17. Use the solubility rules in Table 4.1. Some soluble bromides by Rule 2 would be NaBr, KBr, and NH_4Br (there are others). The insoluble bromides by Rule 3 would be AgBr, $PbBr_2$, and Hg_2Br_2. Similar reasoning is used for the other parts to this problem.

Sulfates: Na_2SO_4, K_2SO_4, and $(NH_4)_2SO_4$ (and others) would be soluble, and $BaSO_4$, $CaSO_4$, and $PbSO_4$ (or Hg_2SO_4) would be insoluble.

Hydroxides: NaOH, KOH, $Ca(OH)_2$ (and others) would be soluble, and $Al(OH)_3$, $Fe(OH)_3$, and $Cu(OH)_2$ (and others) would be insoluble.

Phosphates: Na_3PO_4, K_3PO_4, $(NH_4)_3PO_4$ (and others) would be soluble, and Ag_3PO_4, $Ca_3(PO_4)_2$, and $FePO_4$ (and others) would be insoluble.

Lead: $PbCl_2$, $PbBr_2$, PbI_2, $Pb(OH)_2$, $PbSO_4$, and PbS (and others) would be insoluble. $Pb(NO_3)_2$ would be a soluble Pb^{2+} salt.

18. $Pb(NO_3)_2(aq) + 2\ KI(aq) \rightarrow PbI_2(s) + 2\ KNO_3(aq)$ (formula equation)

$Pb^{2+}(aq) + 2\ NO_3^-(aq) + 2\ K^+(aq) + 2\ I^-(aq) \rightarrow PbI_2(s) + 2\ K^+(aq) + 2\ NO_3^-(aq)$ (complete ionic equation)

The 1.0 mol of Pb^{2+} ions would react with the 2.0 mol of I^- ions to form 1.0 mol of the PbI_2 precipitate. Even though the Pb^{2+} and I^- ions are removed, the spectator ions K^+ and NO_3^- are still present. The solution above the precipitate will conduct electricity because there are plenty of charge carriers present in solution.

Precipitation Reactions

43. The solubility rules referenced in the following answers are outlined in Table 4.1 of the text.

a. Soluble: Most nitrate salts are soluble (Rule 1).

b. Soluble: Most chloride salts are soluble except for Ag^+, Pb^{2+}, and Hg_2^{2+} (Rule 3).

c. Soluble: Most sulfate salts are soluble except for $BaSO_4$, $PbSO_4$, Hg_2SO_4, and $CaSO_4$ (Rule 4.)

d. Insoluble: Most hydroxide salts are only slightly soluble (Rule 5).
Note: We will interpret the phrase "slightly soluble" as meaning insoluble and the phrase "marginally soluble" as meaning soluble. So the marginally soluble hydroxides $Ba(OH)_2$, $Sr(OH)_2$, and $Ca(OH)_2$ will be assumed soluble unless noted otherwise.

e. Insoluble: Most sulfide salts are only slightly soluble (Rule 6). Again, "slightly soluble" is interpreted as "insoluble" in problems like these.

f. Insoluble: Rule 5 (see answer d).

g. Insoluble: Most phosphate salts are only slightly soluble (Rule 6).

44. The solubility rules referenced in the following answers are from Table 4.1 of the text. The phrase "slightly soluble" is interpreted to mean insoluble, and the phrase "marginally soluble" is interpreted to mean soluble.

a. Soluble (Rule 3)

b. Soluble (Rule 1)

c. Inoluble (Rule 4)

d. Soluble (Rules 2 and 3)

e. Insoluble (Rule 6)

f. Insoluble (Rule 5)

g. Insoluble (Rule 6)

h. Soluble (Rule 2)

45. In these reactions, soluble ionic compounds are mixed together. To predict the precipitate, switch the anions and cations in the two reactant compounds to predict possible products; then use the solubility rules in Table 4.1 to predict if any of these possible products are insoluble (are the precipitate). Note that the phrase "slightly soluble" in Table 4.1 is interpreted to mean insoluble, and the phrase "marginally soluble" is interpreted to mean soluble.

a. Possible products = $FeCl_2$ and K_2SO_4; both salts are soluble, so no precipitate forms.

b. Possible products = $Al(OH)_3$ and $Ba(NO_3)_2$; precipitate = $Al(OH)_3(s)$

c. Possible products = $CaSO_4$ and NaCl; precipitate = $CaSO_4(s)$

d. Possible products = KNO_3 and NiS; precipitate = NiS(s)

46. Use Table 4.1 to predict the solubility of the possible products.

a. Possible products = Hg_2SO_4 and $Cu(NO_3)_2$; precipitate = Hg_2SO_4

b. Possible products = $NiCl_2$ and $Ca(NO_3)_2$; both salts are soluble so no precipitate forms.

c. Possible products = KI and $MgCO_3$; precipitate = $MgCO_3$

d. Possible products = NaBr and $Al_2(CrO_4)_3$; precipitate = $Al_2(CrO_4)_3$

47. For the following answers, the balanced formula equation is first, followed by the complete