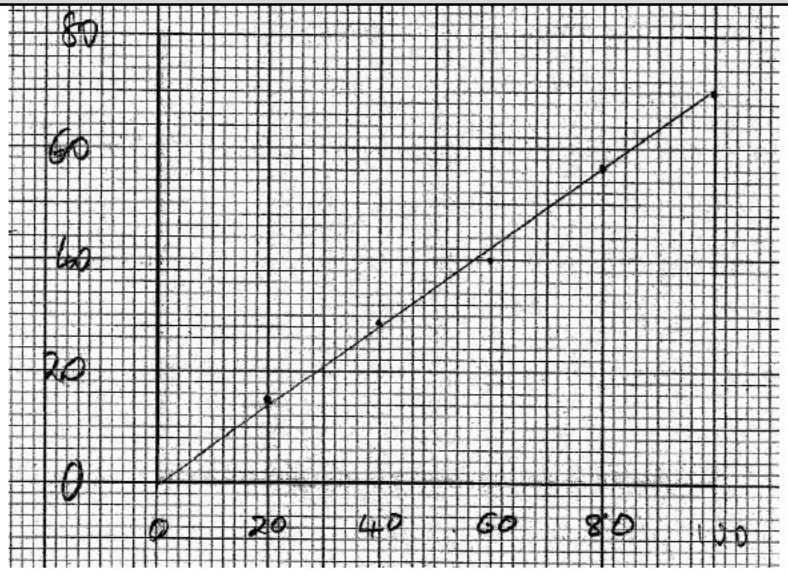
Question number	Answer	Notes	Marks
1 (a)	mass surface area / size / volume	Accept weight Ignore length / width / height / thickness / shape / type Ignore temperature / purity / density	1 1
1 (b)	(2) time / how long (to collect gas) (3) number of / how many (marble) chips (4) volume of gas / how much gas collected (5) per tage / concentration (of acid)	Accept length of reaction/experiment Ignore amount of marble Accept amount of (marble) chips Accept carbon dioxide/CO_2 in place of gas Accept amount of gas Accept strength (of acid) Ignore volume of acid **Reject** amount (of acid)	1 1 1 1

Question number	Answer	Notes	Marks
1 (c) i	all six points plotted to nearest gridline	Deduct 1 mark for each error up to max 2, including extra points, but no penalty for point at 2.4 and 50%	2
	straight line of best fit	Line need not be extrapolated Must be drawn with a ruler CQ on candidate's plotted points	1
ii	anomalous point circled	at 1.5, 20 or CQ on candidate's line of best fit	1
iii	timer started late / stopped early	Ignore just wrong time	2
	concentration/% too high/more than 20%	Ignore just wrong concentration	
	marble chips bigger / more marble chips	Ignore just wrong mass/size	
	air in measuring cylinder before experiment started	Accept smaller volume of gas collected	
	(room) temperature higher	Ignore references to calculation Any two for 1 mark each M1 to M5 CQ on position of anomalous point, so if anomalous point below line of best fit, then: M1 timer started too early/stopped too late M2 concentration/% too low/less than 20% M3 marble chips smaller / fewer marble chips M4 larger volume of gas collected M5 (room) temperature lower	
iv	vertical line from 50% to drawn graph line	Accept short vertical line crossing graph line at 50% Accept point on graph line at 50%	1
	2.4 (cm^3/s)	CQ on drawn graph line but can be awarded without vertical line Do not penalise incorrect units	1
		Total	**14**

