AP CHEMISTRY • EXERCISE SHEET

7.2 Direction of Reversible Reactions

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on the **direction of reversible reactions**.

You must be able to:

- write the **equilibrium expression** $K = \dfrac{[\text{products}]}{[\text{reactants}]}$ with coefficients as powers
- exclude pure solids and liquids
- write K for a given equation

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

The equilibrium expression

For $a\text{A} + b\text{B} \rightleftharpoons c\text{C} + d\text{D}$,

$$K = \frac{[\text{C}]^c[\text{D}]^d}{[\text{A}]^a[\text{B}]^b}.$$

Products over reactants, each raised to its coefficient.

A worked expression

For $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$:

$$K = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}.$$

Leave out solids and pure liquids

Pure **solids** and pure **liquids** have constant "concentration" and are **omitted** from K. Only gases and dissolved species appear.

Gases can use pressures

For gas equilibria, K_p uses partial pressures in place of concentrations, with the same product-over-reactant form.

2 Practice

Now apply the methods above.

2.1 Write K for $2SO_2 + O_2 \rightleftharpoons 2SO_3$. [2]

2.2 Which states are left out of an equilibrium expression? [1]

2.3 Write K for $H_2 + I_2 \rightleftharpoons 2HI$. [1]

3 Exam-style questions

3.1 In the equilibrium expression, each concentration is raised to the power of its [1]

- **A** molar mass
- **B** coefficient in the balanced equation
- **C** oxidation number
- **D** charge

3.2 For $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$:

(a) Write the equilibrium expression. [2]

(b) Explain why the solids do not appear. [1]

3.3 Write the equilibrium expression for $Fe^{3+}(aq) + SCN^-(aq) \rightleftharpoons FeSCN^{2+}(aq)$. [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **7.2 Direction of Reversible Reactions** lesson on the **Learn** page;
- read the **Direction of Reversible Reactions** section of the AP Chemistry handout on the **Know** page.

Solutions

2.1 $K = \dfrac{[SO_3]^2}{[SO_2]^2[O_2]}$.

2.2 Pure solids and pure liquids.

2.3 $K = \dfrac{[HI]^2}{[H_2][I_2]}$.

3.1 B —its coefficient in the balanced equation.

3.2 (a) $K = [CO_2]$. (b) The solids ($CaCO_3$, CaO) have constant activity and are omitted.

3.3 $K = \dfrac{[FeSCN^{2+}]}{[Fe^{3+}][SCN^-]}$.