6. THE REACTION QUOTIENT

UNIT 3 – CHEMICAL EQUILIBRIUM

CH40 MR. WIEBE

1

THE IMPORTANCE OF EQ'M POSITION

Diabetics require their blood-glucose eq'm to be maintained at 4-6 mmol/L.

If this molarity becomes too high or too low, steps must be taken to shift the eq'm back to the desired level.

Blood-glucose meters are used to check the position of the eq'm.

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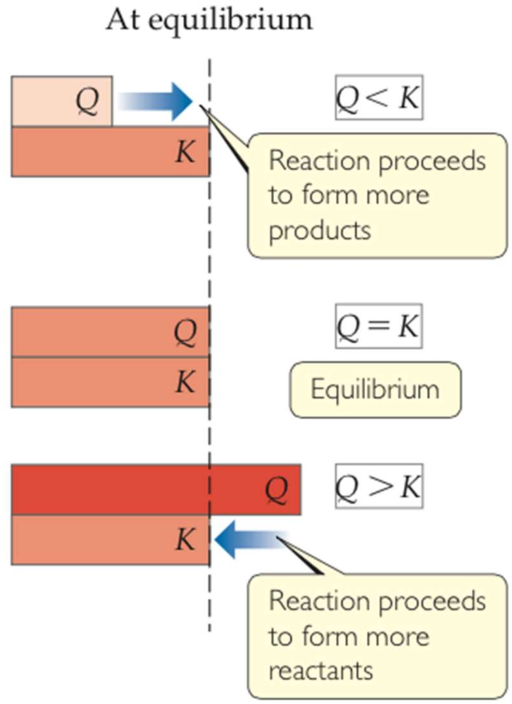
THE REACTION QUOTIENT

If a system starts with quantities of **BOTH** reactant and product, it is hard to tell which way it will shift to achieve equilibrium.

To solve this problem, you must calculate a **reaction quotient**.

$$Q = \frac{[Product]_{initial}}{[Reactant]_{initial}}$$

Compare Q to your known K value



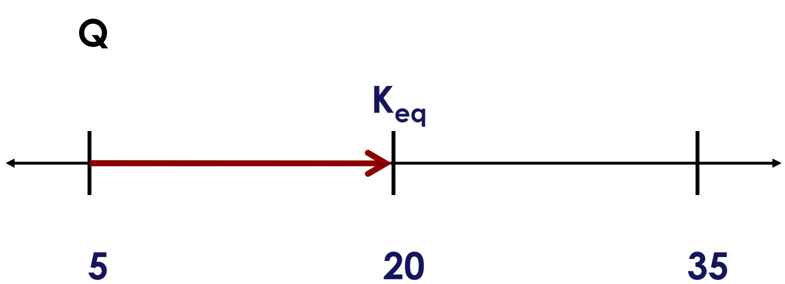
4

THE REACTION QUOTIENT

If Q < K_{eq}

The product concentration is too small. The reaction will reach eq'm by creating more products and using up some reactants

Shifts right



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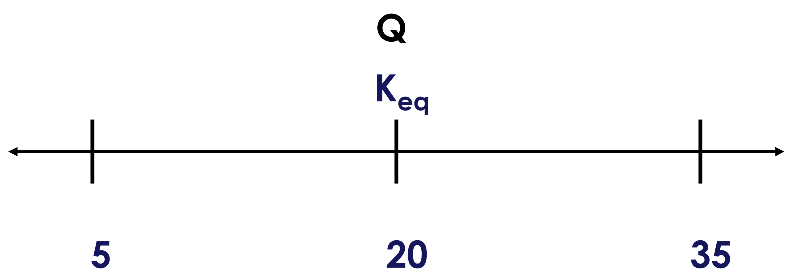
THE REACTION QUOTIENT

If Q = K_{eq}

equilibrium



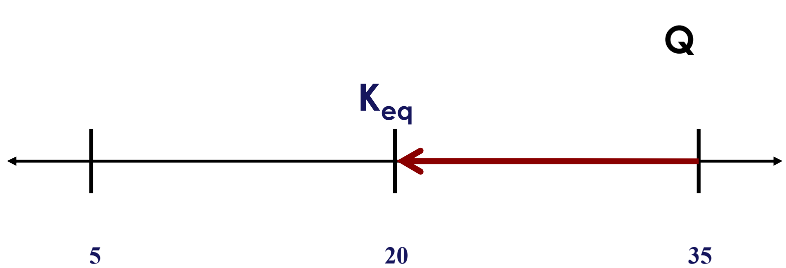
6

THE REACTION QUOTIENT

If Q > K_{eq}

Shifts left

The product concentration is too large. The reaction will reach eq'm by creating more reactants and using up some products



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EXAMPLE 1

10.0 moles of NH_3, 15.0 moles of N_2, and 10.0 moles of H_2 are **initially** put in a 5.0 L container. Is the system in equilibrium and how will it shift if it is not?

$$2NH_{3(g)} \rightleftarrows N_{2(g)} + 3H_{2(g)} \qquad K = 10$$

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EXAMPLE 2

4.56×10^{-5} moles of NH_3, 5.62×10^{-4} moles of N_2, and 2.66×10^{-2} moles of H_2 are **initially** put in a 500.0 mL container. Is the system in equilibrium and how will it shift if it is not?

$$2NH_{3(g)} \rightleftarrows N_{2(g)} + 3H_{2(g)} \qquad Keq = 10$$

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PUTTING IT ALL TOGETHER!

If 4.00 moles of CO, 4.00 moles H_2O, 6.00 moles CO_2, and 6.00 moles H_2 are **initially** placed in a 2.00 L container at 670°C. Calculate the equilibrium concentrations of each substance.

$$CO_{(g)} + H_2O_{(g)} \rightleftarrows CO_{2(g)} + H_{2(g)} \qquad K_{eq} = 1.6$$

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