Question	Marking Guidance	Mark	Comments
2(a)	Because it is a gas compared with solid carbon Nitrogen is more disordered/random/chaotic/free to move	1 1	Mark independently
2(b)	0 K / –273 C / absolute zero	1	
2(c)	$\Delta G = \Delta H - T\Delta S$	1	Allow $\Delta H = \Delta G - T\Delta S$ $T\Delta S = \Delta H - \Delta G$ $\Delta S = (\Delta H - \Delta G)/T$ Ignore θ in ΔG^{θ}
2(d)	ΔG is less than or equal to zero ($\Delta G \leq 0$)	1	Allow ΔG is less than zero ($\Delta G < 0$) Allow ΔG is equal to zero ($\Delta G = 0$) Allow ΔG is negative
2(e)	When $\Delta G = 0$ $T = \underline{\Delta H / \Delta S}$ $\Delta H = +90.4$ $\Delta S = \sum S(\text{products}) - \sum S(\text{reactants})$ $\Delta S = 211.1 - 205.3/2 - 192.2/2 = \underline{12.35}$ $T = (90.4 \times 1000)/12.35 = 7320$ K /7319.8 K	1 1 1 1 1	Allow $\Delta H = +90$ Allow 7230 to 7350 K (Note 7.32 K scores 4 marks) Units of temperature essential to score the mark

2(g)	ΔH = 1.9 (kJ mol^{-1}) ΔS = 2.4 – 5.7 = –3.3 (J K^{-1} mol^{-1}) ΔG is always positive	1 1 1	 for M1 and M2 allow no units, penalise wrong units This mark can only be scored if ΔH is +ve and ΔS is –ve

2(f)	Activation energy is high	1	Allow chemical explanation of activation energy Allow needs route with lower activation energy Allow catalyst lowers activation energy