7.1 Equilibrium

Question Paper

Course	DP IB Chemistry
Section	7. Equilibrium
Topic	7.1 Equilibrium
Difficulty	Easy

Time allowed: 30

Score: /17

Percentage: /100

Question 1a

a)

Distinguish between the terms reaction quotient, Q, and equilibrium constant, K_c.

[1 mark]

Question 1b

b)

Write an expression for the reaction quotient, Q, for this reaction.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

[1 mark]

Question 1c

c)

The equilibrium constant, K_c, for the reaction is 0.282 at temperature T whilst the reaction quotient is calculated to be 0.5.

Deduce the direction of the initial reaction.

[1 mark]

Question 2a

a)

Urea can be made by the direct combination of ammonia and carbon dioxide gases.

$$2NH_3(g) + CO_2(g) \rightleftharpoons CO(NH_2)_2(g) + H_2O(g)$$

Write the equilibrium constant expression, K_c.

[1 mark]

Question 2b

b)

$\Delta H < 0$ for the forward reaction.

Predict the effect on the equilibrium constant, K_c, when the temperature is increased.

[1 mark]

Question 2c

c)
Predict what will happen to the equilibrium position if there is a decrease in pressure.

[1 mark]

Question 2d

d)
The K_c value for the reaction is determined to be 2×10^{-9} mol dm^{-3} at 298 K.
Determine the magnitude of K_c if the reaction is reversed.

[1 mark]

Question 3a

a)
The following reaction was allowed to reach equilibrium at 761 K.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H^{\theta} < 0$$

Determine the K_c expression for this reaction.

[1 mark]

Question 3b

b)
The K_c value for the reaction in part a) is found to be 48.52.
Deduce the K_c value for the following reaction.

$$1/2H_2(g) + 1/2I_2(g) \rightleftharpoons HI(g)$$

[1 mark]

Question 3c

c)
The temperature of the reaction is increased to 703K and the new K_c value is found to be 54.30.
Explain why the value of K_c has changed.

[1 mark]

Question 3d

d)
A catalyst is added in an attempt to speed up the rate of reaction.
State what will happen to the value of K_c.

[1 mark]

Question 4a

a)
State what is meant by the term *dynamic equilibrium*.

[1 mark]

Question 4b

b)
Describe **two** characteristics of a reaction at equilibrium.

[2 marks]

Question 4c

c)
State and explain the effect of a catalyst on the position of equilibrium.

[2 marks]

Question 4d

d)

Methanoic acid reacts with methanol to form the ester methyl methanoate.

$$HCOOH\,(l) + CH_3OH\,(l) \rightleftharpoons HCOOCH_3\,(l) + H_2O\,(l)$$

The esterification reaction is exothermic. State the effect of increasing temperature on the value of the equilibrium constant (K_c) for this reaction.

[1 mark]