19 Equilibrium constant K_p Method sheet

Equilibria

Specification references

- *8.1*
- *3.1.6*

Learning outcomes

After completing the practical you will be able to:

- investigate and observe reverse reactions
- use Le Châtelier's principle to predict what will happen in a reversible reaction at equilibrium when the concentration is changed.

Background

Henri-Louis Le Châtelier was a French chemist who worked on reversible reactions. Le Châtelier's principle states that: if a system at equilibrium is disturbed, the equilibrium moves in the direction that tends to reduce the disturbance.

Therefore, if a system is at equilibrium and you make a change to the concentration or temperature or pressure, then the system tries to restore the equilibrium. This experiment shows that a change in concentration affects the equilibrium. The reaction you will do is between an iron(III) salt and potassium thiocyanate. The following ionic equation shows the reaction:

$$Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons Fe(SNC)^{2+}(aq)$$

pale yellow colourless blood red

Safety

Eye protection must be worn for this experiment since iron(III) chloride is an IRRITANT and ammonium chloride is HARMFUL.

Equipment and materials

- Potassium thiocyanate solution, HARMFUL
- Iron(III) chloride solution, IRRITANT, solid is corrosive and HARMFUL
- Ammonium chloride, HARMFUL
- 5 test tubes
- Test tube rack
- Teat pipettes
- Spatulas
- Stirring rods
- Distilled water (5 cm^3)
- Measuring cylinder (5 cm^3)

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Method

1 Set up four test tubes in a rack, as shown in Figure 1.
2 In a fifth test tube, carefully add one drop of iron(III) chloride and one drop of potassium thiocyanate and dilute with 5 cm^3 of distilled water.
3 Split this into four equal portions in the four test tubes.
4 Leave tube 1 as a colour reference.
5 Add one drop of iron(III) chloride solution into tube 2.
6 Add one drop of potassium thiocyanate solution into tube 3.
7 Add one spatula of ammonium chloride to tube 4 and stir.
8 For each of tubes 2 to 4, note what happens in Table 1.

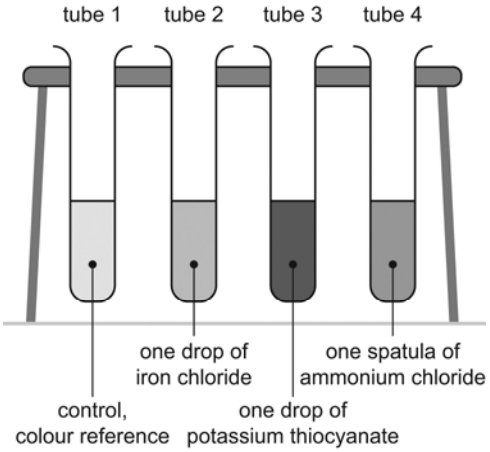

Figure 1 *Experimental set-up*

Results

Reactant added	What are you adding that could affect the equilibrium?	Observation – what colour change is there?	Does the position of equilibrium move to the left or the right?

Table 1 *Results of experiment*

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Questions

1 Explain why adding more $Fe^{3+}(aq)$ or $SCN^-(aq)$ moves the equilibrium to the right.

..... (*1 mark*)

2 Does the addition of the ammonium chloride move the equilibrium to the left or the right? Explain your answer.

.....

..... (*2 marks*)

3 What would be the effect of adding more $Fe(SCN)^{2+}(aq)$?

.....

..... (*2 marks*)