Solution

1.

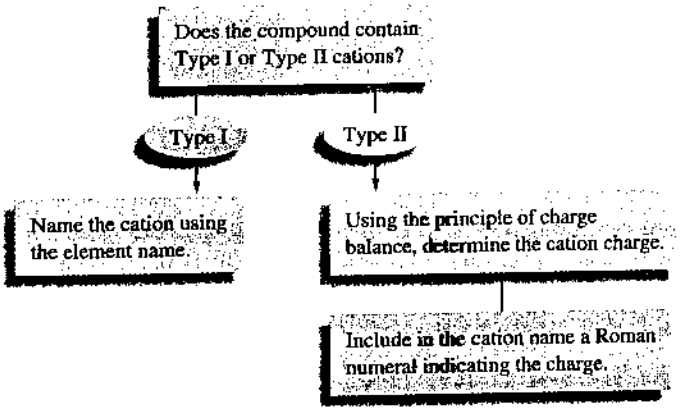
Formula	Name	Comments
a. $CoBr_2$	Cobalt(II) bromide	Cobalt is a transition metal; the compound nam must have a Roman numeral. The two Br^- ion must be balanced by a Co^{2+} ion.
b. $CaCl_2$	Calcium chloride	Calcium, an alkaline earth metal, forms only th Ca^{2+} ion. A Roman numeral is not necessary.
c. Al_2O_3	Aluminum oxide	Aluminum forms only the Al^{3+} ion. A Roman numeral is not necessary.

2.

Name	Formula	Comments
a. Chromium(III) chloride	$CrCl_3$	Chromium(III) indicates that Cr^{3+} is presen so 3 Cl^- ions are needed for charge balanc
b. Gallium iodide	GaI_3	Gallium always forms 3+ ions, so 3 I^- ions are required for charge balance.

See Exercises 2.57 and 2.5

The following flowchart is useful when you are naming binary ionic compounds:



The common Type I and Type II ions are summarized in Fig. 2.22. Also shown in Fig. 2.2 are the common monatomic ions.

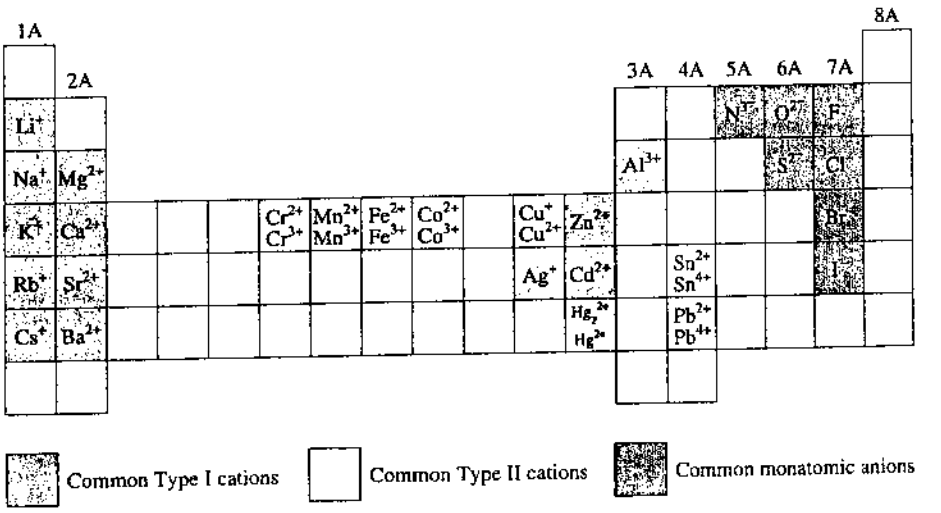


FIGURE 2.22
The common cations and anions.

Various chromium compounds dissolved in water. From left to right: $CrCl_2$, $K_2Cr_2O_7$, $Cr(NO_3)_3$, $CrCl_3$, K_2CrO_4.

TABLE 2.5 Common Polyatomic Ions

Ion	Name	Ion	Name
Hg_2^{2+}	Mercury(I)	NCS^-	Thiocyanate
NH_4^+	Ammonium	CO_3^{2-}	Carbonate
NO_2^-	Nitrite	HCO_3^-	Hydrogen carbonate (bicarbonate is a widely used common name)
NO_3^-	Nitrate		
SO_3^{2-}	Sulfite		
SO_4^{2-}	Sulfate	ClO^-	Hypochlorite
HSO_4^-	Hydrogen sulfate (bisulfate is a widely used common name)	ClO_2^-	Chlorite
		ClO_3^-	Chlorate
		ClO_4^-	Perchlorate
OH^-	Hydroxide	$C_2H_3O_2^-$	Acetate
CN^-	Cyanide	MnO_4^-	Permanganate
PO_4^{3-}	Phosphate	$Cr_2O_7^{2-}$	Dichromate
HPO_4^{2-}	Hydrogen phosphate	CrO_4^{2-}	Chromate
$H_2PO_4^-$	Dihydrogen phosphate	O_2^{2-}	Peroxide
		$C_2O_4^{2-}$	Oxalate

Ionic Compounds with Polyatomic Ions

Polyatomic ion formulas must be memorized.

We have not yet considered ionic compounds that contain polyatomic ions. For example the compound ammonium nitrate, NH_4NO_3, contains the polyatomic ions NH_4^+ and NO_3^- Polyatomic ions are assigned special names that *must be memorized* to name the com pounds containing them. The most important polyatomic ions and their names are listec in Table 2.5.

Note in Table 2.5 that several series of anions contain an atom of a given ele ment and different numbers of oxygen atoms. These anions are called **oxyanions** When there are two members in such a series, the name of the one with the smalle number of oxygen atoms ends in *-ite* and the name of the one with the larger numbe ends in *-ate*—for example, sulfite (SO_3^{2-}) and sulfate (SO_4^{2-}). When more than twc oxyanions make up a series, *hypo-* (less than) and *per-* (more than) are used as pre fixes to name the members of the series with the fewest and the most oxygen atoms respectively. The best example involves the oxyanions containing chlorine, as shown in Table 2.5.

Sample Exercise 2.7 Naming Compounds Containing Polyatomic Ions

1. Give the systematic name for each of the following compounds:

   a. Na_2SO_4
   b. KH_2PO_4
   c. $Fe(NO_3)_3$
   d. $Mn(OH)_2$
   e. Na_2SO_3
   f. Na_2CO_3

2. Given the following systematic names, write the formula for each compound:

   a. Sodium hydrogen carbonate
   b. Cesium perchlorate