



Science Objectives

- Students will calculate the density of liquids.
- Students will order the liquids in a graduated cylinder
- Students will predict at what level a solid object will float in the liquids.

Vocabulary

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

About the Lesson

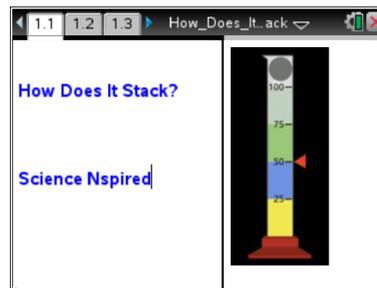
- This lesson allows students to visually see the relationship between density of solutions and the relative position of an object in the solutions based on its density.
- As a result, students will:
 - Understand how solutions will separate based on their densities.
 - Predict where a solid object will stop within the given solutions based on the known densities.

Using TI-Nspire™ Navigator™

- Send out the TI-Nspire document.
- Monitor student progress using Screen Shots.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



- **Tech Tips:** This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- How_Does_It_Stack_Student.doc
- How_Does_It_Stack_Student.pdf

TI-Nspire document

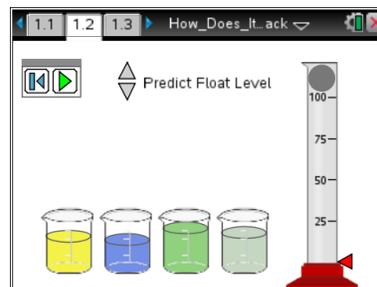
- How_Does_It_Stack.tns



Discussion Points and Possible Answers

Move to pages 1.2 – 1.3.

1. Students will hover over each beaker to obtain mass and volume data.
 - a. **IMPORTANT:** If students click/tap 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.



Tech Tip: The directions presented to students are slightly different on this platform. The mass and volume data is also displayed automatically.



Tech Tip: Selecting the  button will reset the simulation and ALL the masses and volumes of ALL the liquids in the beakers change. The students will basically have to start over again.



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

2. Students will use the calculator page 1.3 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 weight, so the formula is: $\text{density} = \frac{\text{mass}}{\text{volume}}$.
3. Next the student will 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. They are asked to record the order of the solutions—1 to 4 (most dense/bottom).** If the student is not successful, he/she will get a “Goat” and will have to reset the page to start over. Be sure they understand with each mistake, they will have to go back to step #1.
4. The student will then hover over the solid ball to get its mass and volume.
5. Students return to page 1.3 or use Scratchpad to calculate the solid ball’s density.
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  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 the questions on either the handheld, the activity sheet, or both.

Q1. When poured into a graduated cylinder, the most dense liquid will _____.

Answer: C. be the bottom layer

Q2. As the solid becomes denser, it is more likely to _____.

Answer: A. sink

Q3. Density is _____.

Answer: D. how closely packed the matter is

Q4. The density of glycerin is 1.26 g/mL. If the mass of glycerin in the graduated cylinder is increased from 125 g to 250. g, the **volume** of the glycerin _____.

Answer: A. doubles

Q5. The density of glycerin is 1.26 g/mL. If the mass of glycerin in the graduated cylinder is increased 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, collect the TI-Nspire document using the TI-Nspire Navigator System. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the TI-Nspire document. The questions will be graded when the document 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.