A Level OCR Chemistry
Chapter 8 – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)	16.0 (only)		1	3.2.1 AO1 MS1.1
1(b)	Enthalpy change when 1 mole of substance Is completely burnt in oxygen Products and reactants in standard states under standard conditions		1 1 1	AO1 3.2.1
1(c)	C_3H_8O (l) + 4½O_2 (g) → 3CO_2 (g) + 4H_2O (l)	Allow any accurate structure of propan-1-ol State symbols required	1	2.1.3 AO1
1(d)	$Q = mc\Delta T$ $Q = 200 \times 4.18 \times 16 = 13376$ J Moles = mass/M_r = 1.17/ 60 = 0.0195 $\Delta_c H$ = −13376/0.0195 = −685 949 J mol^{-1} −686 kJ mol^{-1}	Or equivalent Must be 3 s.f. must have minus sign	1 1 1 1 1	3.2.1 MS0.0,1.1 AO2
1(e)	Heat lost to surroundings Incomplete combustion of fuel Some fuel evaporates between end of experiment and measurement of mass	 Allow not enough oxygen	1 1 1	3.2.1 AO3
2(a)	Suitable scale Labels on both axis Correct labels All points plotted accurately Both lines extrapolated to 5th minute Instantaneous temperature calculated (expected to be 13.6 °C)	Allow splitting of y axis Points must cover over half the page (if scale can be sensibly doubled lose mark 2 Allow two errors ±1mm	1 1 1 1 1 1	3.2.1 AO3

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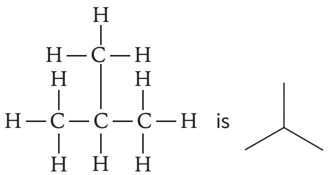
2(b)	With $T = 13.6$ $Q = mc\Delta T$ $Q = 50 \times 4.18 \times 13.6 = 2842(.4)$ Moles $= \frac{C \times V}{1000} = \frac{2 \times 25}{1000} = 0.05$ $\Delta_c H = -2842/0.05 = -56840$ J mol^{-1} -56.8 kJ mol^{-1} MUST have minus		 1 1 1 1 1	3.2.1 MS0.0,1.1 AO2
2(c)	Same value as **02.2** Still producing water so enthalpy per mole should be the same		1 1	3.2.1 AO3
3(a)		Only accept RHS as answer	1	4.1.1 AO1
3(b)	Chain		1	4.1.1 AO1
3(c)	$C_4H_{10} + 6\frac{1}{2}O_2 \rightarrow 4\,CO_2 + 5H_2O$		1	4.1.2 AO3
3(d)	The enthalpy change is independent of the route taken		1	3.2.1 AO1
3(e)	$\Delta_r H = -2878 + 2869 =$ -9 kJ mol^{-1}	Allow correct cycle **1** mark for recall of products-reactants or cycle	1 1	3.2.1 AO2
3(f)	$+9$ kJ mol^{-1}	Allow their answer for **3.5** with opposite sign	1	3.2.1 AO3

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3(g)	High activation energy		1	3.2.1 AO3
4(a)	$\Delta_r H$ = Σreactants – Σproducts = −1072 + − (2 × 432) + (3 × 413) + 358 + 467 = + 128 kJ mol^{-1}		1 1 1	3.2.1 MS1.2 AO2
4(b)	Bond enthalpies are an approximate/average Over a range of compounds		1 1	3.2.1 MS1.2 AO3
4(c)	(ΔH = Σreactants −Σproducts) Σ reactants = (6 × 413) + (2 × 358) + (2 × 467) + 3X (= 3X + 4128) Σ products = (4 × 799) + (8 × 467) = 6932 (2 × −715 = 3X + 4128 – 6932) X = 458 kJ mol^{-1}	Allow correct cycle Sum of reactants and products Any valid simplification to find X	1 1 1	3.2.1 3.2.1 MS1.2 AO2
4(d)	(ΔH = Σ$\Delta_f H$(prod.) – Σ$\Delta_f H$(react.)) −19 = 3X – (−822) – (3 × −111) −1174/3 = X = −391 kJ mol^{-1}	Allow correct cycle **1** mark for recall of products-reactants or cycle	1 1 1	3.2.1 3.2.1 AO2 MS1.1
5(a)	$2C(s) + 3H_2(g) \rightarrow C_2H_6(g)$		1	3.2.1 AO1
5(b)	1, 2-difluoroethane		1	4.1.1 AO1
5(c)	It's an element		1	3.2.1 AO1

