

# CHAPTER 17 EQUILIBRIUM: THE EXTENT OF CHEMICAL REACTIONS

## FOLLOW-UP PROBLEMS

17.1A **Plan:** First, balance the equations and then write the reaction quotient. Products appear in the numerator of the reaction quotient and reactants appear in the denominator; coefficients in the balanced reaction become exponents.

**Solution:**



$$\text{Reaction quotient: } Q_c = \frac{[\text{NO}]^4 [\text{H}_2\text{O}]^6}{[\text{NH}_3]^4 [\text{O}_2]^5}$$



$$\text{Reaction quotient: } Q_c = \frac{[\text{NH}_3]^2}{[\text{NO}_2]^2 [\text{H}_2]^7}$$



$$\text{Reaction quotient: } Q_c = [\text{O}_2]^3$$

17.1B **Plan:** First, balance the equations and then write the reaction quotient. Products appear in the numerator of the reaction quotient and reactants appear in the denominator; coefficients in the balanced reaction become exponents.

**Solution:**



$$\text{Reaction quotient: } Q_c = \frac{[\text{CO}]^2 [\text{H}_2]^2}{[\text{CH}_4] [\text{CO}_2]}$$



$$\text{Reaction quotient: } Q_c = \frac{[\text{H}_2\text{O}]^2}{[\text{H}_2\text{S}]^2 [\text{SO}_2]}$$



$$\text{Reaction quotient: } Q_c = \frac{[\text{NaCN}]}{[\text{HCN}] [\text{NaOH}]}$$

17.2A **Plan:** Add the individual steps to find the overall equation, canceling substances that appear on both sides of the equation. Write the reaction quotient for each step and the overall equation. Multiply the reaction quotients for each step and cancel terms to obtain the overall reaction quotient.

**Solution:**



Canceling the reactants leaves the overall equation as  $\text{Br}_2(g) + \text{H}_2(g) \rightleftharpoons 2\text{HBr}(g)$ .

Write the reaction quotients for each step:

$$Q_{c1} = \frac{[\text{Br}]^2}{[\text{Br}_2]} \quad Q_{c2} = \frac{[\text{HBr}][\text{H}]}{[\text{Br}][\text{H}_2]} \quad Q_{c3} = \frac{[\text{HBr}]}{[\text{H}][\text{Br}]}$$

and for the overall equation:

$$Q_c = \frac{[\text{HBr}]^2}{[\text{H}_2][\text{Br}_2]}$$

# Solutions Manual Chemical Equilibrium

**David Smith**



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