Required Training

UC Lab Safety Fundamentals

Required PPE

Flame-resistant lab coat, safety glasses/goggles, nitrile gloves

Performers Required: 1

Equipment

25mm x 200mm silica (quartz) test tube

Lab stand with test tube clamp and inverted glass cone

Tongs or long forceps

Propane torch

Chemicals

Potassium chlorate (KClO₃)

Gummy bear (halves rolled in powdered sugar to prevent sticking)

Procedure:

1. Add enough solid KClO₃ to the silica tube to fill it to a depth of ~1”.
2. Place the silica tube in the clamp on the lab stand, clamping near the open end of the tube. Position the clamp such that the tube is held vertically, with the opening directly under the inverted glass cone. The rim of the cone should be ~1” above the opening of the tube.
3. Use the propane torch to evenly heat the bottom of the tube until the KClO₃ begins to melt. Bubbles will start to form in the clear liquid as it begins to decompose.
4. When the KClO₃ is fully melted, stop heating with the torch and use tongs or forceps to carefully drop one half of a gummy bear into the tube and step back. The vigorous oxidation reaction will release heat, flame, and light as the sugar is oxidized. The liberated heat from the reaction will melt any remaining solid KClO₃.
5. If the initial reaction dies down (no more light) and there appears to be additional KClO₃ in the tube, a second half gummy bear may be added to continue the demonstration. If it is added too soon, it is likely to be ejected from the tube.

Clean-up: Do not attempt to move or clean up the demonstration until everything has cooled significantly. Once cool, the tube can be cleaned with water and all waste products can be disposed of down the drain.

Hazards: Molten KClO₃ is a strong oxidizer that will ignite combustible materials on contact, and it may also cause thermal burns. The oxidation of the gummi bear is strongly exothermic and produces heat, flame, and light. The gummy bear and small drops of molten KCl or KClO₃ may be ejected from the tube before the reaction is complete, though
these should be stopped by the inverted cone. Ensure the tube is over a non-combustible surface as a precaution.

**Principle:** When heated to a molten state, KClO$_3$ decomposes into potassium chloride (KCl) and potassium perchlorate (KClO$_4$), which upon further heating decomposes into KCl and oxygen (O$_2$). The O$_2$ oxidizes the sucrose (C$_{12}$H$_{22}$O$_{11}$) in the gummy bear into carbon dioxide (CO$_2$) and water (H$_2$O); if the reaction went to completion, it would liberate ~35 kJ of energy per gummy bear. The liberated heat will also caramelize some of the sugar, producing a brown color and giving off a characteristic odor. The lavender color of the flame indicates the presence of potassium ion (as in a flame test).

**Notes:** Use half of a gummy bear instead of a whole one, as it is less likely to be ejected from the tube. To prevent the gummy bear from sticking to the tongs and the side of the tube, it is helpful to coat the cut (sticky) surface with powdered sugar.