

9.2 Properties of liquid oxygen

Subjects: Atomic structure, periodic trends,

Description: Liquid oxygen is produced by the condensation of oxygen gas onto a metal coffee can full of liquid nitrogen, and then collecting it into a Styrofoam cup. The blue color of liquid oxygen is observed and the magnetic properties demonstrated.

Materials:

Metal coffee can

Dewar* of liquid nitrogen[◇]

Ring stand with clamped ring

Coffee cup

Ring magnets tied to a string

*Shared Item. Located on the shelves in the alcove.

[◇]Requires advanced preparation. Get LN₂ ahead of time.

Procedure:

1. Support the coffee can on the ring so that it is at an angle and the bottom edge of the can is pointing down.
2. Set the Styrofoam cup under the edge of the can to catch the condensing liquid oxygen.
3. Pour the liquid nitrogen into the coffee can.
4. Liquid oxygen will condense on the surface of the can and drip into the cup beneath.
5. When enough LOX has been collected, allow the students to observe the blue color.
6. Dip the magnets into the liquid oxygen and remove, pulling out some of the liquid oxygen that is clinging to the magnets.

Discussion:

Oxygen gas condenses to a liquid at -183°C. Liquid oxygen is paramagnetic. A paramagnetic element or compound has unpaired electrons that align when a magnetic field is imposed. Molecular orbital theory predicts a configuration with a bond order of 2 and two unpaired electrons, in agreement with experimental results.

Safety:

Liquid oxygen and the liquid nitrogen in which it is immersed in the Dewar flask are extremely cold. Wear insulating gloves to prevent skin exposure. Liquid oxygen is a very powerful oxidizer. Make sure that this demonstration is performed away from sources of combustion.

References:

1. J. Kotz, P. Treichel, J. Townsend; *Chemistry & Chemical Reactivity*. 7th Ed.
Instructor's Edition; Brooks/Cole; 2009