Marks 6

- The isomerisation of glucose-6-phosphate (G6P) to fructose-6-phosphate (F6P) is a key step in the metabolism of glucose for energy. At 298 K,

$$\text{G6P} \rightleftharpoons \text{F6P} \qquad \Delta G^\circ = 1.67 \text{ kJ mol}^{-1}$$

Calculate the equilibrium constant for this process at 298 K.

Using ΔG° = -RTlnK,

$1.67 \times 10^3 = -(8.314) \times (298) \times \ln K$

K = 0.510

Answer: **K = 0.510**

What is the free energy change (in kJ mol^{-1}) involved in a mixture of 3.00 mol of F6P and 2.00 mol of G6P reaching equilibrium at 298 K?

The reaction quotient, for the reaction, is $Q = \frac{[\text{F6P}]}{[\text{G6P}]} = \frac{3.00}{2.00} = 1.50$.

Using ΔG = ΔG° + RTlnQ,

$\Delta G = (1.67 \times 10^3) + (8.314 \times 298) \times \ln(1.50) = +2670 \text{ J mol}^{-1} = +2.67 \text{ kJ mol}^{-1}$

Answer: **+2.67 kJ mol^{-1}**

Sketch a graph of G_{sys} *versus* "extent of reaction", with a curve showing how G_{sys} varies as G6P is converted to F6P. Indicate the position on this curve corresponding to 3.00 mol of F6P and 2.00 mol of G6P.