

Mark Scheme - 2.4 Chemical Reactions and Energy

1.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	<p>first mark for sensible suggestion with second mark for linked point/explanation</p> <p>e.g. use more calcium oxide (1) more heat would be released on reaction (1) or use smaller pieces of calcium oxide (1) so that reaction occurs more quickly (1)</p>	<p>less water / better insulation on outer wall of can / thinner metal in inner wall</p>	less food	
(b)		2	<p>bond making releases energy and bond breaking absorbs energy (1) reactions are exothermic if more energy is released than is absorbed (1)</p> <p>both marks could be gained by one statement e.g. reactions are exothermic if more energy is released in making bonds than is absorbed in breaking bonds (2)</p>			

2.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	all points plotted correctly (2) any 8 points plotted correctly (1) curve of best fitjudgement by eye <i>i.e. smooth continuous single line</i> (1)	$\pm 1/2$ square		ruler used in drawing 'curve'
(b)	(i)	1 5.5 follow through error from graph (ft)			
	(ii)	1 50 \pm 1 ft			
(c)	2	using a polystyrene cup (1) use a lid / closed top use two polystyrene cups / use thicker polystyrene cup add the acid quickly (1)	beaker traps air form of further insulation around beaker	beaker	
(d)	1	exothermic			

3.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	3 molecules of CO ₂ (1) must get first mark to be awarded second 5 molecules of O ₂ (1)			
(b)	(i)	2	identification of all bonds made e.g. 4 x O–H (1) 1852 (1) award (2) for correct answer only (cao)	max (1) if subtraction done		
	(ii)	2	485 kJ calculated (1) allow error carried forward (ecf) from (i) more energy given out than taken in (1)		negative value	

4.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	2	$436 + 242$ (1) $= 678$ (1) – correct answer only (cao) (2)			
	(ii)	2	2×431 (1) $= 862$ (1) – cao (2)			
(b)		1	exothermic since energy given out (as bonds made) > energy needed (to break the bonds) energy given by reaction is negative / -184 credit 'endothermic' with correct reason if calculation error followed through (ft)			

5.

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 ₂ O ₅
	(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	$\text{CuCO}_3 + 2\text{HNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$ formulae correct (1) balancing (1) formulae must be correct for balancing mark to be awarded			