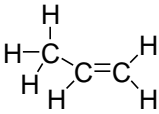
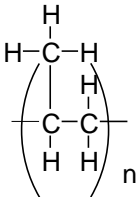
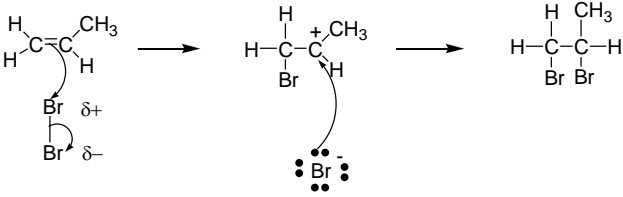




Question number	Answer	Marks	Guidance
1	D	B1	'specific' means 'per gram'
2	D	B1	
3	A	B1	Amount NaOH = 0.02 mol; H ₂ SO ₄ is in excess; energy transferred = $20 \times 4.18 \times y/1000$ kJ; per mol of H ₂ O = per mol of NaOH = $20 \times 4.18 \times y/1000 \times 0.02 = 4.18y$
4	B	B1	
5	D	B1	A has too many hydrogen atoms; B has too many chlorine atoms; C has not been saturated.
6	A	B1	NO _x is produced by nitrogen reacting with oxygen (both from the air) in the engine. Hydrogen does not contain any carbon or sulfur.
7	C	B1	The specific heat capacity is known to greater than the precision of the measurements.
8	B	B1	1. and 2. have the same molecular formula as propan-1-ol C ₃ H ₈ O but 3. does not.
9	C	B1	Both fuels give off CO ₂ when burned. Biofuels have recently absorbed an equivalent amount of CO ₂ from the atmosphere.
10 (a)		B1	All bonds and atoms must be shown. Brackets and 'n' must be shown for the polymer together with the 'spare'

		B1	bonds, though these need not necessarily go through the brackets.
10 (b)	(C=C) double bonds are more reactive than (C-C) single bonds (or reverse)	B1	
10 (c) (i)	(aqueous) bromine is decolorised	B1	
10 (c) (ii)	 <p>curly arrow and partial charges on bromine and curly arrow from double bond to bromine</p> <p>carbocation with positive charge on either central or left-hand carbon</p> <p>attack of bromide ion (with lone pair shown)</p> <p>product</p>	B1 B1 B1 B1	
10 (c) (iii)	<p>(a positive ion or partially positively charged molecule) attracted to a negatively charged region and reacting by accepting a lone pair of electrons (to form a covalent bond)</p> <p>(Br⁻)Br^{delta+} OR Br⁺</p>	B1 B1	
10 (c) (iv)	CH ₃ CHClCH ₂ Br or CH ₃ CHBrCH ₂ Cl	B1	ALLOW any unambiguous formula
10 (d) (i)	A series of compounds differing from each other by –CH ₂ –	B1	
10 (d) (ii)	Unsaturated	B1	
10 (d) (iii)	<p><i>E</i>-but-2-ene </p> <p><i>Z</i>-but-2-ene </p>	B1 B1	two correct structures with wrong names score 1 mark

11 (a) (i)	<p>Level 3 (5–6 marks) Candidate answers the question fully with all main points and three fine detail points</p> <p><i>The ideas are well structured providing significant clarity in the communication of the science</i></p> <p>Level 2 (3–4 marks) Candidate answers the question but without full detail by including all main points and at least one fine detail point.</p> <p><i>There is partial structuring of the ideas with the communication of the science generally clear</i></p> <p>Level 1 (1–2 marks) Candidate makes a reasonable attempt at the answer by giving two main points or one main point and one subsidiary point</p> <p><i>The ideas expressed are poorly structured and do not contribute to the communication of the science</i></p> <p>Level 0 (0 marks) No response or no response worthy of credit.</p>	B1 × 6	<p>Main points</p> <ul style="list-style-type: none"> • mix a portion of acid with a portion of bicarbonate • measure temperature change/fall • heat absorbed = $25 \times 4.18 \times \text{temp change}$ • amount NaHCO_3 ($= 10/84$) = 0.119 mol • ΔH = heat absorbed/amount <p>‘fine detail’ points</p> <ul style="list-style-type: none"> • take temperature at start and maximum temperature at end (subsumes second bullet) • stir (to speed up) • use polystyrene cup • convert to kJ and give units of answer as kJ mol^{-1} • give answer with plus sign
11 (a) (ii)	<p>it is an endothermic reaction</p> <p>not heat loss but heat taken in (or alternative ways of expressing this)</p>	<p>B1</p> <p>B1</p>	
11 (b)	<p>amount CO_2 ($= 10/84$) = 0.119 mol</p> <p>volume = 0.119×24.0 = 2.856 dm^3</p> <p>calculated answer to 2 sf (2.9 dm^3)</p>	<p>B1</p> <p>B1</p> <p>B1</p>	<p>ALLOW ecf from wrong value for amount of NaHCO_3 from ai</p> <p>ALLOW 2856 cm^3 (or fewer sf) for second mark</p> <p>ALLOW 2900 cm^3 for third mark</p>
12 (a) (i)	diesel is less volatile/ higher boiling point	B1	
12 (a) (ii)	$\text{C}_6\text{H}_{14} + 6\frac{1}{2}\text{O}_2 \rightarrow 6\text{CO} + 7\text{H}_2\text{O}$	B1	ALLOW multiples
12 (a) (iii)	they irritate the lungs/respiratory system	B1	
12 (b) (i)	$2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$	B1	ALLOW halves
12 (b) (ii)	catalyst is in a different phase/state from the reactant	B1	

	reactants are adsorbed on the catalyst (surface)	B1	
12 (c)	$C_9H_{20} \rightarrow C_2H_4 + C_7H_{16}$	B1	
12 (d) (i)	$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$	B1	
12 (d) (ii)	Bonds broken 4315 kJ Bonds made 6004 kJ $\Delta H = -1689$ kJ	B1 B1 B1	ALLOW ecf for third mark
12 (d) (iii)	bond enthalpies are average ethanol and water are not in standard states in bond enthalpy calculations (or alternative expressions)	B1 B1	
12 (d) (iv)	they can be re-grown	B1	