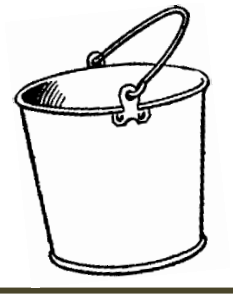
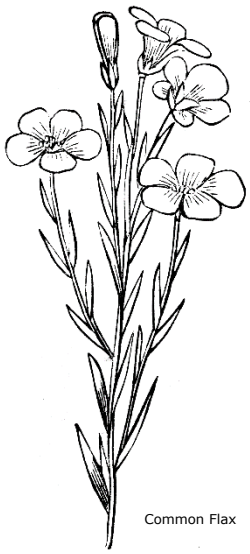


Old School Demonstrations: Liquid Flax

➢ Lesson Plan: Density Experiment

Background:

Density is the mass per unit volume (Mass/Volume) of a material. Simple stated… density is the amount of stuff (matter) in an object.



Common Flax

$$\textbf{Density} = {}^{\text{mass}}/_{\text{volume}} \ (d = {}^{m}/_{v})$$

Density can be a very confusing concept for students to understand, especially in reference to the following question, "Which weighs more, a ton of steel or a ton of feathers?" Many students will automatically answer a ton of steel before they even think about the question. To me this is good because the answer is based on their prior knowledge of density. They have an understanding that the steel is "heavy" and that feathers are "light."

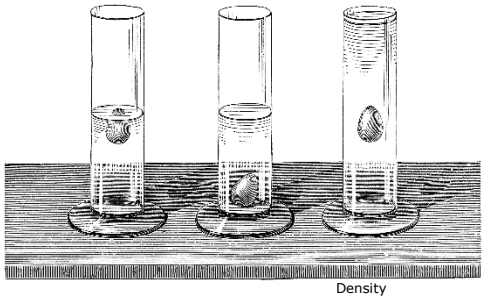
The students need to realize that many times the terms "heavy" and "light" are used inadvertently to describe density. Steel has a very high density resulting in a small amount of material needed to make a ton. The students have all lifted a small metal object and they experienced that the object was heavy. They have also lifted a feather and they know that it was very light. It would take many feathers to make a ton because feathers have a low density. The students need to make the distinction between heavy and high density and light and low density. Terms like heavy and light could be used to describe the weight of something, but not the density of the item. This small distinction makes a huge difference in the understanding of density.

I like to use the following simple demonstration to explain density. This is a demonstration that I keep handy when I am working with density and weight, because is very easy to understand and can be used as a reference to explain density problems/questions. The demonstration is shown in the accompanying Video Lesson. All you need for this demonstration is two baby food jars (one filled with nails) and a tub of water. Show the students the baby food jars; one is empty (filled with air) and the other is filled with nails. Ask the students if the two jars will float or sink. Most students will say that the one with air will float and that the one with nails will sink. The students can physically see that the jar with nails has more stuff (matter) in it resulting in a greater density. The density of the baby food jar with nails is greater than the density of water because it sinks. The density of water is 1 ${}^{\text{gram}}/_{\text{ml}}$; 1 ${}^{\text{gram}}/_{\text{cm cubed}}$. The density of the jar with air is less than the density of the water because the jar floats. Now take the empty jar and add water. Eventually the density of the jar including the air and the water will be greater than the density of the water in the tub, and then the jar will sink.

Liquid Flax Continue, page2

Materials:

- Ice-cream buckets (2)
- Beans and flax (non-milled)
- Balls (metal ball and Ping-Pong ball)
- Clear tub (water)
- Baby food jars (2 – one with nails)
- Objects to float (metal, wood, plastic, etc.)



Density

Procedure:

The Liquid Flax resource can be presented as a standalone class demonstration or it can be expanded into a class activity, depending on the amount of time available. I usually present this demonstration as a science magic trick. I announce that I will place a metal ball into a bucket of beans/flax and make it disappear. The demonstration is shown in the accompanying Video Lesson.

- Setup/Process
  1. Fill two ice-cream buckets ¾ full, one with pinto beans, one with non-milled flax.
  2. Place a Ping-Pong ball approximately 1-1½ inches below the surface of the beans/flax.
  3. Place the metal ball on the surface of the beans/flax.
  4. Cover the bucket and then shake. It usually works best to shake the bucket back and forth on a level surface.
  5. Compare the bucket to a tub of water. Show the students how the metal ball sinks in the water and how the Ping-Pong ball floats.
  6. A comparison can also be made to the baby food jars.

What to expect:

The metal ball will sink and the Ping-Pong ball will rise to the surface. The process can be shown to the kids with the cover of the bucket removed. It is impressive to see the metal ball sink and the Ping-Pong ball rise to the surface. The flax/beans act like a fluid when shaken. Air is introduced and friction is reduced as the material slides by itself. A similar occurrence occurs in a grain bin when an auger is engaged and the grain flows toward the center; see *Suffocation Hazards in Grain Bins* below.

This demonstration can easily be adapted into a class experiment. The students can set up an experiment in which they test the sink/rise rates of the balls in different mediums (corn, pinto beans, flax, soybeans, etc.)

Related Web Resource:

Suffocation Hazards Grain Bins (University of Arkansas)
http://www.uaex.edu/Other_Areas/publications/PDF/FSA-1010.pdf (Click)
PBS LearningMedia (More lessons and video from SDPB)