

7.1 Equilibrium

Question Paper

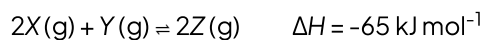
Course	DPIB Chemistry
Section	7. Equilibrium
Topic	7.1 Equilibrium
Difficulty	Hard

Time allowed: 40
Score: /29
Percentage: /100

Question 1a

a)

The following dynamic equilibrium was reached at temperature, T , in a closed container.



The value of K_c for the reaction was $75.0 \text{ mol}^{-1} \text{ dm}^3$ when the equilibrium mixture contained 2.97 mol of Y and 5.38 mol of Z.

i)

Define dynamic equilibrium.

[2]

ii)

Write an expression for K_c for the reaction.

[1]

[3 marks]

Question 1b

b)

If the conditions for a closed container are changed, it can affect the concentrations of the reactants, products and K_c .

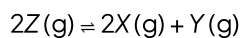
State the effect, if any, on the concentration of Y at equilibrium if temperature, T , is decreased and give a reason for your answer.

[2]

[2 marks]

Question 1c

c)

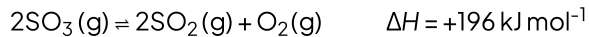
Calculate the equilibrium constant for the following reaction at temperature, T .

[1]

[1 mark]

Question 2a

a)

A 0.680 mol sample of SO_3 is introduced into a reaction container and allowed to reach equilibrium at temperature T .The value of K_c for the reaction was $7.9 \times 10^{-3} \text{ mol dm}^{-3}$.The size of the container for the reaction is increased. State the effect if any on the equilibrium constant, K_c , and the position of equilibrium. Justify your answer.

[4]

[4 marks]

Question 2b

b)

The temperature of the reaction in part (a) is increased. State the effect, if any, on the equilibrium constant, K_c , and the position of equilibrium. Justify your answer.

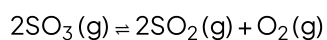
[3]

[3 marks]

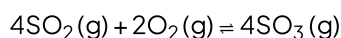
Question 2c

c)

If the value of the equilibrium constant, K_c , is 2.7×10^{-2} at temperature T for the reaction:



Calculate the equilibrium constant, K_c , for the reaction:



Give your answer to 2 decimal places.

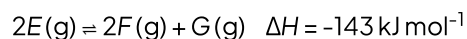
[1]

[1 mark]

Question 3a

a)

A mixture in a container at temperature, T , is allowed to reach equilibrium.



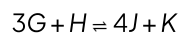
The value of K_c for the reaction at T is 2.98 mol dm^{-3} . Comment on the relationship between the concentration of the reactant E and products F and G with regards to K_c .

[2]

[2 marks]

Question 3b

b)

Reactants *G* and *H* react together to form products *J* and *K* according to the equationWrite the expression for the equilibrium constant, K_c .

[1]

[1 mark]

Question 3c

c)

Diesters are compounds often used as synthetic lubricants for machinery such as compressors. The reaction below shows the formation of a diester from propanoic acid and propane-1,3-diol.

The value for K_c at temperature, T , is 1.29.The forward reaction is slightly exothermic. At a different temperature, T_1 , the value for K_c increases to 22.78.State whether the new temperature, T_1 , is higher or lower than the original temperature. Justify your answer.

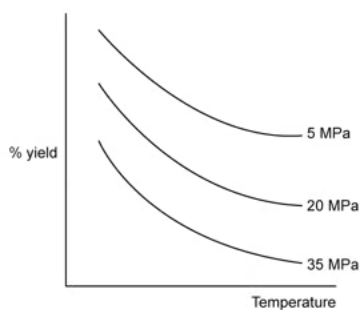
[3]

[3 marks]

Question 4a

a)

The graph below shows the effect of pressure and temperature on the equilibrium yield of gaseous molecules.



Using the graph, explain whether the forward reaction is exothermic or endothermic.

[3]

[3 marks]

Question 4b

b)

Use the graph to explain whether the forward reaction will involve either an increase or decrease in the number of moles of a gas.

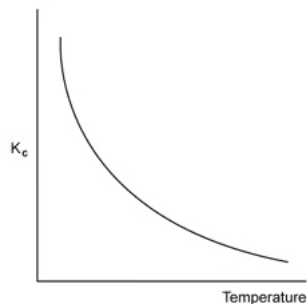
[3]

[3 marks]

Question 4c

c)

The graph to show the relationship between temperature and K_c for a **different** dynamic equilibrium to produce a gaseous product is shown below.



Use the information shown in the graph to establish whether the **forward reaction** is exothermic or endothermic. Justify your answer.

[3]

[3 marks]