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Density of a Material

Recommended grades level(s) 11-12

Time Duration: - 50 minutes lessons

Objective(s):
Students will determine the density of a material.
The student will observe physical and chemical changes
The student will observe chemical and physical properties.
Students will apply methods of weighing by differences.

Materials and/or Resources:
Graduate cylinder
Balance (triple beam)
Stirring rod
Weighting paper
Teaspoon (plastic)
Large plastic cup
Small plastic cup
Sodium borate solution (4%)
Guar gum powder
Food coloring (optional)

Background Information:
Density is mass divided by volume.

Procedures:

1. Determine the mass of the large plastic cup. Record the mass in your table.

2. Add five drops of food coloring (same color, different colors, none – but no more than five drops).

3. Determine the mass of the large plastic cup plus food coloring. Record the mass in your table.

4. Add water to the third ring of the large plastic cup, using your graduated cylinder, read cylinder carefully and record volume in your chart.

5. Determine the mass of the water, cup and (optional) food coloring.

6. Determine the mass of the guar gum powder and record.

7. Determine the mass of the small plastic cup. Fill cup half full with sodium borate solution, using graduated cylinder to determine its volume.

8. Determine the mass of the cup plus the sodium borate solution and record the mass.

9. Slowly dissolve the guar gum powder into the water/food coloring solutions. Stir at all times. Add powder slowly. Break up any "chunks" prior to adding to the water solution. This solution should change to a higher viscosity, but still be quite fluid.

10. When all of the guar has been dissolved, add at once the sodium borate solution. Immediately stir. Continue to stir, observing any changes which may be occurring. Stir for approximately 3 minutes.

11. Scrape as much material off the stirring rod back into the cup. Determine the mass of the large cup plus the material and record.

Reproducible Materials:
Handout 1
Handout 2

Development Resources:
http://wwwteachers.net/lessons/posts/109.html

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Handout 1

Density of a Material
Data Table

Before mixing the water/food coloring solution with the sodium borate solution:

(1) Mass of large plastic cup, water, and food coloring _____
(2) Mass of large plastic cup plus food coloring _____
(3) Mass of large plastic cup _____
(4) Mass of weighing paper + guar gum _____
(5) Mass of weighing paper _____
(6) Mass of weighing guar gum _____
(7) Mass of sodium borate solution + cup: _____
(8) Mass of small plastic cup: _____
(9) Mass of sodium borate solution: _____
(10) Volume of water: _____
(11) Volume of sodium borate solution: _____
(12) Volume of water/ food coloring + sodium borate (add the previous two lines._____
(13) Mass of water + guar gum + food coloring (if used) + sodium borate solution _____

After mixing the water/food coloring solution with the sodium borate solution:

Divide the mass of the mixture (line 13) by the volume of the mixture (line 14) to determine the density of the material. Show the work here.

The density of my material is _____.

Handout 2

Questions:

1. Discuss the changes which occurred as you stirred the guar gum into the water.
   _____
   _____
   _____
   _____
   _____
2. Discuss the changes which occurred after the sodium borate was added to the water/guar mixture_____
   _____
3. What is density?_____
   _____
   _____
4. What chemical changes did you see occur?
   _____
   _____
   _____
5. Was there a chemical change involving the food coloring (did the solution remain the same color?)
   _____
   _____
   _____
   _____
   _____
6. What is a mixture?_____
   _____
   _____
   _____
   ____
7. Is the product a mixture? _____Why or why not?_____
   _____
   _____
   _____
8. Explain the process of weighing by difference._____
   _____
   _____
   _____

9. What physical properties seem to have changed (if any)?_____
_____
_____
_____

10. What is guar gum normally used for?_____
_____
_____
_____
_____