

RATE OF REACTION 1

MARK SCHEME

Question 1

Question	Answer	Extra information	Marks
(i)	32	correct answer with or without working gains 2 marks accept evidence of $31 + 33 / 2$ for 1 mark allow 35 for 1 mark	2
(ii)	reaction rate increases because of more particles (per unit volume) and because there is an increase in frequency of collisions	if incorrect reference to energy = max 2 allow because particles are closer together accept because particles are more likely to collide or higher chance of collision ignore more (successful) collisions	1 1 1
Total marks			5

Question 2

Question	Answer	Extra information	Marks
(a)	fast initially slows down reaction stops	accept qualified answers in terms of volume of gas related to time accept reaction is now very slow	1 1 1
(b)	because they / particles have more energy / move faster (and so) particles collide more often / more frequently or particles more likely to collide	ignore particles move more / vibrate ignore collide faster ignore more collisions accept more successful collisions	1 1 1

	(and) more of the collisions are successful or particles collide with more energy / harder or more of the particles have the activation energy		
Total marks			6

Question 3

Question	Answer	Extra information	Marks
(a)	sensible line of best fit which goes through or close to all the points except the anomalous point	allow wobbly / short double lines $\pm \frac{1}{2}$ square	1
(b)	loss of gas / loss of CO ₂	idea of gas produced / formed	1
(c)	7		1
(d)(i)	steeper line from around the same starting point and left of the points levelling off at 99	allow crosses if they are fully correct for 1 mark accept short level line at 99 $\pm \frac{1}{2}$ square	1
(ii)	any three from: <ul style="list-style-type: none"> • particles / molecules / atoms / ions have more energy • move faster • collide more often or more chance of collisions or bump into each other more • collide with more force / energy or more particles have the activation energy or more collisions result in reaction or more collisions are successful 	allow given / gain / get energy ignore move about more ignore vibrate more / faster ignore collide quicker / faster	3
Total marks			8

	<ul style="list-style-type: none"> • wider range of temperatures (owtte) • (repeat at the same temperature) to improve accuracy / reliability • reveal anomalous results (owtte) • so you can get an average / better average 	<p>allow to make it reliable / accurate</p> <p>allow to eliminate random / human errors / to check results owtte</p> <p>ignore to make it a fair test / to get better results</p> <p>ignore precision and validity</p>	
(b)	<p>any two from:</p> <ul style="list-style-type: none"> • particles gain energy / have more energy • particles move faster • particles collide more • more of the particles have the activation energy or more of the collisions are successful (owtte) <p>or</p> <p>particles collide with more force / harder / more energy</p>	<p>allow atoms / molecules / they instead of particles throughout</p> <p>ignore increases particles activation energy</p> <p>ignore move more / vibrate more</p> <p>ignore increases / decreases activation energy</p> <p>allow more successful collisions alone for 1 mark</p>	2
Total marks			5

Question 6

Question	Answer	Extra information	Marks
(a)(i)	speed up the reaction (owtte)	<p>accept changes the rate</p> <p>accept lowers activation energy</p> <p>accept increases successful collisions</p> <p>accept allows reaction to take place at a lower temperature</p>	1
(ii)	<p>nitrogen (N₂) / oxygen (O₂) / products are safe or not harmful / pollutant / toxic / dangerous / damaging</p> <p>or</p>	<p>ignore releases nitrogen / oxygen unless qualified</p> <p>accept prevents / less acid rain</p> <p>ignore greenhouse gas / ozone</p>	1

	(harmful) nitrogen monoxide / NO is not released into the air.	layer	
(iii)	idea of catalyst not being used up	allow not changed by reaction ignore catalyst does not take part ignore catalyst not used in the reaction	1
(iv)	idea of different reactions (require different catalysts)	accept catalysts work for specific reactions allow different gases	1
(b)	<ul style="list-style-type: none"> • smaller / very small / or any indication of very small / 1-100 nanometres / a few (hundred) atoms • big(ger) surface area • less (catalyst) needed / small amount of catalyst needed 	ignore just small ignore size of the converter	1 1
Total marks			7

Question 7

Questions	Answers	Extra information	Marks
	any two from: <ul style="list-style-type: none"> • particles gain energy or particles have more energy • particles move faster • collide more often • collide more energetically • more of the collisions are successful or more particles have the activation energy 	allow have more activation energy allow they collide faster / quicker ignore move / vibrate more allow more collisions NB more successful collisions alone = 1 mark if particles are identified as electrons = max 1 mark	2
Total marks			2