

Find the Floaters & Sinkers

Advanced preparation for *Find the Floaters & Sinkers*

SOLUTION: If students make their own solution, they will need to add two level tablespoons of calcium chloride (30 grams) to 30 mL of distilled water. This is an exothermic process as the solid dissolves. The cup will get hot! (It could reach 80° C.) The chemical can be obtained from a chemical supply company or as Prestone® Driveway Heat, a product for melting ice on driveways and sidewalks. It can be purchased at Wal-Mart Automotive. A 9.5 lb. container costs \$5.60. Purchase it in the winter since stores do not carry it in the summer. Be careful that the product you purchase isn't a mixture of several salts. Sodium chloride does not work for this application because its saturated solutions are not more dense than the densest of the resins.

If you prepare the solution for the class, mix 450 mL of distilled water with 2 cups of calcium chloride. This solution making process is exothermic! The 450 ml solution may get as hot as 100° C. Prepare the solution in a Pyrex® 1-liter beaker or a large glass canning jar. Place the beaker or jar in a bucket of cold water to help cool the solution as you mix it. Wear your goggles! Calcium chloride may irritate your skin. Wash with water if your skin comes in contact with the solution. Make the solution in a well-ventilated room since the water vapor from the hot solution may be irritating to breathe.

Be sure to check the calcium chloride solution to make sure that all 3 pellets (PETE, PS and PVC float). Depending on the brand of CaCl₂ used you may need to add more of the solute to make the solution dense enough for these pellets to float.

FLOW CHART: Students may need help in reading a flow chart. Make an overhead transparency of the flow chart. Ask students to tell what a person should do next when two pellets of the same color are observed sinking in water? The answer should be that the pellets will be removed from the water and placed in the calcium chloride solution for further testing. Another question to ask, while reading the flow chart, is how would a student describe the behavior of pellet "M"? The answer is that "M" is a floater in water and a sinker in 70 % isopropyl alcohol.

You will need to provide waste containers for the used pellets and solutions at the end of the laboratory period. The pellets may be washed (by the teacher) and reused many times. The solutions may be disposed of by washing down the drain.

WATCH the *Don't be Trashy-Recycle* video (1.15 min) before this lesson. This video helps students understand their integral role in closing the recycling loop, by demonstrating exactly what happens to our used plastics after we toss them in the bin. It shows the purpose of density testing, the activity in these lessons.

MATERIALS: (for a class of 30 students working in pairs)

45 cups with at least 60 mL capacity

45 craft sticks (one for water, one for alcohol solutions, and one for calcium chloride)

450 mL of **70%** isopropyl alcohol. Color blue with food coloring.

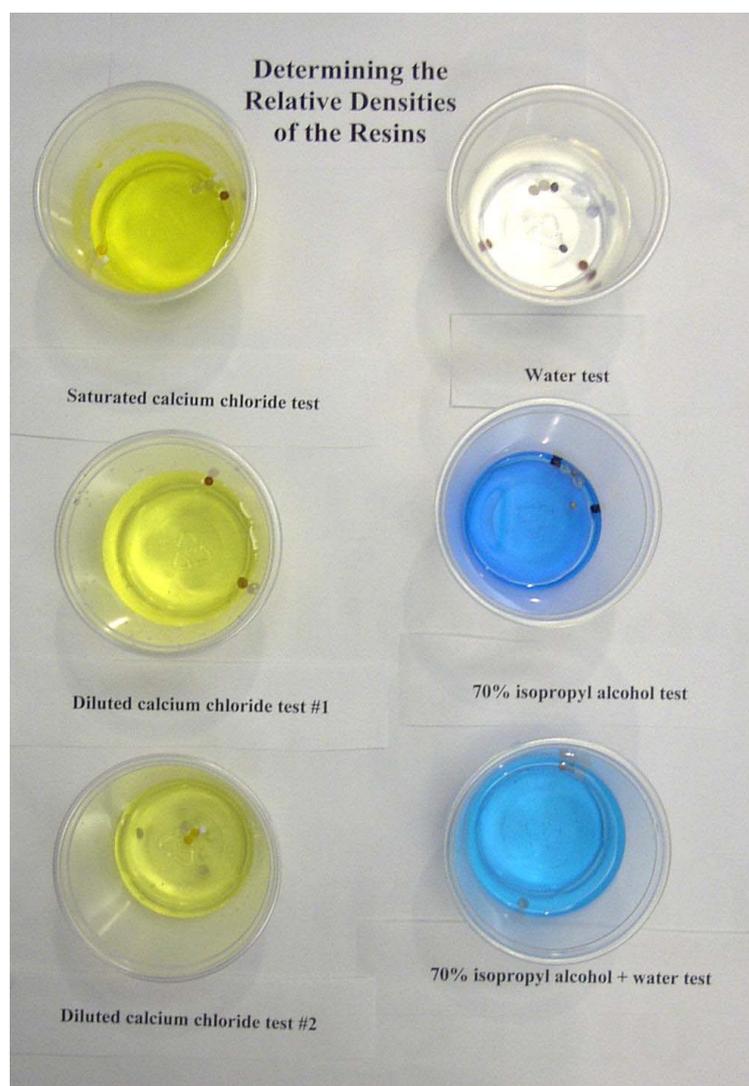
450 mL calcium chloride solution. Color yellow with food coloring.

