1 Calculate the entropy change for the vaporisation of methanol (CH_3OH) given this data.

enthalpy of vaporisation of methanol = +35.2 kJ mol^{-1}
boiling point of methanol = +64.7 °C

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

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

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.

$$WO_3(s) + 3H_2(g) \rightarrow W(s) + 3H_2O(g)$$

substance	$WO_3(s)$	$H_2(g)$	$W(s)$	$H_2O(g)$
$\Delta_f H^\ominus$ (kJ mol^{-1})	–840			–242
$S^\ominus$ (J mol^{-1} K^{-1})	+83.3	+131	+33	+189

ΔH = [Sum $\Delta_f H$ products] – [Sum $\Delta_f H$ reactants]
= [3(–242)] – [–840]
= +114 kJ mol^{-1}

ΔS = [Sum S products] – [Sum S reactants]
= [33 + 3(189)] – [83.3 + 3(131)]
= +123.7 J mol^{-1} K^{-1}

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

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