

Density Rods

P1-1020



BACKGROUND:

The set consists of an aluminum density rod and a PVC “reverse density rod” with a finishing nail insert. Together, they can be used as a discrepant event to encourage students to think about the effects of temperature on the density of liquids and solids.

EXPERIMENTS:

Density Rod (aluminum)

1. Fill a graduated cylinder with warm water (50 or 60C). To prevent air bubbles that cling to the Density Rod and cause erratic operation, use de-aerated water if you can. (Previously boiled water works.) Place the rod in the warm water and observe the results. (It sinks to the bottom and stays there until the water cools.) **Explanation:** As the water cools, it becomes more dense. The water eventually becomes more dense than the rod, and the rod begins to float.
2. Half fill a graduated cylinder with cold water, and carefully pour hot water on top. (You might want to add a drop of food coloring to one half of the water.) Insert the rod and observe the results. (It will sink through the hot water and remain suspended at the boundary between hot and cold water. Note: this process is used to construct density floats that stay at a certain depth of water for ocean research.)
3. Partly fill a graduated cylinder with room temperature water. Insert the rod and observe. (The rod will float.) Carefully add a layer of 90% water and 10% alcohol and observe again. (The rod will remain suspended between the layers.) Stir the two layers together. The rod sinks to the bottom.
4. Challenge students to alter the mixture in Experiment 3 so that the rod will float again. (Adding a little bit of salt will increase the liquid’s density, causing the rod to float.)

Reverse Density Rod (PVC)

1. Fill a graduated cylinder with warm water at about 40C. (Use deaerated water if possible.) At first, the rod will sink, but as the rod warms, it will begin to float. (Watch for bubbles and disperse them if they appear.) The rod will be floating after about 3 minutes. It will float until the water cools. **Explanation:** The density of the rod also changes with temperature. In the case of the PVC rod, the rod changes density more drastically than the water does. When the rod is warm, it is less dense than water, and it floats. When it is cool, it sinks.
2. If you put the warm rod into cold water, the rod will float until the rod cools sufficiently, and then sink.
3. Challenge students to predict what will happen if the Reverse Density Rod is placed in a layered cylinder, as in #2 above. What if the layers are reversed? (The layers won't stay reversed for long. Colored layers will show that the cooler water moves toward the bottom of the cylinder, since it is less dense.)

RELATED PRODUCTS:

Set of Density Blocks (P1-1010).

Solar Bag (P6-7300). Use the Solar Bag to demonstrate concepts of energy, thermodynamics, density, and buoyancy!

