

WARNING NOTICE

The experiments described in these materials are potentially hazardous. Among other things, the experiments should include the following safety measures: a high level of safety training, special facilities and equipment, the use of proper personal protective equipment, and supervision by appropriate individuals. You bear the sole responsibility, liability, and risk for the implementation of such safety procedures and measures. MIT and Dow shall have no responsibility, liability, or risk for the content or implementation of any of the material presented. [Legal Notice](#)

Water to Wine to Milk to Beer

Abstract

A glass of clear water solution is poured into a wine glass and turns into a glass of wine. The wine is then poured into another glass and turns into a glass of milk. Finally, the milk is poured into a beer mug and turns into a bubbling mug of beer.

Materials

Sodium hydrogen carbonate	Hydrochloric acid
Phenolphthalein	lump of dry ice
Barium chloride	water glass, wine glass, milk glass, beer mug
Sodium carbonate	small shot glass for HCl
Sodium dichromate	small container for lump of CO ₂
Bottles for stock solutions	spatula

Safety

Always wear disposable gloves and safety goggles when preparing solutions and working with chemicals in the lab. Sodium dichromate is corrosive and will cause severe burns to any area of contact. Sodium dichromate is also a known carcinogen and strong oxidizer/reducer that can ignite and burn if it comes into contact with other materials. Hydrochloric acid is known to cause severe burns to all body tissues and could be fatal if swallowed or ingested. Inhalation could cause lung damage. Barium chloride should be handled carefully and is an irritant to skin, eyes and lungs. Dry ice can cause frostbite and should be handled only with insulated gloves. Sodium carbonate is only slightly toxic but can cause irritation.

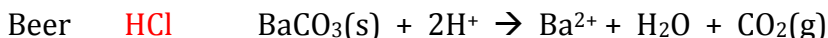
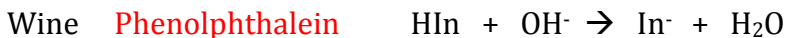
Procedure

Add to the water glass 22 mL of a saturated solution of sodium bicarbonate. Then add 6 mL of a 20% sodium carbonate solution and fill the glass with distilled water. Add 4 drops of a 1% phenolphthalein solution to the empty wine glass. Add 11 mL of a saturated solution of barium chloride solution to the empty milk glass. Add to the beer mug, a few crystals of sodium dichromate. Then, right before you transfer the milk into the beer mug pour in 6 mL of concentrated HCl from the shot glass and toss in one piece of dry ice.

There are many ways to present this demonstration. You can start by creating a story for the audience. Starting with the glass of water, pour the contents of the glass into the wine glass and a colorful glass of wine appears. Pour the contents of the wine glass quickly into the milk glass and a white opaque glass of milk appears. Finally, toss the 6 mL of HCl into the beer mug, throw in a solid piece of dry ice and quickly pour the glass of milk into the mug and the solution turns into a bubbling, frothy, colorful mug of beer.

Discussion

The reactions are eye catching. The water glass contains carbonate ions and hydroxide ions, which are basic. The wine glass contains phenolphthalein, which forms a pink solution in the presence of base giving the impression of a glass of light red wine. When the wine is poured into the milk glass the barium ions react with carbonate to form a solid white milky precipitate of barium carbonate. Finally the milk is poured into the beer mug and the HCl breaks up the solid white precipitate producing CO₂ gas and soluble barium ions in water. The dichromate ions help to give it the yellowish-brown color of beer. The short sequence of reactions is as follows:



Disposal

The final solution should be placed into an appropriate waste container. The glasses can then be rinsed out with plenty of water. Any remaining stock solutions can be stored for future use.

References

<http://chem.lapeer.org/Chem1Docs/WaterWineBeer.html>

MIT OpenCourseWare

<http://ocw.mit.edu>

Chemistry Behind the Magic: Chemical Demonstrations for the Classroom

Fall 2012

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.