

STATION 9

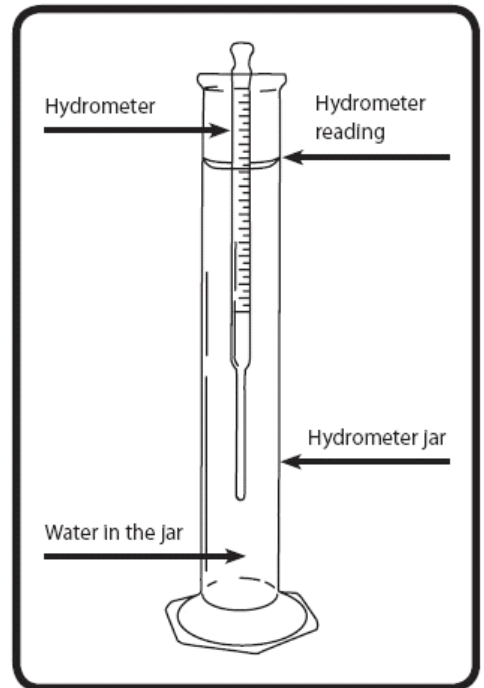
THE MASS DIVIDED BY THE VOLUME OF AN OBJECT IS THE DENSITY OF THE OBJECT. SINCE DENSITY IS NOT DEPENDENT ON THE AMOUNT OF THE OBJECT PRESENT, IT IS A VERY USEFUL PROPERTY FOR DETERMINING IDENTITY. THERE ARE FOUR PARTS TO THIS STATION.

Part 1. The Galileo thermometer provides a temperature measurement by taking advantage of the property of density.

- 1. What is room temperature?**
- 2. How does the thermometer function?**



PART 2. A HYDROMETER LOOKS A LITTLE LIKE AN OLD-FASHIONED THERMOMETER BUT IS A DEVICE THAT HAS BEEN CALIBRATED TO READ OUT DENSITY DIRECTLY WITH ONE MEASUREMENT (INSTEAD OF MASS AND VOLUME). USE THE HYDROMETER IN THE GRADUATED CYLINDER TO READ THE DENSITY OF WATER.



Does the reading suggest any advantage of the metric system over the American customary system?

PART 3. INVERT THE *LIQUID MOTION BUBBLER* AND OBSERVE THE RESULTS.

Does density play a role in what happens after inversion of the bubbler?



PART 4.



A “DENSITY BOTTLE IS PROVIDED THAT CONTAINS SALT WATER AS THE BOTTOM LAYER WITH ISOPROPYL ALCOHOL, THE TOP LAYER. DIFFERENT TYPES OF BEADS HAVE BEEN ADDED TO THE HETEROGENEOUS MIXTURE. SHAKE THE BOTTLE VIGOROUSLY AND OBSERVE THE MIXTURE FOR SEVERAL MINUTES.

Use density to explain your observations.

Concepts and Answers -

The Galileo Thermometer.

From <http://www.howitworksdaily.com/how-does-a-galileo-thermometer-work/>

The Galileo thermometer consists of a vertical glass tube, typically filled with water, and sealed glass bubbles containing colored water or alcohol. Each bubble is also attached to a specific mass (labeled with the temperature it represents) to calibrate its density. The temperature can be read by interpreting the distribution of these bubbles. The principle of buoyancy states that if an object is less dense than a liquid, it floats; and if the object is denser than the liquid, it sinks. When the temperature of the liquid in the glass tube begins to warm up, it expands; hence lowering the density of the liquid. The opposite occurs when the temperature cools (density of the liquid increases). Therefore, if a bubble becomes denser compared with the liquid, it sinks; and if less dense, it floats.

The Hydrometer.

Your measurement should reveal that the density of water in the metric system is just slightly below 1.00 g/cm^3 . The value close to unity makes it much easier to relate volume and distance units. In the American customary system, the relationship between distance cubed and volume is not nearly as easily conceived.

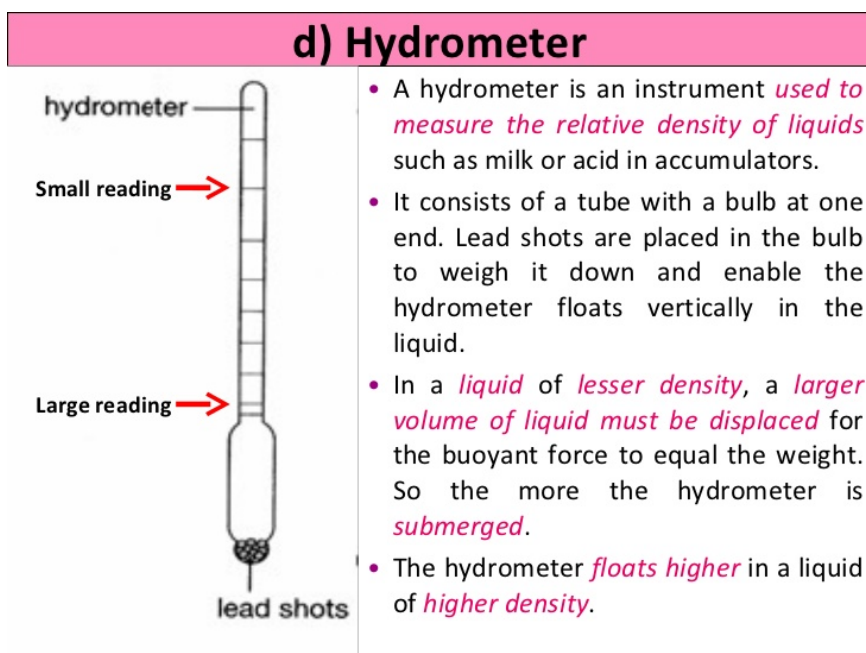
Liquid Motion Bubbler.

Liquid Motion Bubbler presents the phenomena of liquid dynamics in a fun display. The bubbler contains

two immiscible liquids of different densities. Flip this bubbler like an hourglass to watch the denser of the two liquids inside squeeze, slip and float serenely to the bottom.

Density Bottles.

The bottles contain two immiscible liquids, salt water on the bottom and isopropyl alcohol on the top. Look carefully at the bottle and you will see the "line" separating the two phases. Although water and isopropyl alcohol are miscible, the addition of salt to the water makes the alcohol immiscible with the lower phase. The bottle also contains beads of different densities with some denser than salt water and some less dense than salt water but more dense than the alcohol layer. Shaking of the bottle results in a temporary suspension of the two liquid layers with a density intermediate between the density of salt water and alcohol. As the two layers begin to separate, the changing densities cause the beads to either sink or float.



Images and Materials.

<https://www.teachersource.com/product/flowing-color-spectrum-aka-liquid-motion-bubbler/density>

<https://www.teachersource.com/product/poly-density-kit/density>



