Reactions for Estimating $E°_{half\text{-}cell}$.

The half-cell reactions that will be used in this experiment and their standard electrode potentials are:

Standard Electrode (Half-Cell) Potentials	E° (V)
$H_2O_2 + 2\,H^+ + 2e^- \rightarrow 2\,H_2O$	1.77
$Br_2 + 2e^- \rightarrow 2\,Br^-$	1.07
$NO_3^- + 3\,H^+ + 2e^- \rightarrow HNO_2 + H_2O$	0.94
$Fe^{3+} + e^- \rightarrow Fe^{2+}$	0.77
$SO_4^{2-} + 4\,H^+ + 2e^- \rightarrow H_2SO_3 + H_2O$	0.20
$2\,CO_2 + 2\,H^+ + 2e^- \rightarrow H_2C_2O_4$	-0.49
$VO_2^+ + 2\,H^+ + e^- \rightarrow VO^{2+} + H_2O$	??

You will begin this experiment by looking for reactions that cause the reduction of VO_2^+ to VO^{2+}. The oxidation numbers of vanadium in these ions are +5 and +4, respectively. The potential reducing agents can be found in the first through the sixth half-reactions in the preceding table. These substances are H_2O, Br^-, HNO_2 (nitrous acid), Fe^{2+}, H_2SO_3 (sulfurous acid), and $H_2C_2O_4$ (oxalic acid).

You will also look for reactions that lead to the oxidation of VO^{2+} to VO_2^+ using five of the six potential oxidizing agents in the table. Thus, you will try reactions with H_2O_2, Br_2, NO_3^-, Fe^{3+}, and SO_4^{2-}, but you will not use CO_2 because of its limited solubility in an acidic solution.

How will you know that a reaction has occurred? The signal will be a color change. The colors of VO_2^+ and VO^{2+} are yellow and blue, respectively. A successful reduction of VO_2^+ to VO^{2+} by a colorless reducing agent will result in a color change from yellow to blue. Similarly, a successful oxidation of VO^{2+} to VO_2^+ by a colorless oxidizing agent will cause the color to change from blue to yellow.

A reaction mixture may also turn green. If so, the color may be due to roughly equal quantities of yellow VO_2^+ and blue VO^{2+}. Alternatively, a green color can result from a mixture of blue VO^{2+} ions and a yellow color from a reagent you have added.

If you obtain a green color, it is important for you to find the reason. You will want to be sure that a reaction has occurred and that the green color is not due to a mixture of the colors of two substances that have not reacted.