

Question number	Answer	Notes	Marks
2 (a) (i)	M1 $0.53 \div 106$	correct answer scores (2)	2
	M2 $0.005(0) \text{ (mol)}$		
(ii)	M1 $n(\text{CO}_2) = 0.005 \text{ mol}$ / answer to (a)(i)	correct answer scores (2)	2
	M2 $\text{vol}(\text{CO}_2) = (110 \div 0.005) = 22\,000 \text{ (cm}^3\text{)}$ OR $110 \div \textbf{M1}$ correctly evaluated		
(b)	any two from: M1 the bung was not replaced quickly after the acid was added (so some carbon dioxide/gas escaped) M2 (some) carbon dioxide/gas dissolved in the water (in the trough or in the acid) M3 sodium carbonate is not pure	allow 'the bung was not on tightly/there was a leak around the bung (so some carbon dioxide/gas escaped)' allow 'reacted with the water'	2

b		as the (hydrochloric) acid/HCl is added	Allow (immediately) after (all) the acid/HCl added Ignore when the solutions are mixed	1
c	i	timer started too late / stopped too early		1
		OR		
		thermometer (scale) read incorrectly / timer read incorrectly	Allow misread/incorrectly recorded the temperature/time	
	ii	19.5 (s)	Accept range 19-20	1

Question number	Answer	Notes	Marks
5 d i	M1 times are (very) short	Accept reaction happens too/very/so quickly (so hard to time accurately/precisely) Ignore reaction is quicker Ignore hard(er) to measure rate Allow human reaction time becomes significant Allow references to shorter times producing greater percentage (measurement) uncertainties/errors	2
	M2 heat loss greater	Accept heat loss occurs more quickly Accept difficult to maintain a higher temperature/keep temperature constant Ignore references to evaporation occurring	
	ii M1 more collisions/particles have energy equal to/greater than the activation energy	Ignore particles have more (kinetic) energy Ignore harder/more vigorous collisions Ignore references to speed of particles	2
	M2 (therefore there are) more successful collisions (per second)	if state activation energy is lowered scores 0/2 references to concentration scores 0/2	

Question number	Expected answer	Accept	Reject	Marks
4 (a) (i)	108/24 = 4.5	1 mark for answer of 4.8(2) (molar volume = 22.4dm ³)		1
(ii)	M _r of NaN ₃ = 65 Moles of NaN ₃ = 3 OR two thirds of (a)(i) Mass of NaN ₃ = 195 (g) OR moles of NaN ₃ x M _r [Mark consequentially at each stage]	23 + (14 x 3) Correct answer with no working scores 3		1 1
(b) (i)	Removes (harmful) sodium	Produces <u>more</u> nitrogen / gas OR bag inflates more quickly		1
(ii)	K ₂ O(s) + SiO ₂ (s) → K ₂ SiO ₃ (s) OR K ₂ O(s) + SiO ₂ (s) → K ₂ SiO ₃ (l) IGNORE same numbers of Na ₂ O on both sides of equation			1
(c) (i)	Precipitation	<u>Double</u> decomposition	Double displacement	1
(ii)	Filtration / filter IGNORE refs to adding water	Decanting / pour off liquid	Sieving / evaporation / distillation / crystallisation / heat	1

Total 9 Marks

e	Any three from		
	M1 concentration of the (hydrochloric/nitric) acid		
	M2 volume of the (hydrochloric/nitric) acid	Allow amount for volume	
	M3 volume of sodium thiosulfate	If neither M2 or M3 scored allow 1 mark for total volume of the mixture OR depth of liquid in the flask	
	M4 temperature	Ignore reference to volume of water Ignore references to size of flask/same apparatus Ignore references to distance of eye from flask/ the X/references to timing	3