Question	Answer	Marks	Guidance
1	**Level 3** **Complete evaluation including some information from the graph** **AND** **explanation using reacting particle model that must mention the idea of collision frequency** Quality of communication does not impede communication of science at this level. (5 - 6 marks) **Level 2** **Complete evaluation including some information from the graph <u>AND</u> explanation using reacting particle model that must mention the idea of collisions** **OR** **explanation using reacting particle model that must mention the idea of collision frequency** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Complete evaluation including some information from the graph** **OR** **explanation using reacting particle model that must mention the idea of collisions** Quality of communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A** **Indicative scientific points may include:** **Evaluation** • results support the analysis • idea that as concentration increases reaction time decreases and the rate of reaction increases **Reacting particle model** • as acid is more concentrated particles (of acid) are more crowded • as acid is more concentrated particles (of acid) are closer together • as acid is more concentrated more particles (of acid) per unit volume • as acid is more concentrated there are more collisions • as acid is more concentrated there are more collisions per second **allow** collisions more often, more chance of collision, increases collision frequency for more collisions per second **allow** reverse argument with as acid gets less concentrated **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
2 a	**[Level 3]** **Explanation that the results (in relation to <u>both</u> volume of acid & mass of magnesium) do not support the prediction with reference to experimental data** **AND** **an explanation *<u>using collision frequency</u>* that reaction in experiment 4 is faster, or has a shorter reaction time, than experiment 3.** Quality of communication does not impede communication of science at this level. (5-6 marks) **[Level 2]** **Explanation that the results (in relation to <u>both</u> volume of acid & mass of magnesium) do not support the prediction with reference to experimental data** **AND** **an explanation that the reaction in experiment 4 is faster, or has a shorter reaction time, than experiment 3 *using idea of more collisions rather than collision frequency*** **OR** **an explanation *<u>using collision frequency</u>* that reaction in experiment 4 is faster or has a shorter reaction time than experiment 3.** Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** **Explanation that the results (in relation to <u>either</u> volume of acid <u>or</u> mass of magnesium) do not support the prediction with reference to experimental data** **OR** **an explanation that the reaction in experiment 4 is faster or has a shorter reaction time than experiment 3 *using idea of more collisions rather than collision frequency*.** Quality of communication impedes communication of the science at this level (1-2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points for explanation may include:** • results show as volume increases reaction time does not change • results show that as mass increases reaction time does not change **Indicative scientific points for experiments 3 and 4 may include:** • concentration is higher in experiment **4** • acid particles are more crowded in experiment **4** / acid particles are closer together / more acid particles per unit volume / more acid particles per cm^3 / more acid particles in the same space • more (successful) collisions per second / collisions more often / increased collision frequency / more chance of a collision **Use the L1, L2, L3 annotations in Scoris; do not use ticks**

Question	Answer	Marks	Guidance
2 b	(acid) particles have more energy / (acid) particles are moving faster / more collisions per second (1) more successful collisions / more energetic collisions / more collisions above the activation energy / more effective collisions (1)	2	**ignore** particles vibrate more or vibrate faster **ignore** particles move more **allow** more successful collisions per second / more frequent energetic collisions for two marks **ignore** harder collisions / faster collisions **allow** more collisions (1), if no other mark awarded **allow** rate increases / reaction is faster (1), if no other mark awarded
	Total	**8**	

Question			Answer	Marks	Guidance
3	(a)		bond breaking is endothermic / bond breaking takes in energy / bond breaking absorbs energy (1) bond making is exothermic / bond making gives out energy / bond making releases energy (1) more energy taken in than is released / more energy absorbed than given out (1)	3	**allow** heat instead of energy **ignore** more bonds are broken than are made

Question			Answer	Marks	Guidance
	(b)		**[Level 3]** Applies reacting particle model, including mention of collisions frequency and / or successful collisions, to explain the effect of temperature **AND** pressure on the rate of reaction. Quality of written communication does not impede communication of science at this level. **(5-6 marks)** **[Level 2]** Applies reacting particle theory, including mention of collisions, to explain the effect of temperature **OR** pressure on the rate of reaction. Quality of written communication partly impedes communication of science at this level. **(3–4 marks)** **[Level 1]** Applies reacting particle theory to explain the effect of temperature **OR** pressure on the rate of reaction. Quality of written communication impedes communication of science at this level. **(1–2 marks)** **[Level 0]** Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted at grades up to A.** **Indicative scientific points may include:** • Increasing pressure gives more crowded nitrogen and oxygen molecules / molecules are closer together / more nitrogen and oxygen molecules in the same volume so there is an increased number of collisions per second / collisions more often • Increasing temperature has nitrogen or oxygen molecules moving faster / molecules have more energy so more successful collisions per second / more energetic collisions. **Use the L1, L2, L3 annotations in scoris. Do not use ticks.**
			Total	**9**	