

DENSITY IN REAL LIFE

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Which of these is heavier—a metric ton of feathers or a metric ton of bricks? It's the old trick question, except that it might not be as much of a trick question as you think.

Both weigh the same (1 metric ton or 1,000 kg), but have different volumes. A metric ton of feathers will occupy a volume of almost 400 million cubic cm while a metric ton of bricks will occupy only one-half million cubic cm. This difference is due to density.

Density is a physical property of matter that describes how compact a substance is. You can think of it as a measure of how closely packed together the individual particles of a substance are. So going back to the example of bricks and feathers, the individual feather particles are less closely packed together (less dense) than the brick particles; hence, the bigger volume they occupy than the brick particles.



Which is heavier—a ton of bricks or a ton of feathers? The answer lies on density.

Different substances have different densities. Density itself can be affected by temperature. This means that some substances can expand or contract depending on



changes in the temperature and when they do, their density changes. So if a really accurate measurement of density is needed, the temperature at the time density was measured would also need to be taken.

Like many other things you are required to learn in school, you might be wondering why on earth you need to learn about density. Of what use would this be to you in real life?

Density is an important consideration in many professions. For example, an engineer needs to understand the concept of density if he is planning to build anything where weight and distribution of weight are critical. The building of ships and aircraft are two instances where density comes into play. Engineers must figure out at the very start of the design process how much weight they need and how much space they should allot for that kind of weight. In order to estimate the amount of space they need, they have to know the density of the materials they want to use.

Density is also important in the design of pipe systems. Engineers need to know the density of the fluid that needs to be moved through pipes from one point to another. Why? Because denser fluids are harder to move and will need more powerful pumps; less dense fluids, less powerful pumps.

The ketchup or mayonnaise in your kitchen got into their bottles by means of pumps. For that, engineers needed to know their densities.

These are just a few examples of how knowledge and understanding of density comes in useful in everyday life.

Fast Facts

- Density is the ratio of the mass of a substance to its volume. It is calculated by dividing the mass by the volume. ($D = M/V$) and is often expressed in units such as grams per cubic cm (g/cm^3) or pounds per cubic foot (lbs/ft^3).
- To measure the density of a solid object, weigh the object to determine its mass and then immerse it in a liquid to determine its volume. The volume of the liquid displaced by the object is equal to the object's volume. The mass divided by the volume is the object's density.

Sources

Density Applications. <<www.newton.dep.anl.gov/askasci/eng99/eng99421.htm>>
Liquid Density Applications. <<www.newton.dep.anl.gov/askasci/eng99/eng99161.htm>>

Three-layer Float

Materials Needed:

- oil
- cork
- coin
- water
- grape
- honey
- a tall, clear cup

Steps:

1. Fill a third of the cup with honey.
2. Fill the next third with oil.
3. Fill the last third with water.
4. Wait for all three substances to settle.
5. Carefully drop in the coin, then the grape and then the cork in that order.

Each of the three liquids has different densities and will make three separate layers. All three items (grape, coin, and cork) have different densities and will float in separate layers according to their density. The densest goes to the bottom and the least dense goes to the top.

Salty and Sweet

Floating Eggsperiment

Materials Needed:

- Raw egg
- Clear glass
- Salt

Steps:

Place a raw egg in a glass of water and observe. Then add lots of salt to the water and dissolve it. Place the same egg in the glass of salty water.

The egg is denser than fresh water and should sink. When placed in salty water, it should float because the egg is less dense than salt water. Salty water gives the egg more buoyancy. Ships in the ocean also ride higher in the salt water than in fresher river water when they come into port.

Is Diet Softdrink Really Light?

Materials Needed:

- Sink filled almost to the top with water
- A can of diet softdink
- A can of regular softdrink

Steps:

Put both cans of softdrink into the sink filled with water. Which one floats higher in the water than the other?

Because the regular softdrink contains a lot of sugar, it will probably sink. However, the sweetener in the Diet softdrink (possibly aspartane) is only in very small amounts because it has 200 times the sweetness of ordinary sugar. The Diet softdrink will float higher in the sink.