Question 29 **(11 marks)**

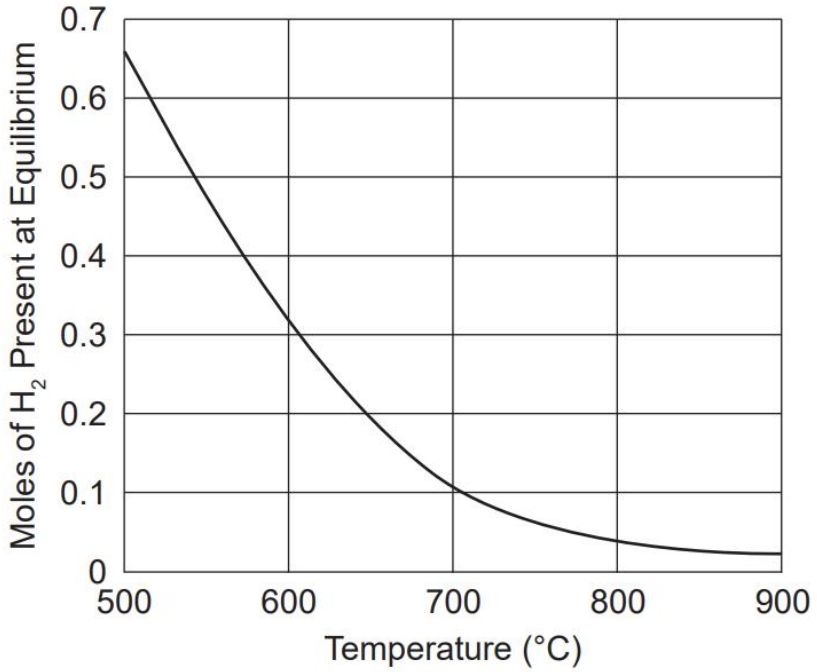
Some hydrogen sulfide and methane were sealed inside a reaction vessel and the following equilibrium was established:

$$2\ H_2S(g) + CH_4(g) \rightleftharpoons CS_2(\ell) + 4\ H_2(g)$$

(a) Write the equilibrium constant expression (K) for this reaction system. (2 marks)

(b) Some methane was removed from the reaction vessel. What effect did this have on the position of the equilibrium? Use collision theory to justify your answer. (5 marks)

The temperature inside the reaction vessel was increased. The heating process was stopped every so often and, once equilibrium had been established at the attained temperature, the amount of hydrogen present in the system was measured. The results are shown on the following graph.



(c) Using the graph and your answer to part (a), predict the effect of an increase in temperature on the numerical value of K. Justify your prediction. (4 marks)