Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit () = words which are not essential to gain credit = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument		nnotat onventised in Scheme
Question	Expected Answers	Marks	Quest
1(a)	(a reaction) that releases energy/ (a reaction) that releases heat/ a reaction with a negative ΔH (1)	1	2(a)
(b)(i)	diagram to show upward hump (1) CO ₂ + (2)H ₂ O/ carbon dioxide and water below reactants (1)	2	(b)
(ii)	E _a marked (1) if an arrowhead is included, it must be upwards	1	(c)
(c)	sketch distribution to show axes labelled number/ fraction of molecules/atoms and energy (1) shape starting at origin, maximum, approaching but not crossing x axis (1) for both graphs		(d)
	explanation of distribution 2 from no molecules with no energy few very energetic molecules most have average amounts of energy area under curve is the number of molecules (2)		
	distribution at higher temperature shown on diagram hump lower than original (1) and to RHS of original (1) E _a marked (1)		
	rate increases with an increase in temperature (1) since more molecules have energy > E_a (1)	9 Total: 13	

Abbreviations, annotations and conventions used in the Mark Scheme	nnotations and onventions sed in the Mark Sed in the Mark Sed	
Question	Expected Answers	Marks
2(a) (b)	<pre>(heat/ energy change) when 1 mole of substance is formed (1) from its elements (1) C(s) + 2H₂(g) → CH₄(g) balanced equation (1)</pre>	2
(c)	state symbols (1) cycle drawn/ sum of enthalpy changes products – sum of enthalpy changes reactants (1) $-75 - 242 + x = -110 (1)$ $\Delta H = 207 (kJ mol^{-1}) (1)$	3
(d)	any industrial use, examples include manufacture of ammonia/ for Haber process manufacture of margarine/ hydrogenation of alkenes	1 Total: 8

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Scheme	= (underlining) key words which <u>must</u> be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument	Lig	Sch
Question	Expected Answers	Marks	
3(a)	to overcome activation energy (1)	11518	Que 4(a
	reaction is endothermic (1)		
	to break bonds – if type of bonds stated must be ionic or covalent (1)		(b)
	A2 answer based on polarisation of carbonate by Ca ²⁺ is acceptable	2	(c)
(b)(i)	rate forward > rate backward (1)	1	
(ii)	rate forward = rate backward (1)	1	
(iii)	equilibrium moves to RHS (1)		
	use of le Chatelier (1)		(0
(-)(1)	more CaO /product / less CaCO ₃ / reactant present (1)	3	
(c)(i)	$CaCO_3(s) + 2HCI(aq) \rightarrow CaCI_2(aq) + CO_2(g) + H_2O(l)$		
	$CaO(s) + 2HCI(aq) \rightarrow CaCI_2(aq) + H_2O(I)$		(
	each balanced equation 1 mark (2)	3	
(::)	all state symbols (1)		
(ii)	CaCO ₃ fizzes/ gas given off/ gas evolved / carbon dioxide evolved (1)	1	
	The state of the s	Total: 11	Ш

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Question	Expected Answers	Marks	
4(a)	anywhere in range 30 - 40% (1) if range given all values must be in this range	1	
(b)(i)	increases (1)	1	
(ii)	more moles of A and B (1) equilibrium moves in direction of less moles (1)	2	
(c)	endothermic (marks for explanation)		
(d)(i)	an increase in temperature converts more A (1) equilibrium moves in direction to lower temperature/ forward reaction must tend to lower temperature/ an increase in temperature favours the endothermic process (1)	2	
(d)(i)	a substance that alters/increases the rate of reaction/lowers Ea(1)	2	
	but remains unchanged after the reaction /is not used up (1)		
(ii)	to save energy/money + reason eg by allowing process to run at a lower temperature/ by lowering Ea (1)		
	goes faster to save time/ allows the process to run continuously (1)	2	
(e)	not enough time was allowed for the equilibrium to establish/ other products were formed (1)	1	
(f)	two important catalysts, examples include iron in Haber process/ manufacture of ammonia vanadium(V) oxide in Contact process/ manufacture of sulphuric acid nickel in hydrogenation of alkenes/ manufacture of margarines phosphoric acid in the conversion ethene to ethanol		
	enzyme/ named enzyme with corresponding function Pt/Pd/Rh in catalytic converter (any 1 metal) Ziegler catalyst in alkene polymerisation any named acid (except nitric) in esterification zeolites/ platinum in catalytic cracking	2 Total: 13	