Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1_Equilibrium Constant Kp For Homogeneous Systems

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Name of the Student:_____
Max. Marks : 16 Marks **Time : 16 Minutes**

Q1.

The equation for the reaction between sulfur dioxide and oxygen is shown.

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

In an experiment, 2.00 mol of sulfur dioxide are mixed with 2.00 mol of oxygen.

The total amount of the three gases at equilibrium is 3.40 mol

What is the mole fraction of sulfur trioxide in the equilibrium mixture?

A 0.176 ⬭

B 0.353 ⬭

C 0.600 ⬭

D 1.200 ⬭

(Total 1 mark)

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Q2.

Nitrogen reacts with hydrogen in this exothermic reaction

$$N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g)$$

Which change increases the equilibrium yield of ammonia but has no effect on the value of the equilibrium constant K_p?

A Add a catalyst ⬭

B Increase the partial pressure of nitrogen ⬭

C Decrease the temperature ⬭

D Decrease the total pressure ⬭

(Total 1 mark)

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Q3.

There are several stages in the industrial production of methanol from methane.

(a) The first stage involves a gaseous equilibrium between the reactants (methane and steam), and some gaseous products. **Figures 1** and **2** show the percentage conversion of methane into the gaseous products under different conditions at equilibrium.

Figure 1

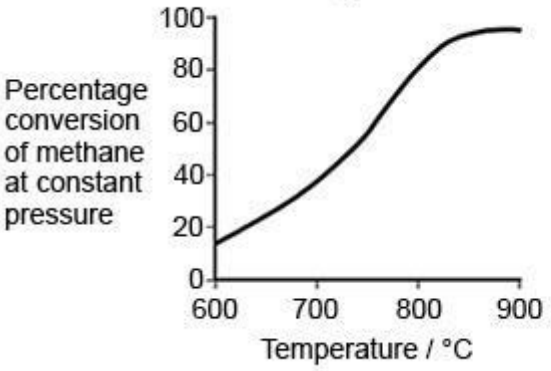
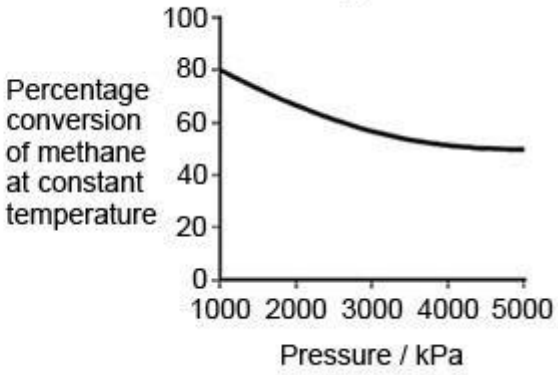


Figure 2



Deduce the optimum conditions for the industrial conversion of methane and steam into the gaseous products.

Explain your deductions.

_____

_____

_____

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_____

(6)

(b) The equation shows the final stage in the production of methanol.

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

20.1 mol of carbon monoxide and 24.2 mol of hydrogen were placed in a sealed container. An equilibrium was established at 600 K. The equilibrium mixture contained 2.16 mol of methanol.

Calculate the amount, in moles, of carbon monoxide and of hydrogen in the equilibrium mixture.

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Amount of carbon monoxide = _____ mol

Amount of hydrogen = _____ mol

(2)

(c) A different mixture of carbon monoxide and hydrogen was allowed to reach equilibrium at 600 K

At equilibrium, the mixture contained 2.76 mol of carbon monoxide, 4.51 mol of hydrogen and 0.360 mol of methanol. The total pressure was 630 kPa

Calculate a value for the equilibrium constant, K_p, for this reaction at 600 K and state its units.

Value of K_p _____ Units _____

(6)

(Total 14 marks)

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