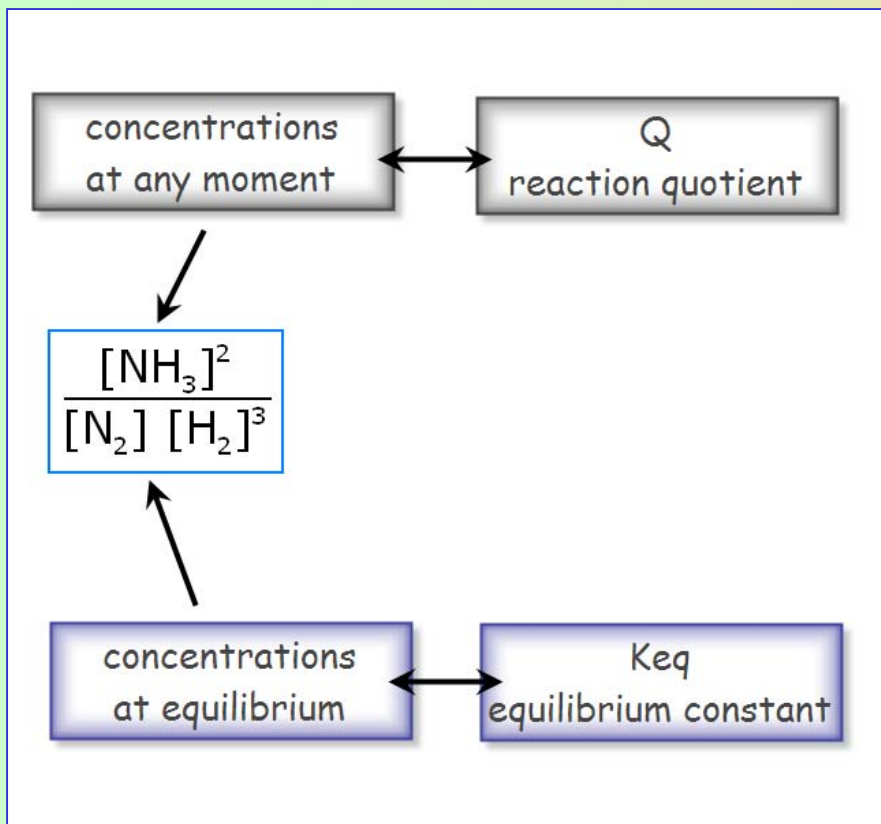


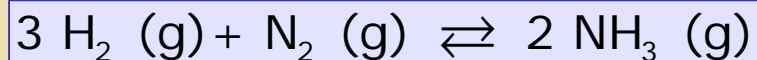
# Predicting the direction of reaction



## Reaction quotient (Q)

When we substitute the actual reactant and product concentrations into the equilibrium constant the result is known reaction quotient (Q).

Let's consider this reaction:



The value from this expression

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

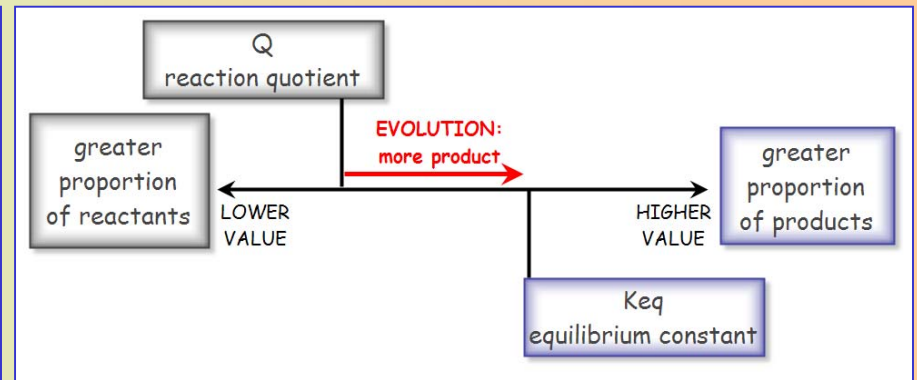
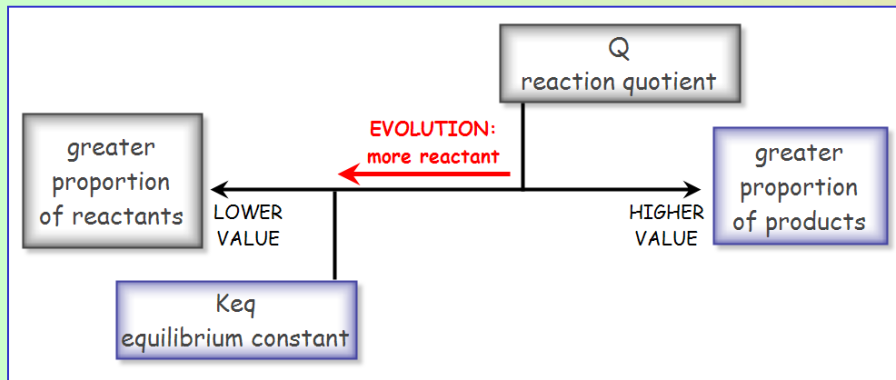
will be a reaction quotient when we write the concentrations at any moment and will be the equilibrium constant when the concentrations are at equilibrium

# Predicting the direction of reaction

## Predicting the direction of reaction

At any moment, if we compare  $Q$  and  $K_{eq}$ , it can happen that

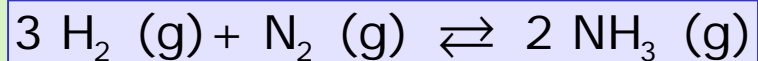
- both are equal ( $Q=K_{eq}$ ): in that case, the equilibrium has been reached
- $Q < K_{eq}$ . In that case, more product will be formed, until equilibrium is reached
- $Q > K_{eq}$ . The system will evolve to produce more reactant, until equilibrium is reached



# Predicting the direction of reaction

## Exercise

We place a mixture of 2 mol of  $\text{H}_2$ , 1 mol of  $\text{N}_2$  and 2 mol of  $\text{NH}_3$  in a 1 L container at 472 °C. The equilibrium constant at this temperature for the equation described below is 0.105



Determine the evolution of the system.

## Solution

The reaction quotient is

$$\frac{[\text{NH}_3]^2}{[\text{N}_2] [\text{H}_2]^3} = \frac{(2 \text{ M})^2}{(1 \text{ M}) (2 \text{ M})^3} = 0.5$$

Therefore, the system will evolve to produce more reactants (from right to left)

