AHL Worksheet – Chapter 7

1 Given the equilibrium concentrations, calculate the value of the equilibrium constant for each reaction.

a $A(g) \rightarrow 2B(g)$ [2]

equilibrium concentrations are:

$[A] = 0.100 \text{ mol dm}^{-3}$ $[B] = 0.200 \text{ mol dm}^{-3}$

b $3Q(g) + X(g) \rightarrow 3Z(g) + 2E(g)$ [2]

equilibrium concentrations are:

$[Q] = 2.50 \times 10^{-3} \text{ mol dm}^{-3}$ $[X] = 2.00 \times 10^{-3} \text{ mol dm}^{-3}$

$[Z] = 5.40 \times 10^{-4} \text{ mol dm}^{-3}$ $[E] = 9.47 \times 10^{-5} \text{ mol dm}^{-3}$

2 In each of the following reactions use the given data to calculate equilibrium number of moles of each substance.

a $A(g) \rightarrow Z(g)$ [1]

initial number of moles of:

A = 0.100 mol Z = 0.100 mol

number of moles of A at equilibrium = 0.0500 mol

b $2A(g) + B(g) \rightarrow 2C(g)$ [2]

initial number of moles of:

A = 1.00 mol B = 2.00 mol C = 0.00 mol

number of moles of C at equilibrium = 0.200 mol

3 Consider the reversible reaction:

$A(g) + X(g) \rightarrow 2Q(g)$

a Write the expression for K_c for this reaction. [1]

b In each of the following situations calculate a value for the equilibrium constant from the data given:

i initial number of moles of:

A = 0.100 mol X = 0.400 mol Q = 0.000 mol

number of moles of A at equilibrium = 0.010 mol

volume of container = 1.00 dm^3 temperature = 300 K [2]

ii initial number of moles of:

A = 0.150 mol X = 0.080 mol Q = 0.100 mol

number of moles of A at equilibrium = 0.120 mol

volume of container = 10.0 dm^3 temperature = 400 K [2]

c Use the values of K_c that you have calculated to work out whether this reaction is exothermic or endothermic. [3]

4 Consider the reversible reaction:

$$2A(g) + X(g) \rightarrow 4Q(g) + Z(g)$$

a Write the expression for K_c for this reaction. [1]

b Calculate a value for the equilibrium constant from the data given:

initial number of moles of:

A = 0.000 mol X = 0.100 mol Q = 2.000 mol Z = 1.000 mol

number of moles of A at equilibrium = 0.800 mol

volume of container = 10.0 dm^3 temperature = 300 K [3]

c Calculate a value for the equilibrium constant for the reaction:

$$4Q(g) + Z(g) \rightarrow 2A(g) + X(g)$$

at 300 K. [2]

5 Consider the equilibrium:

$$A(g) + Z(g) \rightarrow X(g) + Q(g)$$

At a certain temperature the value of the equilibrium constant for this reaction is 4.00. 0.200 mol of A and 0.200 mol of Z are placed in a container of volume 1.00 dm^3 and allowed to come to equilibrium at this temperature. Calculate the number of moles of X present at equilibrium. [5]

6 The data in the table shows the variation of the vapour pressure of ethanol (CH_3CH_2OH) with temperature.

Temperature / °C	**Vapour pressure / Pa**
–31	133
–2	1330
19	5330
35	13300
64	53300

a Draw a Lewis structure for ethanol. [1]

b Explain what is meant by **vapour pressure**. [1]

c Plot the data on a graph and use your graph to estimate the boiling point of ethanol. [4]

d Explain how the vapour pressure of ethanol at 0 °C would compare with that of its isomer methoxymethane (CH_3OCH_3) at the same temperature. [3]