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Educational Innovations, Inc.®

Steel Sphere Density Kit

DEN-350

Great for teaching the skills of observation and deduction! Although these two shiny stainless steel spheres have nearly identical mass, one has a diameter of 3.49 cm, and the other a diameter of 12.7 cm. Seeing the large hollow one float in water seems unbelievable! Great for teaching that density depends on BOTH mass and volume.

NGSS Correlations

Our Steel Sphere Density Kit and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

2-PS1-1
Students can use the Steel Sphere Density Kit in an investigation to describe and classify different kinds of materials by their observable properties.

3-PS2-1
Students can use Steel Sphere Density Kit in an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

5-PS1-1
Students can use the Steel Sphere Density Kit in an investigation to develop a model to describe that matter is made of particles too small to be seen.

5-PS1-3
Students can make observations and measurements of the steel spheres to identify materials based on their properties.

Middle School

MS-PS1-1
Students can use the Steel Sphere Density Kit in an investigation to develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS2-2
Students can use the Steel Sphere Density Kit in an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

High School

HS-PS1-1
Students can use the Steel Sphere Density Kit in an investigation to predict properties of elements. Students can use the Periodic Table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS2-6
Students can use the steel spheres in an investigation to communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Suggested Science Idea(s)

2-PS1-1 • 2-PS1-2 • 5-PS1-1 • 5-PS1-3 • MS-PS1-1 • HS-PS1-1 • HS-PS2-6

Students can use the Steel Spheres Density Kit in an investigation to make sense of density and the forces that act upon them, specifically, buoyancy. Secondary students can do the math to determine the density of each sphere. Density is a fundamental property of matter. Density is defined as mass divided by unit volume, Buoyancy is the upward force experienced by a submerged object. The size of the buoyant force on an object submerged in any liquid is the same as the weight of the displaced liquid. The principle of buoyancy is called Archimedes' Principle.

53-PS2-1 • MS-PS2-2

Students can use Steel Spheres Density Kit in an investigation about density and buoyancy. Although both spheres have the same mass, effects of balanced and unbalanced forces on the motion of the spheres is quite different. An outstanding inquiry activity.

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Suggested Activities

Two Steel Spheres

How are they alike?
How are they different?
Which sphere floats in water?

Suggested Activities:

1. Ask students to observe the two spheres set on a table and predict which one is heavier and by how much. Ask one student to hold a sphere in each hand and estimate which one is heavier and by how much. *The common erroneous answer is that the smaller one is much heavier.* Follow this up by asking a blindfolded student to hold two small identical plastic containers, one in each hand. Place a sphere in each container and ask how the masses compare. *The common answer now is that they both weigh the same.* Discuss how we perceive the mass of an object.

2. Place the large sphere in a container of water. Students are amazed to see it float. What does this tell you about its density?

3. Math Problems:

a. If both spheres weigh about 150 grams, calculate the density of stainless steel. What assumption did you make?
b. Using the calculated density of stainless steel, calculate the thickness of the large sphere.
c. Knowing that the large sphere has a mass of about 150 g, calculate how much additional mass could be placed inside the sphere and still float.
d. In the last problem, if twice the calculated mass is added to the inside of the sphere, would the resulting object float or sink?
e. Calculate the mass of the large sphere if it were solid.

Answers:

a. 6.7 g/cm3 – Base the density on the small sphere, assuming that it is solid.
b. 1.1 mm
c. Less than 920 g
d. If placed inside, it sinks. If placed outside, it depends on the density of the additional mass, whether it is more or less dense than water.
e. 7,190 g or 7.19 kg

Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, "*Teachers Serving Teachers*" isn't just a slogan—it's our promise to you!

Please visit our website for more lesson ideas:

TeacherSource.com/lessons

Check our blog for classroom-tested teaching plans on dozens of topics:

http://blog.TeacherSource.com

To extend your lesson, consider these Educational Innovations products:

Density Sphere Experiment Kit (DEN-12)
This awesome kit is designed to permit students to discover and apply concepts of density and buoyancy. In this kit students make a density gradient from sugar or salt in a plastic column. Students then float five small spheres of different densities in the solution. Each sphere floats at a different level! By manipulating the density gradient, students can change the level at which the spheres float. Kit includes full instructions and write-up as well as spheres made of the following materials: polyethylene, polystyrene, nylon, acrylic, and cellulose acetate. Even unknown plastics are included for student density determination. Great for an elementary science table or as a terrific lab for middle school, high school, or college.

Poly Density Kit (DEN-460)
When the bottle is shaken, blue and white beads mix as expected. However, when allowed to settle, the beads separate, white at the top and blue at the bottom. Then, the two separated colored beads slowly come together in the center of the liquid. How often do you see something floating in the middle of the liquid? Great for illustrating so many concepts: solubility, density, miscibility, the salting out effect...

Pumice Samples (25 pack) (RM-315)
Your class will erupt with excitement as each student explores and observes the product of an actual volcano. Pumice is a lightweight igneous rock, formed when lava cools quickly above Earth's surface and traps gases before the molten material solidifies. As a result, it contains so many air holes that it floats in water! These are a naturally occurring item. Size and shape are dependent on availability and will vary.