Exercise 17 Date:

1. State Le Chatelier's principle.

2 The following reaction reaches equilibrium in an isolated container at 300 K and 150 kPa:

$$H_2O(g) + C(s) \rightleftharpoons CO(g) + H_2(g) \quad \Delta H = +130\ kJ{\cdot}mol^{-1}$$

Explain, using Le Chatelier's principle, the effect that each of the following changes will have on a) the equilibrium and b) the K_C value:

2.1 The temperature is increased by 100°C.

2.2 Steam is pumped into the reaction container.

2.3 The volume of the reaction container is increased.

2.4 Carbon is added to the system.

2.5 A catalyst is added to the reaction system.

2.6 Write down an expression for the equilibrium constant of this reaction.

3 $NaC\ell(s)$ is dissolved in water until a little solid is left on the bottom of the beaker, in other words, a saturated solution is prepared. The dynamic equilibrium reaction is:

$$NaC\ell(s) \rightleftharpoons Na^{+}(aq) + C\ell^{-}(aq)$$

3.1 What is the meaning of the double-sided arrow in the equation?

3.2 Explain what the term in your answer to Question 3.1 means.

3.3 Compare the concentration of the sodium ions to that of chloride ions at equilibrium.

3.4 How do you know that the system has reached equilibrium?

A few drops of silver nitrate solution, $AgNO_3(aq)$, are now added to the existing sodium chloride solution. The solution becomes turbid.

3.5 What causes the turbidity?

3.6 Write down a balanced reaction equation for the reaction between silver ions (Ag^+) and chloride ions ($C\ell^-$).

3.7 What effect will the addition of the $AgNO_3(aq)$ have on the equilibrium system? Explain your answer in terms of Le Chatelier's principle.

4 Four hypothetical gases (A, B, C and D) are in equilibrium in a closed container.
The reaction is represented by:
$A(g) + 2B(g) \rightleftharpoons 2C(g) + D(g)$
The gases are allowed to react for 60 s.
The following accurate graph of concentration versus time is drawn for the whole 60 s:
(*Northern Cape, 2008)*