GALILEO'S THERMOMETER

How Does It Work?

The thermometer works on the principle of buoyancy (Archimedes' Principle). The buoyant force, **B**, upward on the glass ball is offset in whole or in part by the weight, **W**, of the glass ball.

B = weight of water displaced = mass of water × g
= density of water × volume of ball × g

The weight of the glass balls is constant, but the density of the fluid changes with temperature.

W = weight of glass ball = mass of glass ball × g
= density of glass ball × volume of ball x g

When **B** > **W**, the ball floats to the top. When **B** < **W**, the ball sinks. If **B** = **W**, the ball hovers suspended somewhere in the fluid.

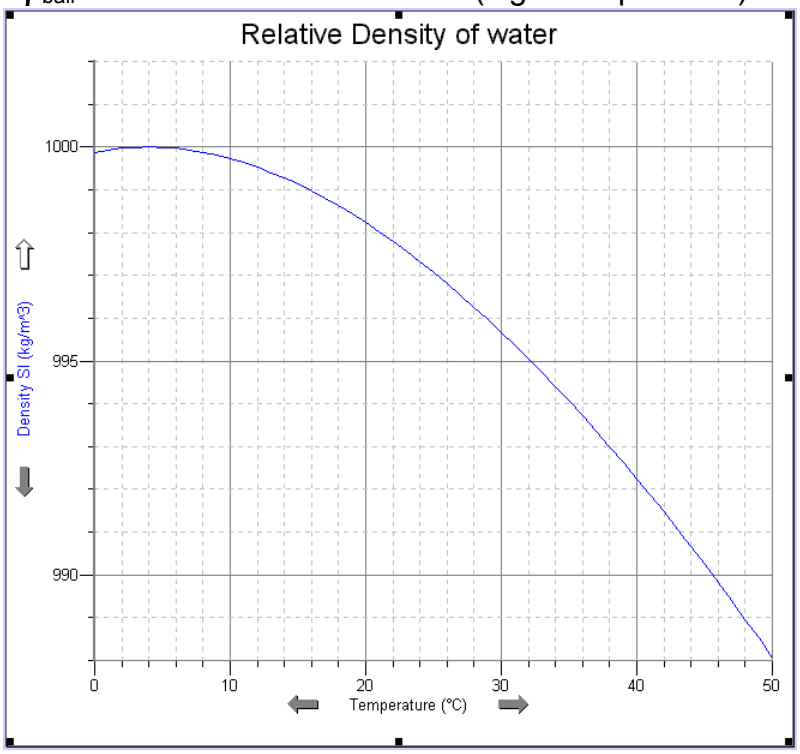
Also, since $\mathbf{B} / \mathbf{W} = \rho_{water} / \rho_{ball}$, we can say:

if $\rho_{water} > \rho_{ball}$ the ball floats on the top (low Temperature)

if $\rho_{water} = \rho_{ball}$ the ball hovers in the middle

if $\rho_{water} < \rho_{ball}$ the ball sinks to the bottom (high Temperature)

This graph shows how the density of water changes with temperature. As the temperature goes up, the density of the water goes down. Hence, all the balls will float at low temperatures, where the density of water is highest. All the balls will sink at high temperatures, where the density of water is lowest.



At normal room temperatures, most liquids behave like water in this example; as the temperatures rises, the density falls. So almost any liquid could be used in making one of these thermometers.