30 pairs of chemical splash goggles

60 plastic pipets, droppers or teaspoons

6 kinds of plastic resin pellets from HOP kit – 2 each of the 6 kinds (12 pellets/group)

Video: *Don't Be Trashy, Recycle* <https://vimeo.com/111446483>



Teacher Key to the Flow Chart

- M. Resin is more dense than 70% isopropyl alcohol, sinks in 1st test solution and is the first to float in 2nd test solution. (PP)
- Z. Resin is more dense than 70% isopropyl alcohol, sinks in 1st test solution and floats in 2nd test solution. Resin is less dense than HDPE but more dense than PP. (LDPE)
- X. Resin X is less dense than water, more dense than 70% alcohol, the 1st and 2nd test solutions and more dense than LDPE. (HDPE)
- Y. Resin is more dense than water and is the most dense of the three that sink in water. (PETE)
- W. Resin is more dense than water, floats in calcium chloride solution, floats in the 1st test solution, and still floats in the 2nd test solution of calcium chloride. (PS)
- P. Resin is more dense than water, floats in calcium chloride solution, floats in the 1st test solution, and is more dense than PS. (PVC)

Student Activity Sheet - Find the Floaters and Sinkers

YOUR MISSION: You are working in a plastic recycling factory. The factory takes used plastic containers and chops them up into small pieces called “flake”. The flake is melted and made into pellets. These pellets or resins are used to make more plastic items like garbage cans, carpeting, and plastic lumber. Someone lost their data sheet on the identification of the pellets. You have volunteered to help identify the pellets.

MATERIALS: (for each group of students)

6 kinds of resins or pellets (2 pellets of each kind)
30 mL 70% isopropyl alcohol (blue)
30 mL of concentrated CaCl₂ solution (yellow)
30 mL of distilled water
3 small cups
Chemical splash goggles
3 craft sticks
Plastic pipets, spoons or droppers

PROCEDURE: *Use the flow chart to help you work with the plastic pellets.*

1. Put on your goggles. Take the 12 pellets (two of each kind of plastic resin) and place them in a small cup of water. Stir them with a craft stick to make sure no bubbles are adhering to the pellets. Observe the floaters and sinkers.
2. Scoop out the floaters and place them in 30 mL of blue alcohol solution in a small cup. Stir with a craft stick. Record your observations of the floaters. Notice their color and their behavior in water and alcohol.
3. Scoop out the floaters from the blue solution. Add squirts of water from a plastic pipet or add one half teaspoon of water into the blue solution containing sinkers. Stir with a craft stick, dropper, or pipet. Observe. Keep adding small amounts of water until you see some pellets float. Record your observations in the notes box at the bottom of the flow chart. You should now have notes on three kinds of pellets.
4. Go back to the water cup and take out the sinkers. Place all of them into the yellow calcium chloride solution. Observe. Record any notes about the pellets.
5. Using a pipet, add a squirt of water or add one-half teaspoon of water to the yellow solution. Stir with a craft stick. Observe the pellets. Add more water and stir. Continue adding water until pellets sink. Stop and record your observations.
6. Continue to add small amounts of water until more pellets sink. Stop and record your observations. At this time you should have notes on all six kinds of pellets.
7. Take out all pellets from the cups with a craft stick or spoon. Place the pellets in the containers provided by your teacher.
8. Pour the solutions into the color-coordinated containers as directed by your teacher.
9. Clean up your work area.

EVALUATION:

Complete your notes on the flow chart of your observations for the six pellets.

Sink or Float Flow Chart

