

7.2 Direction of Reversible Reactions

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS reversible reaction 可逆反应

Objective

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

You must be able to:

- write the **equilibrium expression** $K = \frac{[\text{products}]}{[\text{reactants}]}$ 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 $aA + bB \rightleftharpoons cC + dD$,

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

Products over reactants, each raised to its coefficient.

■ A worked expression

For $N_2 + 3H_2 \rightleftharpoons 2NH_3$:

$$K = \frac{[NH_3]^2}{[N_2][H_2]^3}.$$

■ 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]

Solutions

2.1 $K = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2[\text{O}_2]}$.

2.2 Pure solids and pure liquids.

2.3 $K = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$.

3.1 B — its coefficient in the balanced equation.

3.2 (a) $K = [\text{CO}_2]$. (b) The solids (CaCO_3 , CaO) have constant activity and are omitted.

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