

Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

This question is about some gas mixtures at equilibrium.

This reaction can be used to make hydrogen.



- (a) A mixture of 2.00 mol of $\text{H}_2\text{O}(\text{g})$ and 2.00 mol of $\text{CO}(\text{g})$ is allowed to reach equilibrium at a constant temperature in a 20 dm^3 container.
At equilibrium, there are 0.92 mol of $\text{H}_2(\text{g})$.

Calculate the mole fraction of $\text{H}_2(\text{g})$ in the equilibrium mixture.

Mole fraction of $\text{H}_2(\text{g})$ _____

(2)

- (b) State why the equilibrium constant (K_p) for this reaction has no units.

(1)

- (c) The temperature of the equilibrium mixture formed in part (a) is increased.

How does the amount of $\text{H}_2(\text{g})$ change when the new position of equilibrium is reached?

Tick (✓) one box.

The amount decreases.

☐

The amount does not change.

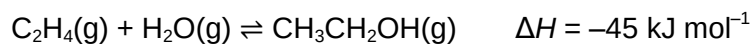
☐

The amount increases.



(1)

Ethanol can be made from ethene and steam.



The table below shows the mole fractions of each of the gases in an equilibrium mixture at 6000 kPa

Gas	Mole fraction
Ethene	0.645
Steam	0.323
Ethanol	0.0321

(d) Give an expression for K_p for this reaction.

Calculate the value of K_p at 6000 kPa

State the units.

K_p

Units _____

(4)

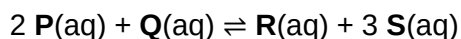
(e) State the effect, if any, of an increase in volume of the container on the value of K_p for this reaction at a constant temperature.

(1)

(Total 9 marks)

Q2.

This question is about an equilibrium.



A 25.0 cm^3 sample of a solution of **P** is added to a 20.0 cm^3 sample of a solution of **Q**. The mixture is allowed to reach equilibrium.

The amounts in the equilibrium mixture are

P = 0.0145 mol **Q** = 0.0275 mol **R** = 0.0115 mol **S** = 0.0345 mol

- (a) Calculate the amount, in moles, of **P** before the reaction with **Q**.

Use your answer to calculate the concentration, in mol dm^{-3} , of **P** in the initial 25.0 cm^3 sample.

Amount of **P** _____ mol

Concentration _____ mol dm^{-3}

(2)

- (b) Give the expression for the equilibrium constant, K_c

Calculate the value of K_c and deduce its units.

K_c

Value of K_c _____ Units _____

(4)

- (c) Explain why the amount of **S** increases when water is added to the equilibrium mixture.

(2)

(Total 8 marks)