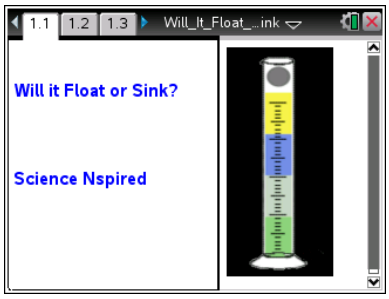
Science Objectives

- Students will calculate the density in g/mL given the mass of a liquid and its volume.
- Students will sort layers of liquids of different densities.
- Students will predict where a solid object of a given density will float in a density column.



Vocabulary

- density
- float
- liquid
- mass
- sink
- solid
- volume

TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Answer multiple choice questions

Tech Tips:

Make sure that students understand how to reset the animation by clicking .

Lesson Materials:

Student Activity

- Will_It_Float_or_Sink _Student.doc
- Will_It_Float_or_Sink _Student.pdf

TI-Nspire document

- Will_It_Float_or_Sink.tns

About the Lesson

- While students may associate flotation with a solid and a liquid (for example, ice floating on water), this lesson allows students to visually see the relationship between density of liquid solutions and the relative position of an object in the solutions based on its density.
- As a result, students will:
  - Understand how solutions will separate based on their densities.
  - Predict where a solid object will float within the given solutions based on its given mass and volume.

Using TI-Nspire™ Navigator™

- Send out the .tns file.
- Monitor student progress using Screen Shots.
- Use Live Presenter to spotlight student answers.

Activity Materials

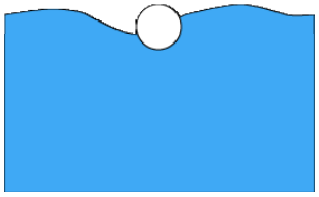
- *Will_It_Float_or_Sink.tns* document
- TI-Nspire™ Technology

Discussion Points and Possible Answers

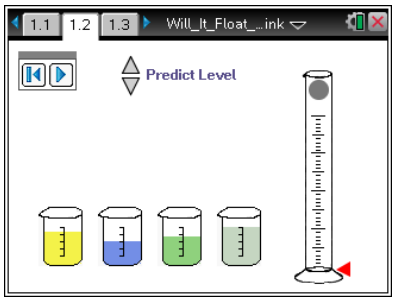
Have students read the background information on the student activity sheet. Review the concept of density with students.

$$Density = \frac{Mass}{Volume}$$

While students may normally associate flotation with a solid object floating in a liquid (e.g., ice floating in water), "flotation" also occurs with liquids.



Move to pages 1.2–1.3.



1. Students should move the cursor above each beaker to see the mass and volume data. As the cursor hovers over each beaker, students should record the data in the table below.
   a. IMPORTANT: If students click on the beaker, the liquid will be "poured" into the cylinder and they will have to reset the page to remove the liquid from the cylinder using . This also resets the data for all the liquids.
   b. Reinforce that when reset is pressed, the masses and volumes of ALL the liquids in the beakers change. They have to start over again.
   c. The page can be reset using the reset button on the screen or the delete button on the handheld.

Sample Data:

Container 1	Container 2	Container 3	Container 4
Mass: 45.23 g	Mass: 25.28 g	Mass: 85.12 g	Mass: 62.15 g
Volume: 30 mL	Volume: 20. 5 mL	Volume: 25 mL	Volume: 35.5 mL

2. Students should use the calculator page 1.3 or the Scratchpad to calculate the density of each solution.

   Guide students to use dimensional analysis if they cannot remember the formula for density. The units of g/mL are units of mass divided by volume.

Q1. What is the formula for calculating density? _____

Answer: $\text{density} = \frac{\text{mass}}{\text{volume}}$

Tech Tip: Students can press [calculator] to use Scratchpad instead of moving between pages 1.2 and 1.3 to perform calculations.

Sample Answers:

Container 1	Container 2	Container 3	Container 4
Density: __1.51 g/mL_	Density: __1.23 g/mL_	Density: __3.40 g/mL_	Density: __1.75 g/mL_

3. Once they have calculated all the densities, they should arrange them in order from greatest to least. Next the student should go back to page 1.2 and click on the solutions in the order they would be poured into the graduated cylinder—most dense first and least dense last.

   If the student is not successful, he/she will "win a Goat" and have to reset the page to start over.

4. The student will then hover over the solid ball to reveal the mass and volume.

   Sample Data:

   Mass: _____18.11 g_____ Volume: _____5.00 mL_____

5. Students can then return to page 1.3 or use Scratchpad to calculate the solid ball's density.

   Sample Calculation:

   Density of Solid Ball: _____3.63 g/mL_____

6. Students then predict on page 1.2 where the solid will settle in the column. Be sure students understand which buttons are "predict" and which are "reset/play."

7. Students click the play button [play] to test their predictions. If the prediction is incorrect, the student will have to reset the simulation and try again until they get a Gold Star.

   Tech Tip: If students have to reset because they incorrectly predicted where the ball will fall, they will start over again with new liquids.

TI-Nspire Navigator Opportunities

Use Screen Capture to monitor for "Goats" and "Gold Stars" as students progress through the simulation.

Move to pages 2.1–2.5.

Have students answer questions 2 – 6 on the handheld, the activity sheet, or both.

Q2. When poured into a graduated cylinder, the densest liquid will _____.

Answer: C. be the bottom layer

Q3. As the solid becomes denser, it is more likely to _____.

Answer: A. sink

Q4. Density is _____.

Answer: D. how closely packed the matter is

Q5. The density of glycerin is 1.26 g/mL. If the mass of glycerin doubles, increasing from 125 g to 250 g, the **volume** of the glycerin _____.

Answer: A. doubles

Q6. The density of glycerin is 1.26 g/mL. If the mass of glycerin doubles, increasing from 125 g to 250 g, the **density** of the glycerin _____.

Answer: C. is unchanged

TI-Nspire Navigator Opportunities

TI-Nspire Navigator can be used to make screen shots to follow student progress. A visual check can be made to see which students are successful and which are struggling.

Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved by TI-Nspire Navigator. The TI-Nspire Navigator Slide Show can be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test, inquiry project, performance assessment, or an application/elaborate activity.