

15.2 Equilibrium: The Chromate-dichromate system

Subjects: Equilibrium

Description: Changes in the concentrations of the reactants and products cause a shift in equilibrium in the yellow chromate-orange dichromate system.

Materials:

3 Petri dishes
4 150 mL beakers (optional: for holding solutions)
0.1 M chromate solution[‡]
0.1 M dichromate solution[‡]
1M hydrochloric acid[‡]
1M sodium hydroxide[‡]
Disposable pipets to transfer solutions

[‡]Chromate and dichromate solutions can be found in the solutions storage cabinets. Hydrochloric acid and sodium hydroxide can be found in the cabinets under the hood.

Pre-class preparation:

1. Place a small amount of the solutions in the labeled beakers provided.

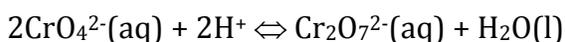
Procedure:

Note: Use the document camera to display the demo on the screen.

1. Place a Petri dish containing chromate solution and another Petri dish containing dichromate solution under the document camera. These will act as references.
2. Place more chromate solution in a third Petri dish just enough to cover the bottom.
3. Add acid drop wise and note color change from yellow to orange.
4. Add sodium hydroxide drop wise to the dish. Note the reformation of the yellow color.

Discussion:

This demonstration illustrates the following equilibrium:



(yellow)

(orange)

Adding acid shifts the equilibrium to the right, producing the orange color. Addition of base decreases the concentration of H⁺ ions, shifting the equilibrium back to the left and the yellow color.

Safety: Use proper protective equipment including gloves and goggles when performing this reaction. Chromate complexes are toxic and carcinogenic and

exposure should be avoided. Hydrochloric acid and sodium hydroxide can irritate skin and cause burns.

Disposal: The solutions can be neutralized and placed in the appropriate aqueous waste container.

References:

1. L. Summerlin, J. Ealy; *Chemical Demonstrations: A Sourcebook for Teachers*; 1985; Vol. 1; p 32-33; 56-59.