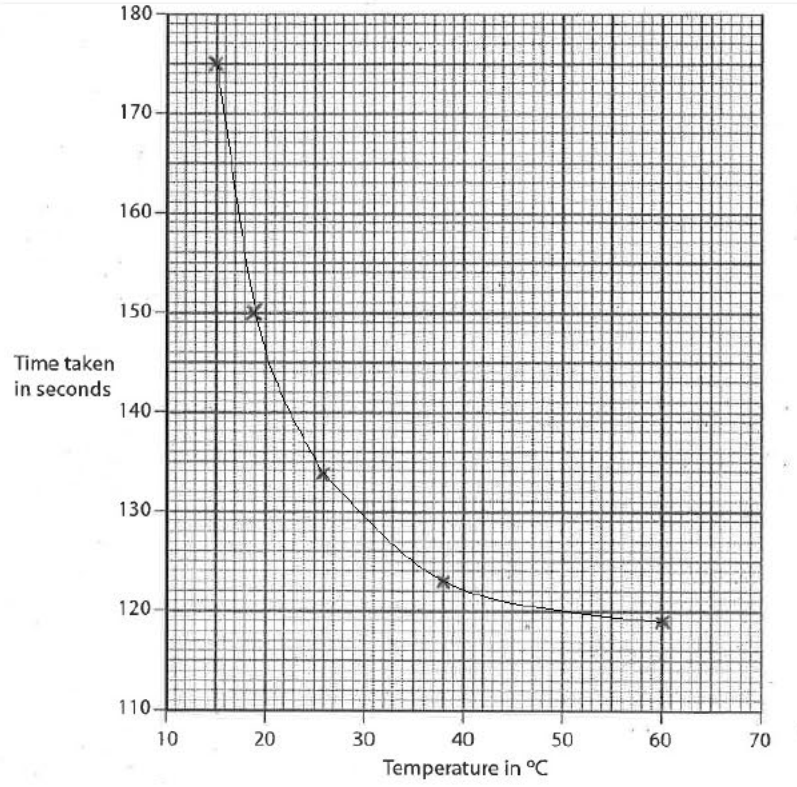
Question number	Answer	Accept	Reject	Marks
2 (a)	**M1** (reactants) s aq **M2** (products) aq l g	capital letters		1 1
(b) (i)	to prevent acid escaping/spraying out/spitting out **IGNORE** to prevent water escaping	solution/liquid/HCl		1
(ii)	C			1
(c) (i)	**M1** A **M2** gas produced/collected more quickly / experiment over in shorter time / (gradient of) line steeper **M2** dep on **M1**	reaction is faster		1 1 1
(ii)	**M1** 0.1(0) **M2** volume of gas is half/40 **÷** 80 = ½ / 80 = 40 x 2 **M2 dep on M1**	Half the products are produced		1
(d) (i)	**M1** & **M2** - all points plotted to nearest gridline deduct 1 mark for each incorrect plot up to a max. of 2			2 1
(ii)	**M3** suitable straight line of best fit (csq on plotted points) (must be drawn with the aid of a ruler). Line need not beextrapolated. **M1** as concentration increases rate increases	(show a) positive correlation as one doubles the other doubles/directly proportional		1 1

(iii)	**M2** proportional / in proportion **M1** more ions/particles (in a given volume) **IGNORE** more reactants **M2** collide (successfully) **M3** more per second/more frequently Must be reference to frequency or number of collisions per unit time **IGNORE** greater chance of collision	for 2 marks	molecules/atoms any reference to greater energy	1 1 1
			Total	**16**

Question number	Answer	Notes	Marks
3 a	mass / amount surface area / size / volume	Accept weight Ignore number of marble chips Ignore length / width / height / thickness / shape / type Ignore temperature / purity / density	1 1
b	gas/carbon dioxide escapes / OWTTE	Ignore references to solid dissolving Ignore references to acid spray / vapour Do not penalise incorrectly named gas (eg hydrogen)	1
c	prevents loss of acid (spray)/liquid	Ignore references to evaporation / water vapour / spilling of liquid Reject references to stopping gases/marble chips escaping	1
d i	210 (s) some indication of mark on curve OR vertical line from 50% / horizontal line from 210 s	 Mark M1 and M2 independently	1 1
ii	B (the loss of mass was greater than 1.0g		1
e	1 ÷ 210 evaluation of M1 / 0.00476	Accept any time value in range 200 - 210 Accept answer in range 0.004- 0.005 Accept any number of sig fig	1 1

Question number	Answer	Notes	Marks
3 f			
	all five points plotted to nearest gridline	Deduct 1 mark for each error up to max 2	2
	straight line of best fit	Line need not be extrapolated to origin If line not extrapolated, it should go to the origin if extrapolated Must be drawn with a ruler CQ on candidate's plotted points	1

Question number	Answer	Notes	Marks
3 g	more particles (in a given volume)	Accept ions Reject atoms / molecules Accept quantitative answer such as twice as many particles when concentration doubles	1
	more collisions (between particles) / OWTTE		1
	per unit time / OWTTE	more frequent collisions scores M2 and M3 Ignore greater chance/likelihood of collisions Accept reverse argument if clear that decreasing concentration is being considered MAX 1 if any reference to particles moving faster / having more energy	1
			Total 15 marks

Question number	Answer	Accept	Reject	Marks
4 (a) (i)	**M1** & **M2**– all points correctly plotted to nearest gridline deduct 1 mark for each incorrectly plotted point **M3** <u>smooth</u> curve of best fit drawn  			2 1
(ii)	value from candidate's graph to nearest gridline Penalise incorrect units			1
(iii)	as temperature <u>increases</u>, time (taken) <u>decreases</u> IGNORE references to rate and inverse proportionality	reverse argument negative correlation		1

Question number	Answer	Accept	Reject	Marks
4 (b)	**M1** (average kinetic) energy of particles/ions increases **M2** more collisions/particles/ions have energy ≥ activation energy **M3** more (successful) collisions <u>per</u> <u>second</u> / more <u>frequent</u> (successful) collisions **IGNORE** references to chance of collisions Penalise reference to molecules once only	particles move faster sufficient energy to react	molecules/atoms (but once only)	1 1 1
(c)	(same) concentration (of each solution)	(same) volume (of each solution) (same) amount of (each) solution rate of mixing		1
			Total	**9**