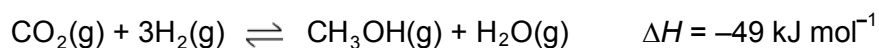**5** **Table 3** contains some entropy data relevant to the reaction used to synthesise methanol from carbon dioxide and hydrogen. The reaction is carried out at a temperature of 250 °C.

Table 3

Substance	$CO_2(g)$	$H_2(g)$	$CH_3OH(g)$	$H_2O(g)$
Entropy ($S^\ominus$) / J K^{-1} mol^{-1}	214	131	238	189

$$CO_2(g) + 3H_2(g) \rightleftharpoons CH_3OH(g) + H_2O(g) \qquad \Delta H = -49 \text{ kJ mol}^{-1}$$

0 5 . 1 Use this enthalpy change and data from **Table 2** to calculate a value for the free-energy change of the reaction at 250 °C.
Give units with your answer.

[4 marks]

Free-energy change = _____ Units = _____

0 5 . 2 Calculate a value for the temperature when the reaction becomes feasible.

[2 marks]

Temperature = _____ K

0 5 . 3 Gaseous methanol from this reaction is liquefied by cooling before storage.

Draw a diagram showing the interaction between two molecules of methanol.
Explain why methanol is easy to liquefy.

[4 marks]

Diagram

Explanation _____

_____

_____