# The equilibrium constant

**1** For the equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$, the forward reaction is exothermic.

(a) Write the expression for the equilibrium constant, $K_c$.

..... **(1 mark)**

(b) How can the value of $K_c$ be increased?

The question is not asking about yield, but about $K_c$ value.

☐ A Increasing the concentration of sulfur dioxide

☐ B Reducing the temperature

☐ C Increasing the pressure

☐ D Adding a suitable catalyst **(1 mark)**

(c) In industry this reaction is carried out at a temperature of around 450 °C.

Explain why this temperature is chosen, and not a higher or lower temperature.

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..... **(4 marks)**

Maths skills

Guided

(d) In a simulation, under certain conditions the equilibrium mixture was found to have 0.5 mol $SO_2$, 0.25 mol $O_2$ and 1.5 mol $SO_3$ in a vessel of volume 100 $cm^3$.

Use your expression from (a) to find $K_c$ and give the units.

The concentrations of each gas in mol $dm^{-3}$ are .....

Substituting into the $K_c$ expression, $K_c$ = .....

Substituting mol $dm^{-3}$ into $K_c$ to give units .....

..... **(3 marks)**

**2** In the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, $K_c = 0.105\,dm^6\,mol^{-2}$ under certain conditions.

This value of $K_c$ indicates that

☐ A the concentration of $NH_3$ is $0.105\,mol\,dm^{-3}$

☐ B the concentration of $NH_3$ is $\sqrt{0.105}\,mol\,dm^{-3}$

☐ C the equilibrium position lies to the left hand side

☐ D 10.5% of the mixture is ammonia. **(1 mark)**