Suggested Problems: Chapter 7

7.15: For a metal to dissolve it must be in an ionic form; thus, we know that we start with Ag(s) and form Ag^+(aq) when it reacts with HNO_3. The change in oxidation state for Ag from 0 to +1 means that this is an oxidation-reduction reaction.

7.17: For each, we know that oxygen has an oxidation state of –2 because we are told that none of the compounds is a peroxide (oxidation state of –1 for oxygen) or a superoxide (oxidation state of $-\frac{1}{2}$ for oxygen). We also know that H has an oxidation state of +1 when bound to a non-metal. Finally, we know that the sum of the oxidations in each case is zero as the compounds are all neutral.

(a) H is +1; O is –2; P is +5 (to bring charge to zero)

(b) H is +1; O is –2; Al is +3 (to bring charge to zero)

(c) O is –2; Se is +4 (to bring charge to zero)

(d) O is –2; K is +1 (alkali metals only have +1 oxidation state); N is +3 (to bring charge to zero)

(e) S is –2 (sulfur has many oxidation states, some positive and some negative, but here it is negative because the metal indium must have a positive oxidation state; sulfur lies below oxygen, so it, too, has a –2 oxidation state); In is +3 (to bring charge to zero)

(f) O is –2; P is +3 (to bring charge to zero)

7.19: An acid–base reaction is a proton-transfer reaction; thus, we will find that a H^+ ion has moved from one reactant to another reactant. An oxidation–reduction reaction is an electron-transfer reactions; thus, we will find that elements in the reactants undergo a change in oxidation states.

(a) acid–base: proton is transfered from HCl to S^{2-} in Na_2S

(b) oxidation–reduction: Na is oxidized from 0 in Na to +1 in NaCl and H is reduced from –1 in HCl to 0 in H_2

(c) oxidation–reduction: Mg is oxidized from 0 in Mg to +2 in $MgCl_2$ and Cl is reduced from 0 in Cl_2 to –1 in $MgCl_2$

(d) acid–base: proton is transfered is from HCl to O^{2-} in Mg

(e) oxidation–reduction: P is oxidized from –3 in K_3P to +5 in K_3PO_4 and oxygen is reduced from 0 in O_2 to –2 in K_3PO_4

(f) acid–base: proton is transfered from H_3PO_4 to OH^- in KOH

7.21: The number of protons given up by the acid must equal the number of protons accepted by the base.

(a) $2HCl(g) + Ca(OH)_2(s) \longrightarrow CaCl_2(s) + 2H_2O(l)$

(b) $Sr(OH)_2(aq) + 2HNO_3(aq) \longrightarrow Sr(NO_3)_2(aq) + 2H_2O(l)$