

# Poly Density Bottle

## Equipment and Chemicals:

pre-filled poly density bottle (transparent plastic bottle filled with isopropanol and salt water as well as plastic beads of two different colors (e.g. white and blue))

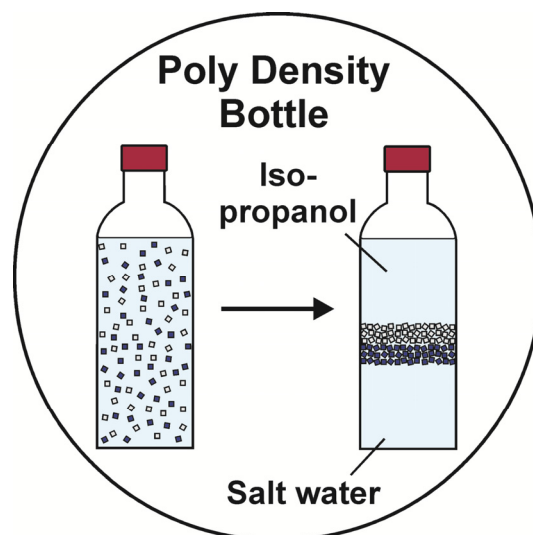
## Safety:

isopropanol ( $C_3H_7OH$ ):



H225-319-336

P210-233-240-305 + 351 + 330 + 338-403 + 235



Liquid and vapor are highly flammable. Isopropanol also causes severe eye irritation. Therefore, it is necessary to wear safety glasses and protective gloves if the bottle should be opened.

## Procedure:

The bottle is thoroughly shaken, so that the beads are randomly distributed in the liquid. Subsequently, the system is allowed to settle.

## Observation:

Upon standing, the beads separate from one another: the white beads rise to the top while the blue ones sink to the bottom. The liquid, once clear, now appears to be slightly cloudy. After a very short while, the white beads begin to slowly sink down, while the blue beads start to float up. The liquid above and below the beads is again clear, while the liquid between the “layers” of beads remains slightly cloudy. Finally, the two “layers” of beads meet near the middle of the bottle.

## Explanation:

The alcohol and the salt water in the bottle are immiscible; in equilibrium they would form two liquid layers with the less dense isopropanol layer on top.

When the bottle is shaken, the two liquids momentarily mix and form an emulsion with a density between the two separate liquid densities. Since the density of the white beads is less than that of the emulsion, they float on top. The blue beads with a higher density than the emulsion, however, sink to the bottom.

Over time, the emulsion begins to separate into distinct layers of salt water and isopropanol. While this separation occurs, the white beads float at the isopropanol-emulsion interface (below the alcohol but above the emulsion), because they are less dense than the emulsion but more dense than the alcohol. Together with the interface, the plastic pieces move downwards. The blue beads, however, float at the salt water-emulsion interface (below the emulsion but above the salt water), because these plastic pieces are less dense than salt water and more dense than the emulsion. They move upwards together with the salt water-emulsion interface. Finally, the emulsion has

completely separated into salt water and isopropanol and the two layers of beads meet at the resulting isopropanol–saltwater interface.

**Disposal:**

The poly density bottle can be reused for years. If the liquid content is to be disposed of, it has to be collected in the container for aqueous halogen-free solvent mixtures.