Rules for Assigning Oxidation States

1. The oxidation state of an atom in its elemental form is zero; thus, the oxidation states for the following are all 0:

   $Cu \quad Ag \quad O_2$

2. The oxidation state of a monatomic cation or anion is the same as the ion's charge; thus:

   Na^+ has a +1 oxidation state Cl^- has a –1 oxidation state

3. The algebraic sum of oxidation states for the elements in a polyatomic compound or ion must equal the compound's or ion's total charge; thus:

   for CH_4, the oxidation state of C × 4 + oxidation state of H = 0

   for NO_3^-, the oxidation state of N × 3 + oxidation state of O = –1

4. When more than one element is present, the more electronegative element maintains the negative oxidation state; thus:

   in CH_4, carbon has a negative oxidation state

   in NO_3^-, oxygen has a negative oxidation state

5. There are a few elements that have only one or two common oxidation states when not in their elemental form; these are:

   hydrogen is always +1 when bound to a more electronegative element, such as in HCl or CH_4, and –1 when bound to a less electronegative element, such as in NaH

   alkali metals are always +1

   alkaline earths are always +2

   oxygen is usually –2, but it is –1 in peroxide, O_2^{2-}, and it is –½ in superoxide, O_2^-

6. Other oxidation states almost always can be determined by applying these rules; thus:

   the P in PO_4^{3-} is +5

   the P in PCl_3 is +3

   the P in PH_3 is –3