

## Oxidation States of Chromium

**Description:** Three different colors are observed from compounds containing different oxidation states of chromium: +2 (blue), +3 (green), and +6 (orange).

**Materials:**

Cr <sub>2</sub> O <sub>3</sub>	125 mL side arm Erlenmeyer
CrO <sub>3</sub>	2 125 mL Erlenmeyer flasks
3% H <sub>2</sub> O <sub>2</sub>	Balloon and rubber stopper

**Procedure:**

For large lecture halls, project demonstration using a document camera.

1. Display a flask containing Cr<sub>2</sub>O<sub>3</sub> in “solution”. Cr<sub>2</sub>O<sub>3</sub> is relatively insoluble in water but the green color from Cr<sup>3+</sup> is still observed.
2. Prepare a 1.0% by weight solution of CrO<sub>3</sub>. Pour 50 mL into one of the Erlenmeyer flasks and 50 mL into the side arm flask. Attach a balloon to the arm of this flask and seal the arm with parafilm.
3. Add ~10 mL of 3% H<sub>2</sub>O<sub>2</sub> to the CrO<sub>3</sub> solution in the side arm flask. Immediately seal the flask with a rubber stopper to allow the O<sub>2</sub> generated to fill up the balloon. Observe the change in color from orange (Cr<sup>6+</sup>) to blue (Cr<sup>2+</sup>).

**Discussion:**

The following equation describes the redox chemistry observed in this demonstration. Chromium is reduced from Cr<sup>6+</sup> (orange) to Cr<sup>2+</sup> (blue).



**Safety:** Wear proper protective equipment including gloves and safety glasses when preparing and performing this demonstration. Certain chromium compounds are carcinogenic. CrO<sub>3</sub> is a strong oxidizing agent.

**Disposal:** Solutions can be collected together and disposed of in an appropriate waste container.

**References:**

Summerlin, L. R.; Ealy, J. L. In *Chemical Demonstrations: A Sourcebook for Teachers*; American Chemical Society: 1985; Vol. 1, p 109.

Knox, K. J. *Chem. Educ.* **1990**, 67, 700. (inorganic chem. demo)