

13.1A Egg in Sugar solution[◊][◊]Requires several days lead time**Subjects:** Solutions, osmosis, osmotic pressure, colligative properties**Description:** An egg (shell removed) is placed in a sugar solution. The egg will shrivel. Conversely, when an egg is placed in distilled water, it will swell.**Materials:**3 Raw eggs with shells removed (Eggs must be provided and prepared by instructor in advance)[◊]Sucrose solution[‡]

Distilled water

3 400 mL beakers

1 large beaker for soaking eggs
vinegar[‡][‡]Located on solutions shelf. Vinegar is located with the other household chemicals in the solutions cabinets.**Preparation:**

1. Soak the 3 eggs in vinegar for 2-3 days in the large beaker, until the shell has dissolved and the translucent membrane remains. Do not use a stronger acid, or the membrane may be dissolved. Carefully remove the eggs and dry.

Procedure:

1. Place one decalcified egg in the sugar solution, one in the distilled water and the third in the empty beaker with no solution as a comparison.
2. Observe. Over time the egg in syrup will decrease in size. The egg in water will increase in size. This may take the whole class period to see the results. Let the eggs soak until the next class period for an enhanced effect.

Discussion:

Osmosis is a process in which solvent molecules flow through a semipermeable membrane. This membrane allows the passage of the solvent, but not the solutes. Water flows from the region of low solute concentration (hypotonic) to high solute concentration (hypertonic). The movement of solvent through a membrane produces a pressure called the osmotic pressure. The movement of the solvent through the membrane will continue until an equilibrium is met. This happens when the pressure in the compartment into which the solvent is flowing is raised to the equivalent of the pressure of the solvent moving through the membrane from the hypotonic side (osmotic pressure).

Osmosis is a colligative property in that it depends on the concentrations of the solutes, but not the identity of the solutes.

The solution inside the egg membrane contains a complex solution of salts, proteins, lipids and carbohydrates. Compared to distilled water, the solution within the egg membrane is hypertonic. Therefore when the decalcified egg is placed in water, the water flows through the membrane into the egg.

A concentrated sugar solution is hypertonic compared to the solution inside the egg. Therefore when the egg is placed in the concentrated sugar solution water flows out of the egg, causing it to shrivel.

Safety: None

Disposal: Eggs can be disposed of in the trash. Solutions can be flushed down the drain with water.

References:

1. B. Z. Shakhashiri; *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Wisconsin; Volume 3; 1989; p. 283-285
2. Kotz, Treichel, Townsend; *Chemistry & Chemical Reactivity*; 7th Ed; Teachers Edition; Brooks/Cole; 2009; p. 635-637
3. For a video of this experiment go to: ChemistryNow Screen 14.1 Puzzler, and Screen 14.9, Colligative Properties.