Optional Activity

Teacher Notes on *Explain*: How Do You Calculate the Density of a Bowling Ball?

Purpose: To introduce another example of a plastic object that might sink or float in water. Students have the misconception that large objects are more dense than smaller ones. It is difficult for students to master the idea of density and that the mass and volume of an object must both be considered in order to predict its density. Bowling balls are large and heavy and excellent examples to study with the integration of mathematics for this module.

Time: one class period

Explanation of the mathematics involved:

Given these formulas and conversions: (Older students may not need these.)

Volume of a sphere: $V=4/3\ \pi\ r^3$	**$1\ cm^3 = 1$ mL for water**
Diameter = Circumference/π	**$1000\ cm^3 = 1$ Liter for water**
1 inch = 2.54 cm	**Density = mass/volume or g/cm^3**

Show the movie clip for measuring the mass of each bowling ball. Pause the movie and record.

This particular "16 pound ball" (16.1 lbs) has a mass of 7295 grams. (16 lbs = 7272 g)

This particular "12 pound ball" (11.7 lbs) has a mass of 5300 grams. (12 lbs = 5454 g)

Show the movie clip for measuring the circumference of the balls. Pause the movie and calculate.

Each ball is standard at 27 inches for the circumference. Convert this to cm.

27 in x (2.54 cm/in) = 68.6 cm for the circumference

Calculate the volume of the ball:

68.6 cm/π = 21.8 cm for the diameter

21.8 cm /2 = 10.9 cm for the radius

$V=4/3\ \pi\ r^3$ so $V= 4/3\ (3.14)\ (10.9)^3 = 5422\ cm^3$ for each ball since they are alike in volume.

Calculate the density of the two bowling balls:

16 pound ball: D=M/V or $D = 7295\ g/5422\ cm^3 = 1.34\ g/cm^3$ (a sinker)

12 pound ball: D=M/V or $D = 5300\ g/5422\ cm^3 = 0.98\ g/cm^3$ (a floater)

Look at the last clip of the movie to see the bowling balls tossed into a swimming pool. You will see that the 12 pound ball barely floats as predicted by the calculations of density while the 16 pound ball sinks in water. (Some "12 pound" balls will float but all 8 pound ones will float).

Student Activity Sheet **Name: _____**

Explain: How Do You Calculate the Density of a Bowling Ball?

Your Mission: You are to help settle an argument about bowling balls. Your two friends are arguing about whether bowling balls will float or sink in water. One thinks they will sink and the other thinks they will float. You are a clever person and know how to calculate density so that you can predict the floating or sinking of bowling balls in water.

Purpose: To introduce another example of an object that might sink or float in water.

Time: one class period

Given these formulas and conversions:

Volume of a sphere = _____	**1 cm^3 = __ mL for water**
Diameter = Circumference/ ____	**1000 cm^3 = __ Liter for water**
1 inch = _____ cm	**Density = ____/_____**

Calculations:

1. Watch the movie clip on measuring the mass of each bowling ball. Record the masses.
   The 16 pound ball as a mass of _____ grams.
   The 12 pound ball as a mass of _____ grams.

2. Watch the movie clip on measuring the circumference of the balls. Record and Calculate.
   Each ball is standard at ____ inches for the circumference. Convert this to cm. Show your work here:

3. Calculate the volume of a ball: Show your work here.

4. Calculate the density of the two bowling balls: Show your work.
   16 pound ball:

   12 pound ball:

   Predict: Do you have either bowling ball as a floater in water? _____

5. Watch the movie clip of the bowling balls in water. Were you correct? _____