants are 2 radicals and there are none in the products.	Allow combination of 2 radicals to form a molecule	1	AO1 3.3.2.4
03.7		The molecule can be on its side	1	AO3 3.3.2.4; 3.1.3.2

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03.8	1 from the following: $Cl\bullet + Cl\bullet \rightarrow Cl_2$ $Cl\bullet + C_3H_5\bullet \rightarrow C_3H_5Cl$	The equations must be balanced with 2 radicals on the left-hand side and a neutral molecule on the right-hand side	1	AO2 and AO3 3.3.2.4
04.1	1.48×10^4 mol		1	AO2 MS2.2; MS2.3; 3.1.2.2
04.2	$C_{10}H_{22}$		1	AO1 3.3.1.3
04.3	$C_{10}H_{22} + 15½O_2 \rightarrow 10CO_2 + 11H_2O$ $mol_{decane} = \frac{1}{10}$ mol $CO_2 = 1.48 \times 10^3$ mol	Allow multiples	1 1	AO2 3.3.2.3
04.4	$\Delta_{r/c}H = \sum\Delta_f H(\text{products}) — \sum\Delta_f H(\text{reactants})$ $\Delta_{r/c}H = –3935 – 3145 + 556.6$ $= –6523$ kJ mol^{-1}		1 1 1	AO2 3.1.4.3
04.5	Heat generated = $6523 \times 1.48 \times 10^3$ 9.65 MJ	Lose 1 mark if not to 3 sf Allow −9.65 MJ	1 1	AO2 MS0.0

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05.1	$2NO + CO \rightarrow N_2 + CO_2$ +2 +2 0 +4 The oxidation number of the nitrogen has been reduced from +2 to 0, therefore reduced the oxidation number of the carbon has been increased from +2 to +4 therefore oxidised		1 1 1 1	AO2 3.1.7
05.2	The formation of NO (forward reaction) is endothermic The high temperature of the engine favours the endothermic reaction because this will lower the temperature (Le Chatelier's principle) The formation of NO_2 (forward reaction) is exothermic High temperature will favour the reverse reaction which will be endothermic and formation of NO_2 is **not** favoured.		1 1 1 1	AO2 3.1.6.1; 3.1.6.2
05.3	+180.8/2 = +90.2 kJ mol^{-1} The equation (A) represents the formation of 2 mol of NO from its constituent elements		1	AO3 3.1.4.1
05.4	$K_c = \frac{[NO_2]^2}{[NO]^2\,[O_2]}$ Units are $dm^3\ mol^{-1}$	Accept $mol^{-1}dm^3$	1 1	AO2 3.1.6.2
06.1	It has an unpaired electron Readily combines with other atoms to complete outer shell of electrons		1 1	AO1 3.1.3.2; 3.3.2.4
06.2	Correct structural formula for 2-bromopropane $CH_3CH_2CH_3 + Br_2 \rightarrow CH_3CHBrCH_3 + HCl$ and balanced equation	Give this mark even if, for example, molecular formulae given or wrong structural formula of 2-bromopropane	1 1	AO1 and AO2 3.1.3.2; 3.3.2.4

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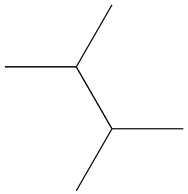
06.3	$CH_3CH_2CH_3 + Br\bullet \rightarrow CH_3CH\bullet CH_3 + HBr$ $CH_3CH\bullet CH_3 + Br_2 \rightarrow CH_3CHBrCH_3 + Br\bullet$	If electron (•) above carbon okay, but it must be clear with which carbon it is associated.	1 1	AO2 3.1.3.2; 3.3.2.4
06.4	$CH_3CH(CH_3)CH(CH_3)CH_3$ OR 	Displayed formula also acceptable	1	AO3 3.1.3.2; 3.3.2.4
06.5	2,3-dimethylbutane		1	AO2 3.3.1.1

Skills box answers:
As long as your answer are with ± 10% of these then you are likely to get full marks in an exam.

1. Gradient = -3.85×10^{-5} mol dm^{-3} s^{-1}
2. Gradient = -2.62×10^{-5} mol dm^{-3} s^{-1}
3. Gradient = -1.21×10^{-5} mol dm^{-3} s^{-1}
4. Gradient = -8.25×10^{-6} mol dm^{-3} s^{-1}