Chemical equilibria, Le Chatelier's principle and Kc – A2 2022 Chemistry P1

1. June/2022/Paper_7405/1/No.1

0 1 This question is about equilibria.

0 1 . 1 Give **two** features of a reaction in dynamic equilibrium.

[2 marks]

Feature 1 _____

_____

Feature 2 _____

_____

0 1 . 2 A gas-phase reaction is at equilibrium.
When the pressure is increased the yield of product decreases.

State what can be deduced about the chemical equation for this equilibrium.

[1 mark]

_____

_____

0 1 . 3 Carbon monoxide and hydrogen react to form methanol.

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$$

0.430 mol of carbon monoxide is mixed with 0.860 mol of hydrogen.
At equilibrium, the total pressure in the flask is 250 kPa and the mixture contains 0.110 mol of methanol.

Calculate the amount, in moles, of carbon monoxide present at equilibrium.

Calculate the partial pressure, in kPa, of carbon monoxide in this equilibrium mixture.

[3 marks]

Amount of carbon monoxide _____ mol

Partial pressure _____ kPa

0 1 . 4 Give an expression for the equilibrium constant (K_p) for this reaction.

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$$

[1 mark]

K_p

0 1 . 5 A different mixture of carbon monoxide and hydrogen is left to reach equilibrium at a temperature *T*.

Some data for this equilibrium are shown in **Table 1**.

Table 1

Partial pressure of CO	125 kPa
Partial pressure of CH_3OH	5.45 kPa
K_p	1.15×10^{-6} kPa^{-2}

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$$

Calculate the partial pressure, in kPa, of hydrogen in this equilibrium mixture.

[3 marks]

Partial pressure _____ kPa

0 1 . 6 Use the K_p value from **Table 1** to calculate a value for K_p for the following reaction at temperature *T*.

$$CH_3OH(g) \rightleftharpoons CO(g) + 2H_2(g)$$

Give the units for K_p

[2 marks]

K_p _____

Units _____