

## Mark Scheme - 9

1.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		3	all points plotted correctly (2) 4 correct (1)  smooth curve through points (1)			line drawn using ruler
	(ii)		1	the higher the temperature, the shorter the time / faster the reaction / higher the rate	'faster the rate'		'faster / quicker the time'
	(iii)		1	curve must be <b>below</b> original curve and <b>steeper</b> – ignore end point			
(b)			2	light intensity decreases (1)  continuous readings / graph plotted automatically / more precise end point (1)	light blocked  more reliable than eyesight / more repeatable / no judgement required	reference to 'reliability' or 'accuracy' or to 'human error' needs qualification	'no chance of human error'

2.

Mark	Guidance
6	<p>Indicative content: For a chemical reaction to take place the reactant particles must collide. Increasing the concentration increases the number of particles in the same volume which gives a greater chance of the particles colliding, giving an increase in the rate of the reaction. As the temperature increases the reactant particles are moving faster, increasing the chance of a collision. At higher temperature the particles also have higher energy which increases the possibility of having sufficient energy during collision to overcome the activation energy and become a 'successful collision'. Therefore increasing the temperature also increases the speed of a reaction.</p> <p>5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

3.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		1	gas escaped during time taken to place the bung in the flask	gas syringe 'sticks'	human error	
	(ii)		3	all points plotted correctly [ $\pm\frac{1}{2}$ square] (2) seven points plotted correctly (1)  smooth curve drawn, not passing through (10,8) (1)	curve through (10,8) if (0,0) not plotted		
	(iii)		1	value read correctly from graph [ $\pm\frac{1}{2}$ cm <sup>3</sup> ]  ecf possible from any curve – except to give 8			8
	(iv)		1	line continues horizontally / volume stops increasing		straight line	
	(v)		2	less time (1)  more time (1)			
(b)			2	4 days - correct answer only (2)  if answer incorrect (1) for any indication of correct working e.g. from 30-20°C doubles time from 1 day to 2 days			

4.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		1	the higher the temperature the shorter the reaction time	higher temp, faster reaction		
	(ii)		2	surface area (1) the greater the surface area the shorter the reaction time / faster reaction (1) or particle size (1) the smaller the particle size the shorter the reaction time / faster reaction (1) both marks could be credited for one statement e.g. smaller particles react faster	'form' of calcium carbonate 'powder takes less time than chips'		molecules become smaller
	(iii)		2	volume of acid (1) concentration of acid (1) mass/weight of calcium carbonate (1) max (2)	'amount of' once only	pH type of acid	
(b)			2	mass decreases (1) gas / carbon dioxide lost from container / released (1)	gets lighter	gas produced	incorrect gas named

## 5.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	significantly different/ long way out when compared to other two readings		not the same / 6 or 8 out etc.	
(b)			2	all points plotted correctly (2) 4 points correct (1)  curve not needed so ignore if drawn			
(c)			2	volume / rate increases with temperature up to an optimum (1)  then volume / rate goes back down (1)	up to maximum / up to 40 °C		
(d)			2	glucose (1)  ethanol + carbon dioxide (1)	$C_6H_{12}O_6$  $C_2H_5OH + CO_2$		+ yeast
(e)			1	enzyme	zymase	biological	

6.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	coal dust has a much greater surface area than lumps of coal (1)  greater chance of collision / more collisions per unit time (1)		faster reaction	
(b)			2	1 day - correct answer only (2)  if answer incorrect (1) for any indication of correct working e.g. from 5-15°C halves time from 8 days to 4 days			

7.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		2	collection of gas (e.g. in a gas syringe or gas jar) (1)  experiment repeated with different particle size of zinc (1)	mass method disappearing zinc		
	(ii)		2	same mass (or amount) of zinc / same volume (or amount) of acid / same concentration of acid / same temperature or room temperature – any two for (1) each		repeat readings same apparatus	
	(iii)		1	the fastest is the experiment that gives the volume of gas in the least time	fastest reaction is the one giving off most bubbles in a given time		
(b)	(i)		1	less time / time decrease		faster reaction	
	(ii)		1	volume of gas remains the same			

8.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	A steepest line / steepest graph / finishes in the shortest time  both needed	greatest gradient / highest gradient / quickest reaction	precipitate	
(b)			2	time = 22 (1)  0.045 / 0.0455 / 0.04545 (1)  award (2) for cao	21  0.048 / 0.0476		0.05
(c)			3	higher the temperature, faster the rate (1)  particles have more energy / move faster at higher temperature (1) must be correct to award third mark  therefore greater chance of (successful) collisions / more (successful) collisions per second (1)	more particles have required activation energy	more collisions	

9.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	hydrogen	H <sub>2</sub>	H	
(b)			2	iron (1)  speeds up the reaction / increases the rate of the reaction (1)			
(c)			2	recycled / returned into reactor (1)  basic qualification required e.g. reduces cost of process / less waste of raw materials (1)	fed back in re-used	more efficient / reacted again / more yield / saves time	
(d)			2	lower yield with higher temperature (1)  higher yield with a higher pressure (1)	vice versa		
(e)			3	N <sub>2</sub> + H <sub>2</sub> (1)  NH <sub>3</sub> (1)  (1), 3, 2 (1)  formulae must be correct to award balancing mark			



10.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		2	number of nitrogen atoms <b>2</b> number of hydrogen atoms <b>6</b> both needed for (1)  equal / same number (of these atoms) on right hand side (1)			
	(ii)		1	gas / gaseous			
(b)	(i)	I	1	cooling			
		II	1	recycling			
	(ii)		2	iron (1)  speeds up reaction (1)			

11.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		1	1000 atmospheres 100 °C both needed for (1)			
	(ii)		2	low rate/ slow reaction (1)  (iron) catalyst (1)	decreased rate		incorrectly named catalyst e.g. V <sub>2</sub> O <sub>5</sub>
	(iii)		1	cost of container/more expensive to build/thicker container walls/ cost of getting to high pressure		'cost'	
(b)	(i)		1	exothermic			
	(ii)		1	4                      →                      4			
	(iii)		2	CuCO <sub>3</sub> + 2HNO <sub>3</sub> →                      Cu(NO <sub>3</sub> ) <sub>2</sub> + H <sub>2</sub> O + CO <sub>2</sub>  formulae correct (1) balancing (1)  formulae must be correct for balancing mark to be awarded			