Continued ...

Step 3 The value $x = 4.3$ is not physically possible. It would result in negative concentrations of H_2 and I_2 at equilibrium. The concentration of each substance at equilibrium is found by substituting $x = 1.7$ into the last line of the ICE table.

Concentration (mol/L)	$H_{2(g)}$	+	$I_{2(g)}$	$\rightleftharpoons$	$2HI_{(g)}$
Equilibrium	2.00 − 1.7		3.00 − 1.7		3.4

Applying the rule for subtraction involving measured values,

$[H_2] = 0.3$ mol/L

$[I_2] = 1.3$ mol/L

$[HI] = 3.4$ mol/L

Check Your Solution

The coefficients in the chemical equation match the exponents in the equilibrium expression. To check your concentrations, substitute them back into the equilibrium expression.

$$K_c = \frac{3.4^2}{0.3 \times 1.3} = 30$$

Solving the quadratic equation gives a value of x, correct to one decimal place. As a result, $[H_2]$ can have only one significant figure. The calculated value of K_c is equal to the given value, within the error introduced by rounding.

Practice Problems

11. At a certain temperature, hydrogen fluoride gas dissociates.

$2HF_{(g)} \rightleftharpoons H_{2(g)} + F_{2(g)}$

At equilibrium in a 1.0 L reaction vessel, the mixture of gases contained 0.045 mol of $H_{2(g)}$, 0.045 mol of $F_{2(g)}$, and 0.022 mol of $HF_{(g)}$. What is the value of K_c?

12. At 25°C, the following reaction takes place.

$I_{2(g)} + Cl_{2(g)} \rightleftharpoons 2ICl_{(g)}$

A chemist determined that a 10 L container contained these amounts of gases at equilibrium: $I_2 = 0.15$ mol, $Cl_{2(g)} = 0.15$ mol, and $ICl = 1.4$ mol. What is the value of K_c for the reaction at 25°C?

13. A chemist was studying the following reaction.

$SO_{2(g)} + NO_{2(g)} \rightleftharpoons NO_{(g)} + SO_{3(g)}$

In a 1.0 L container, the chemist added 1.7×10^{-1} mol of $SO_{2(g)}$ to 1.1×10^{-1} mol of $NO_{2(g)}$. At equilibrium, the concentration of $SO_{3(g)}$ was found to be 0.089 mol/L. What is the value of K_c for the reaction at this temperature?

14. Phosgene, $COCl_{2(g)}$, is an extremely toxic gas. It was used during World War I. Today it is used to manufacture pesticides, pharmaceuticals, dyes, and polymers. It is prepared by mixing carbon monoxide and chlorine gas.

$CO_{(g)} + Cl_{2(g)} \rightleftharpoons COCl_{2(g)}$