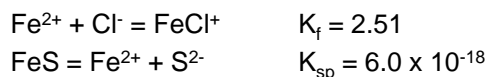


A systematic approach to solving complex equilibrium problems.

In many cases, multiple equilibria coexist in a system, making calculating concentrations difficult.

Example: How many grams of Iron (II) Sulfide can be dissolved in 100 mL of 0.1 F KCl?



How do we tackle this problem? We can't simply set up two equilibrium constant expressions, there are too many unknowns!

Use a more systematic approach: We need to write enough equations to solve for all of our unknowns.

1

Here's the Plan:

1. Write the pertinent reactions:

2. Write the *charge balance* equation.

Charge balance requires that the total positive charge is equal to the total negative charge.

3. Write mass balance equations.

Mass balance requires that the total number of moles (or atoms) of a particular element must always equal the amount of that atom delivered to the solution. (conservation of matter)

2

Here's the Plan:

4. Write equilibrium constant expressions for all equilibria.

5. Count equations and unknowns.

Four equations, four unknowns.

6. Solve for all the unknowns.

Algebra, here we come!

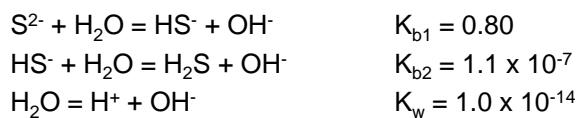
Life becomes easier if we use computer-based tools

- Solve problem *iteratively* (repeated substitutions)
- Use numerical solution routines

3

General Strategy Applies Regardless of Number of Equilibria

Now consider adding the following equilibria to the discussion:



Life gets even more complicated!!! Strategy still works!

1. Write the pertinent reactions:
2. Write the *charge balance* equation.
3. Write mass balance equations.
4. Write equilibrium constant expressions for all equilibria.
5. Count equations and unknowns.
6. Solve for all the unknowns.

4