

14.1A Alternate: Vitamin C clock reaction**Subject:** Kinetics, titration (iodometry)**Description:** A clock reaction is demonstrated with common household items. Two clear, colorless solutions are mixed together. Upon mixing the solution remains clear for a period of time and then suddenly turns dark purple-blue.**Materials:**

Solution A	5 mL 0.1 M Ascorbic acid solution 5 mL 2% tincture of iodine 30 mL dI water
Solution B	15 mL 3% H ₂ O ₂ 3 mL 1% starch solution 30 mL dI water

10 ml graduated cylinder
 25 ml graduated cylinder
 50 mL graduated cylinder
 100 ml graduated cylinder
 2 100 mL beakers labeled A and B
 1 250 mL beaker
 Mortar and pestle
 timing device (optional)
 stir bar
 hot plate, water bath (optional)*
 dI water in wash bottle

*Shared item: Located in drawers opposite the chemical storage cabinets.

Pre-class Preparation:**Solution A:**

1. Pre-prepared Vitaminc C stock solution is in the refrigerator. If there is none left prepare as follows: Pulverize a 1000 mg vitamin C tablet and add 60 mL distilled water.
2. Add 5 mL of ascorbic acid stock solution and 5 mL tincture of iodine to the 100 ml beaker labeled A. Add 30 mL distilled water to produce solution A.

Solution B:

1. Add 15 mL 3% H₂O₂ and 3 mL starch solution to the other 100 mL beaker labeled B. Add to 30 mL distilled water to make solution B.
2. Rinse the cylinders with dI water in between measurements.

Procedure:

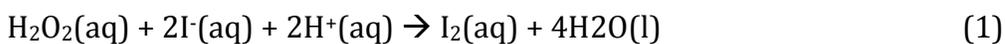
1. Pour solutions A and B simultaneously into the 250 mL beaker and count the seconds for the solution to turn blue.

Note: When tested it took about 1 minute for the color to change. The change wasn't as sudden as the original iodine. The color was more purple than dark blue initially, then turned to black.

Discussion:

Note: Tincture of iodine contains 0.08M iodine and 0.16 M sodium iodide in solution of ethanol and water.

Hydrogen peroxide slowly oxidizes the iodide in acidic solution to iodine (equation 1). Once the iodine is formed vitamin C rapidly reduces it to regenerate I⁻ (equation 2).



Vitamin C is also being oxidized by hydrogen peroxide to a lactone which spontaneously decomposes.

When the vitamin C has been consumed I₂ accumulates, reacts with I⁻ to form the I₃⁻ ion, which reacts with the starch to form the I₅⁻—starch complex with the blue-black color.

Variation:

Heat the solution to show effect of temperature on rate.

Use lower concentrations of reactants to show effect of concentration on rate.

Safety: None

Disposal: Solutions can go down the drain with water.

References:

1. S.W Wright: "The Vitamin C Clock Reaction", Journal of Chemical Education; Vol. 79; p. 41; 2002
2. J. Koch, P. Treichel, J. Townsend, *Chemistry and Chemical Reactivity*; 7th Ed; Brooks/Cole; 2009; p. 676