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5(d)	$\Delta_r H$ = Σproducts – Σreactants −1134 = X + (2 × −273) – (−84) −1134 = X −462 X = – 672 kJ mol^{-1}	Allow correct cycle	1 1 1	3.2.1 3.2.1 AO2 MS1.1
6(a)	−136 = (612 + 436 +4X) – (6X + 348) −136 = (612 + 436) − 2X − 348 −136 = 700 – 2X −836 = − 2X −836/−2 = X = 418 kJ mol^{-1}	Allow correct cycle	1 1 1	3.2.1 3.2.1 MS1.2 AO2
6(b)	It is an element		1	3.2.1 AO1
6(c)	Giant covalent (macromolecule) Strong covalent bonds Lots of energy needed to break the bonds		1 1 1	2.2.2 AO1
6(d)	Ethane More moles of water can be formed	Allow references to forms more bonds Ignores breaks more bonds	1 1	3.2.1 AO3
7(a)	$3N_2H_4 \rightarrow N_2 + 4NH_3$		1	2.1.3 AO1
7(b)	ΔH = (12 × 388) + (3 × 163) – (12 × 388) – (944) = −455 kJ for 3 moles hydrazine −455/3 = −151.67 −152 kJ mol^{-1}	Allow e.c.f. from **08.1** Allow correct cycle	1 1 1 1	3.2.1 MS1.2 AO2

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7(c)	$\Delta H = \Sigma$products − Σreactants = (4 × −286) − 96 − (2 × −187) = −866 kJ mol^{-1}	Allow e.c.f. from **08.1** Allow correct cycle	1 1 1	3.2.1 3.2.1 MS1.2 AO2
7(d)	Moles = 1.45/32 = 0.0453 q = 866 × 0.0453 = 39.24 kJ = 39240 J $q = mc\Delta T$ $\Delta T = q/mc$ = 39 240/(500 × 4.18) = 18.8 298 + 18.8 = 316.8 = 317 K	Answer must be 3 s.f. Allow 43.8 °C	1 1 1 1	3.2.1 MS 0.0 1.1 AO2
7(e)	$PV = nRT$ $n = \frac{PV}{RT} = \frac{100000 \times 4.6}{8.31 \times 298}$ = 185.755 moles Mass = 32 × 185.755 = 5944 g = 5.9 kg	Must be 2 s.f.	1 1 1 1	2.1.3 MS0.0,2.2,2.3,2.4 AO2
8(a)	(Enthalpy change) when 1 mol of a compound is formed from its constituent elements in their standard states		1 1 1	3.2.1 AO1
8(b)	The enthalpy change for a reaction is independent of the route		1	3.2.1 AO1
8(c)	$\Delta_R H = \Sigma\Delta_f H$ products − $\Sigma\Delta_f H$ reactants = [(3 × −286) + (3 × −394)] − (−248) = −1792 (kJ mol^{-1})	Allow correct cycle	1 1 1	3.2.1 AO2 MS0.0,1.1

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Skills box answers:

(i) $\Delta T = 69.5 - 20.5 = 49.0\,°C$

$\%\ error = \frac{2 \times 0.5}{49.0} \times 100 = 2\%$

(ii) With 150 cm^3 cylinder: $\%\ error = \frac{1}{150} \times 100 = 0.67\%$

With 25 cm^3 cylinder 6 times: $\%\ error\ 6 \times \frac{0.2}{25} \times 100 = 4.8\%$

Therefore, using the 150 cm^3 cylinder once is better than using the 25 cm^3 six times.

(iii) The measured temperature change would be higher as less heat/energy would be lost to the surroundings
Therefore, the calculated value for $\Delta_c H$ would be more exothermic

(iv) The temperature change would reach 100 °C and not get any higher as the water would be boiling/evaporating/changing state.
So, the measured value of ΔT would be lower.
Therefore, the measured value of $\Delta_c H$ would be less exothermic.