Predicting Solubility

The table below shows a set of ionic compounds, each of which occupies a space located at the intersection of a row that identifies the cation and a column that identifies the anion. For example, iron (III) chloride, $FeCl_3$, is located in the first column of the second row at the intersection of Fe^{3+} and Cl^-. For each of the ionic compounds represented here, consider what will happen if you add a pinch of the solid to to a test-tube of water: if the solid **will not** dissolve, then write the ionic compound's formula at the intersection of the cation and the anion; if the solid **will** dissolve, then leave the space blank.

anion $\longrightarrow$ cation $\downarrow$	Cl^-	OH^-	NO_3^-	SO_4^{2-}	PO_4^{3-}	CO_3^{2-}	F^-
K^+	—	—	—	—	—	—	—
Fe^{3+}	—	$Fe(OH)_3$	—	—	$FePO_4$	$Fe_2(CO_3)_3$	—
Ca^{2+}	—	$Ca(OH)_2$	—	$CaSO_4$	$Ca_3(PO_4)_2$	$CaCO_3$	CaF_2
Ag^+	$AgCl$	$AgOH$	—	Ag_2SO_4	Ag_3PO_4	Ag_2CO_3	—
Pb^{2+}	$PbCl_2$	$Pb(OH)_2$	—	$PbSO_4$	$Pb_3(PO_4)_2$	$PbCO_3$	PbF_2
NH_4^+	—	—	—	—	—	—	—

Notes

- alkali metal cations, such as K^+, and the ammonium cation, NH_4^+, generally form very soluble ionic compounds
- the nitrate anion, NO_3^-, generally forms very soluble ionic compounds
- the chloride anion, Cl^- (and the bromide anion, Br^-, and the iodide anion, I^-) generally form very soluble ionic compounds with the notable exceptions of Ag^+, Hg_2^{2+}, and Pb^{2+}
- the fluoride anion, F^-, generally forms insoluble (or slightly soluble) ionic compounds with the alkaline earths, such as Ca^{2+}, and with divalent transition metals, such as Pb^{2+}
- the sulfate anion, SO_4^{2-}, generally forms soluble ionic compounds with the notable exceptions of Ag^+, Hg_2^{2+}, Pb^{2+}, Ca^{2+}, Sr^{2+}, and Ba^{2+}
- the hydroxide anion, OH^-, generally forms insoluble ionic compounds
- the phosphate anion, PO_4^{3-}, generally forms insoluble ionic compounds
- the carbonate anion, CO_3^{2-}, generally forms insoluble ionic compounds