ions whose salts are completely soluble

NO_3^- (nitrate), Na^+, K^+, and NH_4^+ (ammonium)

A completely soluble salt dissolves via a reaction which always goes to completion.
A salt which is only slightly soluble dissolves via an equilibrium reaction.

solubility and K_{sp}

***Initial* amount of salt added**	**Condition of the solution at the *end* of the reaction**		
less than the solubility	unsaturated	no precipitate	$Q < K_{sp}$
equal to the solubility	saturated	no precipitate	$Q = K_{sp}$
greater than the solubility	saturated	precipitate	$Q = K_{sp}$

The "solubility product" (K_{sp}) is just a special name for the equilibrium constant (K) of a dissolution reaction. Equilibrium for a dissolution reaction is known as "saturation".
The reaction quotient (Q) of a dissolution reaction is known as the "ion product".

How to find the K_{sp} from the solubility or the solubility from the K_{sp}

1. Write the chemical equation and ICE table. If more than one salt is present, first do ICE tables for any salts whose dissolution reactions always go to completion (i.e., salts that are completely soluble). Then do an ICE table for the salt whose dissolution is an equilibrium reaction (i.e., the salt that is only slightly soluble).
2. Saturate the solution. This is generally achieved by adding an *initial* amount of the salt that is equal to the salt's molar solubility. If the molar solubility is unknown, we can use a variable (say, "*x*"), to stand for the molar solubility.
3. Set Q = K and solve for the unknown variable. At the *end* of the reaction, Q will equal K, since, in step 2, we saturated the solution. Since this is a dissolution reaction, the K will be the K_{sp}.