



- 1 Calculate the entropy change for the vaporisation of methanol (CH₃OH) given this data.

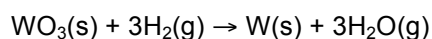
enthalpy of vaporisation of methanol = +35.2 kJ mol⁻¹

boiling point of methanol = +64.7 °C

at the boiling point, $\Delta G = 0$ $\Delta H - T\Delta S = 0$

$$\Delta S = \frac{\Delta H}{T} = \frac{35200}{337.7} = 104 \text{ J mol}^{-1} \text{ K}^{-1}$$

- 2 Tungsten can be extracted from tungsten oxide by reaction with hydrogen. The reaction is not feasible at room temperature. Calculate the temperature at which this reaction becomes feasible.



substance	WO ₃ (s)	H ₂ (g)	W(s)	H ₂ O(g)
$\Delta_f H^\ominus$ (kJ mol ⁻¹)	-840			-242
S^\ominus (J mol ⁻¹ K ⁻¹)	+83.3	+131	+33	+189

$$\begin{aligned}\Delta H &= [\text{Sum } \Delta_f H \text{ products}] - [\text{Sum } \Delta_f H \text{ reactants}] \\ &= [3(-242)] - [-840] \\ &= +114 \text{ kJ mol}^{-1}\end{aligned}$$

$$\begin{aligned}\Delta S &= [\text{Sum } S \text{ products}] - [\text{Sum } S \text{ reactants}] \\ &= [33 + 3(189)] - [83.3 + 3(131)] \\ &= +123.7 \text{ J mol}^{-1} \text{ K}^{-1}\end{aligned}$$

when $\Delta G = 0$ $\Delta H - T\Delta S = 0$

$$T = \frac{\Delta H}{\Delta S} = \frac{114}{\frac{123.7}{1000}} = 922 \text{ K}$$