## Pre-lab 6, Question 5
## How to determine oxidation numbers

When we assign oxidation numbers to the atoms in a molecule, we are treating every compound as though it is an ionic salt (even when we know it is not), and are determining the charge on each "ion" in the compound. Each atom gets its own oxidation number. We assign these charges based on a few simple rules.

- All atoms in their elemental state ($H_2$, He, Cu, $O_2$, $N_2$, etc) have an oxidation number of 0.

- The oxidation state of a monatomic ion (a single atom with a charge, such as $Na^+$, $Fe^{3+}$, $F^-$) is the same as the charge on the ion.

- In simple ionic compounds (NaCl, $FeBr_3$, etc) the oxidation numbers are the same as the actual charges on the ions.

- The oxidation states of all the atoms in a neutral molecule add up to 0. The oxidation states of all the atoms in an ion (such as $NO^{3-}$ or $SO_4^{2-}$) add up to the charge on the ion.

- Group I metals ($Li^+$, $Na^+$, $K^+$, etc) are almost always +1 in compounds.

- Group II metals ($Be^{2+}$, $Mg^{2+}$, $Ca^{2+}$, $Ba^{2+}$, etc) are nearly always +2 in compounds.

- Hydrogen is almost always +1, except when it is:
     0 in elemental hydrogen ($H_2$ gas)
     -1 in metal hydrides such as $LiAlH_4$ (these are rare).

- Oxygen is almost always –2, except when it is:
     0 in elemental oxygen ($O_2$ gas)
     –1 in peroxides such as $H_2O_2$.
     Oxygen will be positive when paired with fluorine.

- Fluorine in a compound is always –1.

- Chlorine, bromine, and iodine in a compound are always –1 unless bonded with oxygen.

So to find the oxidation numbers in Question 5,

a) $CrO_4^{2-}$ – the oxygens are -2 each, for a total of -8. The overall charge is -2, so the difference between these is the charge on the chromium. Report the oxidation states of both the oxygen and the chromium.

d) $[Cr(H_2O)_6](NO_3)_3$ – the nitrate ions each have an overall charge of –1, so the overall charge on the $[Cr(H_2O)_6]$ must be _____. Look at the rules for oxygen and hydrogen above, then determine the oxidation states for the nitrogen and for the the chromium. Report the oxidation states for each element in the compound.

Do problems b) and c) similarly.