

3(c)(i)	value for the activation energy for the reaction A (no enzyme) compared to reaction B (with enzyme) value / range of values that are more (+) 29 kJ mol ⁻¹	1
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May/June 2020 9701/22 · Q3 (c)(i)

1(c)(ii)	- rate increases (increase in temperature means) more particles have energy $\geq$ activation energy - frequency of successful collisions increases	2
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Question	Answer	Marks
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March 2021 9701/22 · Q1 (c)(ii)

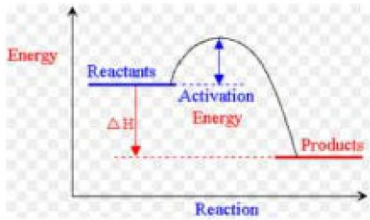
4(a)(iv)	in the same phase / in same state	1
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Oct/Nov 2021 9701/21 · Q4 (a)(iv)

1(f)(i)	white flame / light OR white solid / smoke	1
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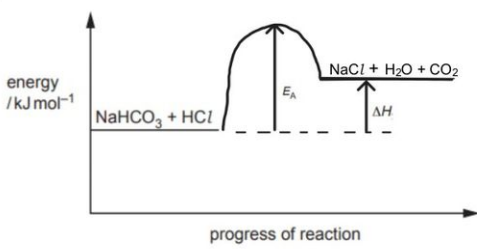
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Question	Answer	Marks
1(f)(ii)	M1 sketch shows exothermic reaction with a 'hump' AND labelled reactants (Mg + O₂) and products (MgO) M2 arrow from reactants / Mg + O₂ to products / MgO shown as ΔH M3 arrow showing activation energy / E_a / (+)148 	3
1(g)	M1 (heat / energy released from burning Mg) provides more particles with energy $\geq E_a$ M2 frequency of successful / effective collisions is greater	2

Question	Answer	Marks
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May/June 2022 9701/21 · Q1 (f)(i), (f)(ii), (g)

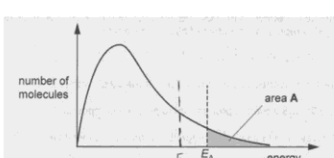
2(a)	 All three correct (2 marks) or two correct (1 mark): - profile for endothermic reaction (include 'hump') - arrow representing E_A - arrow representing ΔH OR (+) 27.2	2
2(b)(i)	no more fizzing / effervescence stops	1
2(b)(ii)	M1 calculate Q from $= 50 \times 4.18 \times (26.2 - 19.6) = 1379.4$ M2 Use M1 to find energy change when 1 mol Na_2CO_3 / 2 mol HCl reacts M1 $\div 0.04 = 34485$ M3 express Q as $\Delta H_{(1)}$ in $\text{kJ mol}^{-1} = -(\text{value for M2}) \div 1000$ $= -34.5 \text{ kJ mol}^{-1}$ Alternative method M1 evidence of use $Q = mc\Delta T = 50 \times 4.18 / 1000 \times (26.2 - 19.6) = 1.3794$ M2 Use M1 to find energy change when 1 mol Na_2CO_3 / 2 mol HCl reacts M1 $\div 0.04 = 34.485$ M3 express Q as $\Delta H_{(1)}$ in $\text{kJ mol}^{-1} = -(\text{value for M2})$ (expressed in kJ) $= -34.5 \text{ kJ mol}^{-1}$	3

Question	Answer	Marks
2(b)(iii)	Using answer from 2(b)(ii) $(=) 2\Delta H_2 - (\Delta H_1)$ $(=) 2 \times 27.2 - (2b(ii))$ $2 \times 27.2 - (-34.50) = (+) 88.9 \text{ kJ mol}^{-1}$ All three correct (2 marks) or two correct (1 mark): $(27.2) - (-34.5)$ OR $(27.2) - (2b(ii))$ 2×27.2 and $1 \times 2b(ii)$ - calculate correctly their expression Using alternative value of $\Delta H_1 = -38.4 \text{ kJ mol}^{-1}$ $\Delta H_1 = (+)92.8 \text{ kJ mol}^{-1} = 2 \text{ marks}$	2

May/June 2024 9701/22 · Q2 (a), (b)(i), (b)(ii), (b)(iii)

3(a)(ii)	M1 greater proportion of (H_2) molecules have energy greater than or equal to the activation energy $/ \geq E_A$ M2 increase in frequency of successful collisions (between H_2 and C_6H_{12})	2
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May/June 2025 9701/21 · Q3 (a)(ii)

3(d)(i)	E_A shown on Fig. 3.3 to the left of original (on the x axis) 	1
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Question	Answer	Marks
3(d)(ii)	M1 it / (area) B larger AND rate (reaction / hydrogenation) increases OR (area) B identified by shading or labelling on Fig 3.3 AND rate (reaction / hydrogenation) increases in prose M2 increase in the frequency of effective / successful collisions OR increase in rate of effective / successful collisions	2

May/June 2025 9701/22 · Q3 (d)(i), (d)(ii)

4(a)(iii)	the frequency of effective collisions decreases as concentration of HCl(aq) and / or $\text{Na}_2\text{S}_2\text{O}_3$ decreases	1
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Question	Answer	Marks
4(a)(v)	It reacts with water (to produce H_2SO_3)	1

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