4.2 No. Electrolyte solutions conduct electricity because the dissolved ions carry charge through the solution (from one electrode to the other).

4.6 (a) $MgI_2(aq) \rightarrow Mg^{2+}(aq) + 2I^-(aq)$ (b) $Al(NO_3)_3(aq) \rightarrow Al^{3+}(aq) + 3NO_3^-(aq)$
(c) $HClO_4(aq) \rightarrow H^+(aq) + ClO_4^-(aq)$ (d) $(NH_4)_2SO_4(aq) \rightarrow 2NH_4^+(aq) + SO_4^{2-}(aq)$

4.9 When $HCHO_2$ dissolves in water, neutral $HCHO_2$ molecules, H^+ ions and CHO_2^- ions are all present in the solution. $HCHO_2(aq) \rightleftharpoons H^+(aq) + CHO_2^-(aq)$

4.11 *Analyze*. Given: formula of compound. Find: solubility.

Plan. Follow the guidelines in Table 4.1, in light of the anion present in the compound and notable exceptions to the "rules". *Solve*:

(a) $NiCl_2$: soluble (b) Ag_2S: insoluble
(c) Cs_3PO_4: soluble (Cs^+ is an alkali metal cation)
(d) $SrCO_3$: insoluble (e) $(NH_4)_2SO_4$: soluble

4.12 According to Table 4.1:

(a) $Ni(OH)_2$: insoluble
(b) $PbSO_4$: insoluble, Pb^{2+} is an exception to soluble sulfates
(c) $Ba(NO_3)_2$: soluble
(d) $AlPO_4$: insoluble
(e) $AgC_2H_3O_2$: soluble

PROBLEM SET #2 APCHEM

4.13 *Analyze*. Given: formulas of reactants. Find: balanced equation including precipitates.

Plan. Follow the logic in Sample Exercise 4.3.

Solve. In each reaction, the precipitate is in bold type.

(a) $Na_2CO_3(aq) + 2AgNO_3(aq) \rightarrow \mathbf{Ag_2CO_3(s)} + 2NaNO_3(aq)$
(b) No precipitate (all nitrates and most sulfates are soluble).
(c) $FeSO_4(aq) + Pb(NO_3)_2(aq) \rightarrow \mathbf{PbSO_4(s)} + Fe(NO_3)_2(aq)$

4.14 In each reaction, the precipitate is in bold type.

(a) $Sn(NO_3)_2(aq) + 2NaOH(aq) \rightarrow \mathbf{Sn(OH)_2(s)} + 2NaNO_3(aq)$
(b) No precipitate, and therefore, no reaction. There is no chemical change to any of the reactant ions.
(c) $Na_2S(aq) + Cu(C_2H_3O_2)_2(aq) \rightarrow \mathbf{CuS(s)} + 2NaC_2H_3O_2(aq)$

4.17 *Analyze*. Given: reactions of unknown with HBr, H_2SO_4, NaOH. Find: The unknown contains a single salt. Is K^+ or Pb^{2+} or Ba^{2+} present?

Plan. Analyze solubility guidelines for Br^-, SO_4^{2-} and OH^- and select the cation that produces the observed solubility pattern.

Solve. Pb^{2+} is not present or an insoluble hydroxide would have formed. $BaSO_4$ is insoluble and $Ba(OH)_2$ is soluble, so the solution must contain Ba^{2+}. It could also contain K^+, but since we are dealing with a single salt, we will assume that only Ba^{2+} is present.

4.18 Br^- and NO_3^- can be ruled out because the Ba^{2+} salts are soluble. (Actually all NO_3^- salts are soluble.) CO_3^{2-} forms insoluble salts with the three cations given; it must be the anion in

4.23 *Analyze*. Given: chemical formulas. Find: acid-base properties.

Plan. Use Table 4.2 to identify common strong acids and bases. If a compound doesn't appear in the table, it is either a weak acid or base, or a nonelectrolyte.

Solve. (a) strong acid (b) weak acid (c) weak base (d) strong base

4.24 Use Table 4.2. (a) strong base (b) weak acid (c) weak acid (d) strong acid

4.26 Since the solution does conduct some electricity, but less than an equimolar NaCl solution (a strong electrolyte) the unknown solute must be a weak electrolyte. The weak electrolytes in the list of choices are NH_3 and H_3PO_3; since the solution is acidic, the unknown must be H_3PO_3.

4.32 (a) $CaCO_3(s) + 2HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + H_2O(l) + CO_2(g)$

$2H^+(aq) + CaCO_3(s) \rightarrow H_2O(l) + CO_2(g) + Ca^{2+}(aq)$

(b) $FeS(s) + 2HBr(aq) \rightarrow FeBr_2(aq) + H_2S(g)$

$2H^+(aq) + FeS(s) \rightarrow H_2S(g) + Fe^{2+}(aq)$

4.33 *Analyze/Plan*. Given the balanced complete molecular equation, determine the spectator ion(s) and write the net ionic equation. In each case, $HClO_4$ and the metal perchlorate are strong electrolytes, so ClO_4^- (aq) is the only spectator. All other species change form upon reaction. *Solve*:

(a) $FeO(s) + 2H^+(aq) \rightarrow H_2O(l) + Fe^{2+}(aq)$

(b) $NiO(s) + 2H^+(aq) \rightarrow H_2O(l) + Ni^{2+}(aq)$