

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	
Question	Expected Answers	Marks
2(a)	(heat/ energy change) when 1 mole of substance is formed (1) from its elements (1)	2
(b)	$C(s) + 2H_2(g) \rightarrow CH_4(g)$ balanced equation (1) state symbols (1)	2
(c)	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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Question	Expected Answers	Marks
3(a)	to overcome activation energy (1) reaction is endothermic (1) to break bonds – if type of bonds stated must be ionic or covalent (1) A2 answer based on polarisation of carbonate by Ca^{2+} is acceptable	2
(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)	3
(c)(i)	more CaO / product / less CaCO_3 / reactant present (1) $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ $\text{CaO}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$ each balanced equation 1 mark (2)	3
(ii)	all state symbols (1) CaCO_3 fizzes/ gas given off/ gas evolved / carbon dioxide evolved (1)	1
		Total: 11

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<p>Question</p>	<p>Expected Answers</p>	<p>Marks</p>
<p>4(a)</p>	<p>anywhere in range 30 - 40% (1) if range given all values must be in this range</p>	<p>1</p>
<p>(b)(i)</p>	<p>increases (1)</p>	<p>1</p>
<p>(ii)</p>	<p>more moles of A and B (1) equilibrium moves in direction of less moles (1)</p>	<p>2</p>
<p>(c)</p>	<p>endothermic (marks for explanation) 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)</p>	<p>2</p>
<p>(d)(i)</p>	<p>a substance that alters/increases the rate of reaction/lowers E_a(1) but remains unchanged after the reaction /is not used up (1)</p>	<p>2</p>
<p>(ii)</p>	<p>to save energy/money + reason eg by allowing process to run at a lower temperature/ by lowering E_a (1) goes faster to save time/ allows the process to run continuously (1)</p>	<p>2</p>
<p>(e)</p>	<p>not enough time was allowed for the equilibrium to establish/ other products were formed (1)</p>	<p>1</p>
<p>(f)</p>	<p>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</p>	<p>2 Total: 13</p>