

The Jar That Sorts Things: Five Liquids, Four Objects

Learning target: I can record careful observations of liquids and objects settling into layers, and write a first explanation of what decides where each one stops.

Phenomenon exploration

About 25 min

Individual

MS-PS1-2 · practice

MS-PS1-1 · supports

discussion

writing

Name _____

Date _____

Period _____

Directions

Read the description of the demonstration and study the figure of the jar. Write what you notice before you try to explain anything; a good noticing is something anyone looking at the jar could check. Then record what you wonder, say what you already think, and write a first explanation. Your first explanation does not have to be right. It has to be yours, and it has to be something a test could prove wrong.

You will need: This worksheet, Pencil

The demonstration

Mr. Castillo sets a tall glass jar on the front table. One at a time he pours in five liquids: honey, green dish soap, water tinted red, vegetable oil, and rubbing alcohol tinted blue. He pours each one slowly down the inside of the glass. Then he drops in four small objects: a cork, a plastic bottle cap, a grape, and a steel bolt. The class watches for ten minutes. The liquids settle into five bands. Each object stops at a different level and stays there.

Five bands and four resting places

Blue rubbing alcohol: the cork floats on top of this band	top
Vegetable oil: the bottle cap rests on top of this band	
Red water	
Green dish soap	
Honey: the grape rests on top of this band; the steel bolt sits on the jar's bottom	bottom

The jar after ten minutes. Band thickness is not to scale. The objects are drawn where they came to rest.

Before class, Mr. Castillo had tried the demonstration twice with the same five liquids but poured in a different order each time. His notes are below. The order he poured changed. The order of the bands after ten minutes did not.

Mr. Castillo's practice runs (pouring order)

Run	Poured first	Poured second	Poured third	Poured fourth	Poured fifth	Band order after ten minutes, top to bottom
Run 1	honey	dish soap	water	oil	alcohol	alcohol, oil, water, soap, honey
Run 2	alcohol	honey	oil	dish soap	water	alcohol, oil, water, soap, honey

The four objects (measured on the classroom balance)

Object	Mass (g)	Where it stopped
Cork	2.0	top of the alcohol band
Plastic bottle cap	1.5	top of the oil band, under the alcohol
Grape	5.0	top of the honey band, under the soap
Steel bolt	12.0	bottom of the jar

Part A: Notice and wonder

1. Write at least four things you **notice** about the jar and the tables. Each one must be something another student could check by looking, not an explanation. Include at least one noticing about the liquids and one about the objects.
2. Write at least three things you **wonder**. Start each with 'Why', 'What if' or 'How'. At least one should be about Run 2 in the pouring table.

3. Look at the object table. List the four objects in order from least mass to most mass. Then list them in order from highest resting place to lowest. Are the two lists the same?

Part B: What do you already think?

4. Which statement is the best reason the steel bolt ended up on the bottom?
- ☐ A. It has the most mass of the four objects.
- ☐ B. Steel is denser than every one of the five liquids, so no liquid can hold it up.
- ☐ C. It was dropped in last, after the other objects had taken the higher spots.
- ☐ D. Metal objects always sink in any liquid.
5. The bottle cap (1.5 g) has less mass than the cork (2.0 g), yet the cap stopped **lower** than the cork. What does this tell you about using mass alone to predict where an object will stop?

Part C: Your first explanation

6. Write your first explanation of **two** things: (a) why the five liquids settled into the same order in both practice runs no matter how they were poured, and (b) what decides the level at which each object stops. Use the words *substance* and *property* at least once each.

7. Name one measurement you could make on each liquid, using only a balance and a measuring cup, that might predict its band position. Describe exactly what you would measure and compare.

8. Mr. Castillo now drops in a small piece of pencil eraser (rubber). Predict which band it will stop in or on, and give the reasoning behind your prediction. You do not have enough information to be sure; say what would make you more sure.

Noticing sentence starters

If you are stuck on Part A, use these frames and fill in the blanks from the figure and the tables: 'The ___ band is above the ___ band.' 'The ___ stopped on top of the ___.' 'In Run 2, ___ was poured first, but it ended up ___.' 'The object with the most mass is ___, and it stopped ___.' Each completed frame is one noticing.

Design a sixth band

Suppose Mr. Castillo wants to add a sixth liquid that would settle **between** the water and the dish soap. Describe what you would need to know about the new liquid before choosing it, how you would measure that with a balance and a graduated cylinder, and how you would test your prediction without taking the jar apart. Then explain why pouring the new liquid in last would still put it in the middle.