

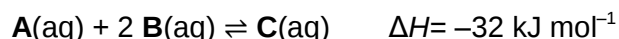
Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Q1.

This question is about the equilibrium mixture formed when **A** and **B** react.



- (a) A solution containing 0.60 mol of **A** is added to a solution containing 0.60 mol of **B**.
The amount of **C** formed at equilibrium is 0.28 mol

Deduce the amounts, in moles, of **A** and **B** in this mixture at equilibrium.

Amount of **A** _____ mol

Amount of **B** _____ mol

(2)

- (b) Give an expression for the equilibrium constant (K_c) for this reaction.

K_c

(1)

- (c) The temperature of the equilibrium mixture is decreased.

Predict the effect, if any, on the value of K_c
Give a reason for your prediction.

Prediction _____

Reason _____

(3)

(d) In another mixture at equilibrium

$$[\text{A}] = 0.48 \text{ mol dm}^{-3}$$

$$[\text{C}] = 0.62 \text{ mol dm}^{-3}$$

For this reaction, the equilibrium constant $K_c = 7.8 \text{ mol}^{-2} \text{ dm}^6$

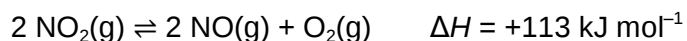
Calculate **[B]** at equilibrium.

Give your answer to the appropriate number of significant figures.

[B] _____ mol dm^{-3} (3)
(Total 9 marks)

Q2.

Nitrogen dioxide decomposes at a high temperature.



- (a) A 0.317 mol sample of nitrogen dioxide is placed in a sealed flask and heated at a constant temperature until equilibrium is reached.

At equilibrium, the flask contains 0.120 mol of oxygen.

Calculate the mole fraction of each substance at equilibrium.

Mole fraction of NO_2 _____

Mole fraction of NO _____

Mole fraction of O_2 _____

(3)

- (b) The total pressure in the flask in part (a) is 120 kPa at equilibrium.

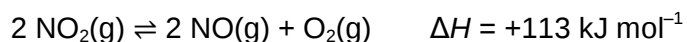
Calculate the partial pressure, in kPa, of NO_2

If you were unable to answer part (a) you should assume that the mole fraction of NO_2 is 0.380. This is **not** the correct answer.

Partial pressure _____ kPa

(1)

- (c) The table below shows the mole fractions of the three gases in a different equilibrium mixture.



Gas	Mole fraction
NO_2	0.310
NO	0.460
O_2	0.230

For this equilibrium mixture, $K_p = 59.7 \text{ kPa}$

Give an expression for K_p for this reaction.

Use your expression and the data in the table to calculate the total pressure, in kPa, in the flask.

K_p

Total pressure _____ kPa

(3)

- (d) The equilibrium mixture in part (c) is compressed into a smaller volume.

Deduce the effect, if any, of this change on the equilibrium yield of oxygen and on the value of K_p

Effect on yield of oxygen _____

Effect on K_p _____

(2)

- (e) The equilibrium mixture in part (c) is allowed to reach equilibrium at a lower temperature.

Explain why the equilibrium yield of oxygen decreases.

(2)

(Total 11 marks)