
Water Filled Jugs Can Cause Fires

by: Jim Blackburn

CONVEX LENSES CAN CONCENTRATE THE SUN'S RAYS¹

My wife Marla refills some of her three-liter jugs with water and saves them on our wooden deck in case our water pump or plumbing give out and we need a temporary supply of water. While cleaning the deck she moved the jugs and noticed underneath them a charred area about the size of a thumb. Scratching confirmed it actually was a burn down into the wood! She reasoned that the sun was focused by the bottle and could have caused a fire.

When she related this observation to me, I quickly agreed since as a retired physicist I knew that a somewhat spherically shaped bottle filled with a clear liquid could be a crude lens. The sun's rays are bent on passing through the spherical bottle of water and the right-shaped bottle would concentrate the rays to a very hot focal point.

We've all played with glass lenses (even our eye glasses for example) to find their principal focus. A cylindrical bottle would only concentrate the rays along a line and probably not enough to cause a fire. A small bulbous shape such as a rain drop won't concentrate enough energy to cause a fire. Even a good one-inch-



A replica (on a smaller scale) of the burning lens owned by Joseph Priestly, in his laboratory. [Wikipedia]

¹ See related article in [Wikipedia](#).



diameter glass lens focused on a flammable material might not cause a fire. But a filled vase or water jug of several inches dimension, even if not particularly spherical but with opposing convex surfaces, can produce a focused image concentrated enough to cause a fire.

The hot spot is usually a couple of inches or so beyond the bottle, as shown by calculations and experiments with several bottles. Time of day makes a difference. Early morning or late evening the focal point might hit a nearby flammable object, such as a hanging drape, for example. Mid-morning or afternoon with the sun at a higher angle the focal point would be just outside the base of the jug. At noon with the sun overhead there could be a hot spot immediately under the jug but not focused enough, not hot enough and without oxygen necessary to cause a burn.

I tried a wad of paper towel at the focal point near the base of Marla's bottle filled with water about 9:30 a.m. and had smoke and some flames in just a couple of minutes! Having the bottle sitting on a tablecloth, a mat or a wooden window sill could lead to a fire. In our case with the jug on the east deck, the sun as it rose caused a moving focus on the deck leading to the observed elongated thumb-shaped charred area!

Three requirements:

1. Bulbous-shaped transparent bottle several inches in diameter.
2. Clear filling such as water, olive oil, wine.
3. Flammable material at the focal point.

Marla and I strongly caution you not to place in the sun near flammable material a filled spherical shaped jug that might act as a lens and cause a FIRE.

