

Opening Day Signs for Chemistry

The Exciting Nature of Chemistry



Introduction

Develop signs and send a message about the nature of chemistry. Chemistry can be a lot of fun if you have the right attitude!

Concepts

- Introduction to chemistry
- Chemical reactions

Materials

Iron(III) chloride solution, FeCl_3 , 0.1 M, 250 mL

Potassium ferrocyanide solution, $\text{K}_4\text{Fe}(\text{CN})_6$, 0.1 M, 25 mL

Potassium thiocyanate solution, KSCN , 0.1 M, 25 mL

Chromatography or blotting paper, 3 sheets

Cotton swabs or brushes

Spray bottle

Paper towels

Safety Precautions

Potassium ferrocyanide and potassium thiocyanate solutions are slightly toxic by ingestion. The solutions may generate toxic hydrogen cyanide gas if heated with concentrated acids. Do not heat and avoid contact with concentrated acids. Iron(III) chloride solution is irritating to the skin and eyes. Do not spray near anyone when developing the signs. Avoid contact of all chemical with eyes and skin. Wear chemical splash goggles, chemical-resistant gloves, and chemical-resistant apron. Wash hands thoroughly with soap and water after completing the demonstration. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

Dip cotton swabs or a thin brush into the potassium thiocyanate solution. Use the swabs to draw the outlines and mouths for three “Chemistry” faces on chromatography paper. Make three signs, one for each face. See Figure 1. Using fresh cotton swabs and the potassium ferrocyanide solution, draw the letters and eyes for the “Chemistry” faces.

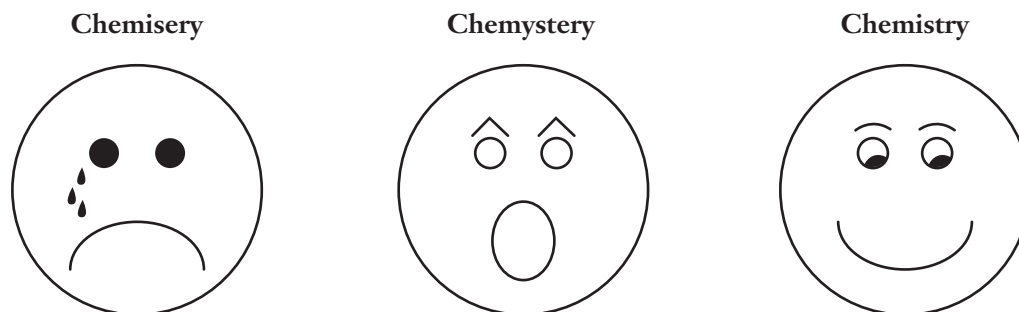


Figure 1. What is your “Chemistry” face?

Allow the signs to air dry. The writing should not be visible (the solutions are colorless or pale yellow.)

Procedure

1. Tape the “Chemistry” signs on the presentation board in the classroom or lab. Place paper towels underneath the signs.
2. Fill the spray bottle about one-third full with the iron(III) chloride solution just before beginning the demonstration.
3. Discuss student expectations and attitudes toward chemistry (see the *Discussion* section). To illustrate the importance of a good attitude in approaching the subject, spray each “Chemistry” face in turn using the solution of iron(III) chloride.
4. Observe the color changes. (*The mouths will turn red, while the letters and other parts of the faces will turn blue.*)

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Avoid contaminating the solutions—the solutions may be saved for future use. Do not store the iron(III) chloride solution in the spray bottle. It will corrode the spray mechanism.

Tips

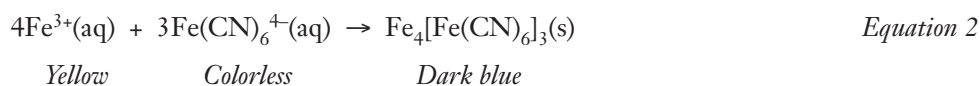
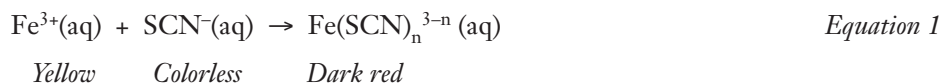
- For best results, use absorbent chromatography or blotting paper to draw the messages. Regular writing paper will cause the liquid to run off, making a mess.
- The chemical reactions that are used to develop the signs in this activity are likely to come up again several times over the course of the year in chemistry. The formation of iron(III)–thiocyanate complex ions is a classic reversible reaction that is usually studied in more detail in a unit on equilibrium. The “Prussian blue” reaction is used as a confirmation test for iron(III) ions in qualitative analysis schemes, and it is also used as a color identification test for the oxidation of iron(II) to iron(III) ions.

Discussion

First impressions are so important, and you only get one chance to get them right! Many beginning chemistry students approach the subject with anxiety or even fear. Maybe they have heard stories from their friends that chemistry is hard work, and that they never really understood the subject. These attitudes may shape how new students view the class, and may be a roadblock to student success. Experienced teachers know that they cannot ignore these student perceptions. They use various “opening day” demonstrations to engage the students, address their concerns, and show them that chemistry will be exciting and fun.

How do you spell “Chemistry?” Some students assume it must be “Chemisery,” and that is likely to be a self-fulfilling prophecy if students don’t study regularly or do their assigned problems and other homework. Other students assume it will just always be “Chemystery.” They love the amazing color changes and other “special effects” in many chemical reactions, but true understanding seems to elude them. Everyone, however, will be able to spell “Chemistry” correctly if they study and pay attention in class!

The following chemical reactions are responsible for the color changes in Opening Day Signs for Chemistry. Iron(III) ions react with thiocyanate ions to form dark red complex ions having the general formula $\text{Fe}(\text{SCN})_n^{3-n}$. (The product is often assumed to be just FeSCN^{2+} .) See Equation 1. Iron(III) ions react with ferrocyanide ions to form a dark blue, mixed iron(II)/iron(III) ionic product, which is commonly known called Prussian blue. See Equation 2. Discovered in 1710, Prussian blue was one of the first dye pigments manufactured for commercial use.



Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Constancy, change, and measurement

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry

Content Standard B: Physical Science, chemical reactions

Content Standard G: History and Nature of Science, science as a human endeavor, nature of scientific knowledge

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Opening Day Signs for Chemistry* activity, presented by Annis Hapkiewicz, is available in *The Exciting Nature of Chemistry*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Opening Day Signs for Chemistry* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP4299	Chromatography Paper, Sheets, Pkg/100
P0178	Potassium Thiocyanate Solution, 0.1 M, 500 mL
P0220	Potassium Ferrocyanide Solution, 0.1 M, 500 mL
F0045	Iron(III) Chloride Solution, 0.1 M, 500 mL
AP5338	Bottle, Spray Mist Dispenser

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.