

Mark Scheme

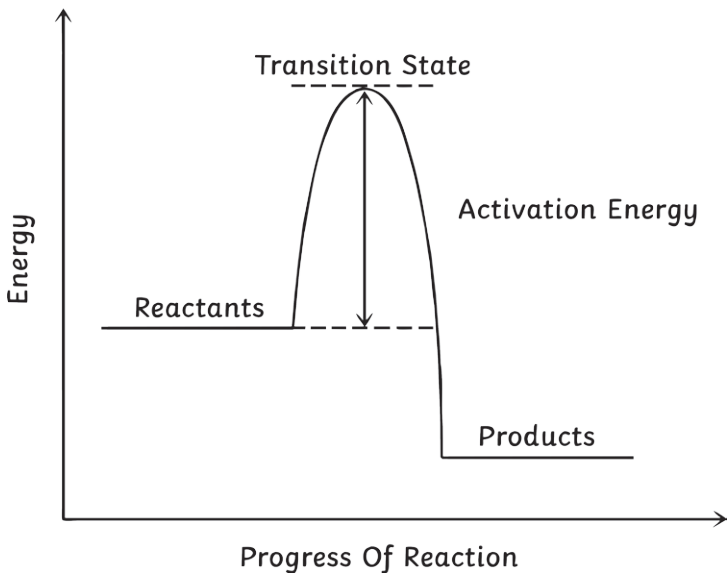
Combined Science GCSE

Rates of Reaction and Energy Changes Test

(Levels 4-9)

	Answer	Marks
1. (a)	B Use a more concentrated solution of hydrochloric acid.	(1)
1. (b) (i)	The reaction would be quicker/reaction rate would decrease.	(1)
(ii)	Choose from: more energy (1) so more frequent collisions (1) more particles have the activation energy (1) more successful collisions (1)	(2)
1. (c)	Experiment: • Volume of acid; mass of marble; add together in a test tube. • Collect gas/measure amount of carbon dioxide given off/measure loss (on balance). • Time how long reaction takes. • Repeat using larger sized marble chips but everything else the same. • Repeat using crushed marble/powder. Results: • Smaller chips/powder have vigorous reaction/more fizzing. • Smaller chips/powder take less time to react. • Smaller chips/powder have larger surface area. • Smaller chips react faster. • Larger surface area means quicker reaction. L1 – Brief description of experiment. L2 – Description of experiment and mentions what would be seen. L3 – Description of experiment, description of what is seen and explanation linking surface area to rate of reaction.	(6)
1. (d) (i)	A substance that speeds up/increases the rate of reaction (1) without being changed itself (1).	(2)
(ii)	Graph C	(1)
1. (e) (i)	A biological catalyst	(1)
(ii)	Any reasonable suggestion including alcoholic drinks; food/cheese/yogurt; laundry products.	(1)

(Total for Question 1 = 15 marks)

	Answer	Marks
2. (a)	Link an explanation of energy being released when bonds formed/breaking bonds needs energy (1) to, more heat/energy is released than is needed (1)	(2)
2. (b) (i)	$436 + 243 = 679$ (bonds broken) (1) $2 \times 432 = 864$ (bonds formed) (1) $679 - 864$ (energy change) (1) Answer = $-185 \text{ (kJ mol}^{-1}\text{)}$ (1) 4 marks for correct bald answer with negative sign at front.	(4)
(ii)	Diagram like this: with marks awarded as follows: Reactant and product lines drawn and labelled (1) correct curve drawn on diagram (1) activation energy identified (1).	(3)
		
(iii)	The energy needed to start a reaction off.	(1)

(Total for Question 2 = 10 marks)

	Answer	Marks																
3. (a)	endothermic	(1)																
3. (b)	D - electrolysis	(1)																
3. (c)	If forming bonds releases less heat than is needed to break binds a reaction is endothermic, so energy is taken in (in this order only).	(3)																
3. (d)	The temperature (1) would drop/fall/lower (1) crystals would disappear (1) and a solution would be formed (1)	(2)																
3. (e)	<table><tr><th>Reaction</th><th>Initial Temperature °C</th><th>Final Temperature °C</th><th>Reaction Type</th></tr><tr><td>A</td><td>16</td><td>10</td><td>endothermic</td></tr><tr><td>B</td><td>17</td><td>24</td><td>exothermic</td></tr><tr><td>C</td><td>18</td><td>27</td><td>exothermic</td></tr></table>	Reaction	Initial Temperature °C	Final Temperature °C	Reaction Type	A	16	10	endothermic	B	17	24	exothermic	C	18	27	exothermic	(3)
Reaction	Initial Temperature °C	Final Temperature °C	Reaction Type															
A	16	10	endothermic															
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(Total for Question 3 = 10 marks)

	Answer	Marks
4. (a) (i)	$\text{Na}_2\text{S}_2\text{O}_3(\text{aq}) + 2\text{HCl}(\text{aq}) \longrightarrow 2\text{NaCl}(\text{aq}) + \text{S}(\text{s}) + \text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ (1 mark each)	(2)
(ii)	Sulfur	(1)
4. (b)	The rate of reaction increases, as the temperature increases (1) with a more rapid increase from 50° onwards (1). Accept converse.	(2)
4. (c)	As concentration increases the number of particles increases/particles are closer together (1) so there are more frequent collisions/more successful collisions (1) so as the number of particles double so does the rate of reaction/frequency of collisions (1).	(3)

(Total for Question 4 = 8 marks)

	Answer	Marks
5. (a) (i)	B - precipitation	(1)
(ii)	$\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$ (1 mark each)	(2)
(iii)	Potassium iodide (1) and potassium nitrate (1)	(2)
5. (b) (i)	Filtration	(1)
(ii)	Filter, funnel and paper.	(1)

(Total for Question 5 = 7 marks)