

Density: Orange Life Jacket

NOTE: Children should always be given ample time to experiment, notice, and wonder before they are provided an explanation.

Always engage children with our two favorite questions:

What do you notice? What do you wonder?

Resist the urge to answer any questions children have while exploring. Instead, respond back with questions to children and let them make sense of the world. Sample questions you might use: What do you think? Do you notice any patterns? What could we change? Can we test something else? What can we try next? If children ask a testable question, which they could answer by doing an experiment, talk through with them how they might design a test to help answer their question. As much as possible and within reason, let them actually test their questions by trying the experiments they propose.

Vocabulary (See **What the heck? Explanation of Science** at the end for definitions.)

Density	Gas	Buoyancy
Mass	Liquid	Weight
Volume	Sink	Gravity
Fluid	Float	Force

Learning Objectives

Children will...

- learn about density.
- learn the rule for how density determines if an object will sink or float.

Materials

An orange	Large clear bowl	Water
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Key Question

Does the peel of an orange affect whether it will sink or float?

Notice and Wonder Developmentally Appropriate Practice

If you drop an orange in the water will it float?

1. Fill the large clear bowl with enough water to completely cover the orange.
2. Ask children to predict if the orange will sink or float.
3. Give children ample time to either draw or write down their prediction.
4. Gently place an unpeeled orange into the water.
5. Let children observe what happens and draw a picture or write down in words what they observe.
6. Take the orange out of the water and peel the orange.
7. Ask the children to predict if the peeled orange will now sink or float.
8. Give children ample time to either draw or write down their prediction.
9. Gently place the peeled orange in the water.
10. Let children observe what happens and draw a picture or write down in words what they observe.
11. Help students use the rule to explain what they observed. The unpeeled orange was less dense than the water, so it floated. The peeled orange was more dense than the water, so it sank.

Extensions for Additional Learning

Try this with other fruits. Does it work with a lemon? A grapefruit? An apple? Etc.

References

Adapted from an experiment described in *The 101 Coolest Simple Science Experiments: Awesome Things To Do With Your Parents, Babysitters and Other Adults* by Rachel Miller, Holly Homer, and Jamie Harrington

AZ Early Learning Standards

Science Standard - Strand 1: Inquiry & Application - Concept 1: Exploration, Observation & Hypotheses

The child observes, explore, and interacts with materials, others, and the environment.

Science Standard - Strand 1: Inquiry & Application - Concept 2: Investigation

The child researches their own predictions and the ideas of others through active exploration and experimentation.

Density: Orange Life Jacket

What the heck? **Explanation of the Science** (Vocabulary in bold.)

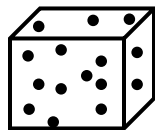
These phenomena can all be explained using density. What is density? Technically, **density** is the ratio of an object's **mass** to its **volume**. **Mass** is the amount of matter in an object. **Volume** is the size of the object.

IMPORTANT NOTE: Mass is not the same thing as the weight of an object. **Weight** is the **force** (pull) due to **gravity** on an object. For example, your mass (the amount of matter you are made up of) would not change if you were standing on the Moon's surface. However, your weight would change (it would be less) because the strength of gravity on the Moon is less than the strength of gravity on Earth. It should also be noted that the weight of an object does not determine whether it sinks or floats in a fluid. **Fluid** is a term used to describe either a gas or a liquid. So, air (a **gas**) is a fluid and water (a **liquid**) is a fluid. The density of an object compared to the density of the fluid it is in determines whether it will sink or float. More on this below.

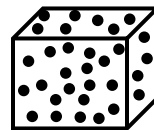
In equation form: $density (\rho) = \frac{mass (m)}{volume (V)}$

Density is a measure of how much matter is packed into an object. You cannot easily compare the density of two **solid** objects unless they are both the same mass or both the same volume (size).

Two solid objects with the same volume but different masses.



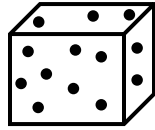
Less Dense



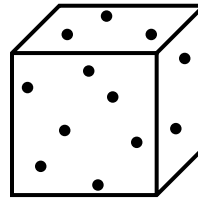
More Dense

If two solid objects are the same size, as shown above, then the one with less mass is less dense. The object with more mass packed into the same volume is more dense. The more matter packed into a certain volume or object, the greater its density. If it has less matter packed into a certain volume, then it is less dense.

Two solid objects with the same mass but different volumes.



More Dense



Less Dense

If two solid objects have the same mass, as shown above, then the one with a smaller volume is more dense. The object with the same amount of matter spread throughout a larger volume is less dense. If an amount of mass is packed into a smaller volume, the density is greater than the same mass packed into a larger volume.

So, what determines if a solid object will **sink** (fall to the bottom) or **float** (rise to the top) of a fluid?

Here is the rule:

A solid object will **SINK** if it is MORE DENSE than the fluid it is in.

A solid object will **FLOAT** if it is LESS DENSE than the fluid it is in.

Video Lesson: <https://bit.ly/SciShowKidsSinkFloat>

NOTE: An object DOES NOT sink or float because it is lighter or heavier. The weight of an object DOES NOT determine if it will sink or float. The object's density compared to the fluid it is in, as noted in the rule above, is what determines if it will sink or float. Just because an object is heavy, or weighs a lot, does not mean it will sink. Think about a big ship, which weighs a lot, and still floats. It floats because it is less dense than the water it is in. Just because an object is light, or weighs a small amount, does not mean it will float. Think about a small pebble, which weighs just a little, but will sink when placed in water. The small pebble sinks because it is more dense than the water. **PLEASE be careful to reference density and not weight when describing why something sinks or floats.**

What the heck? Explanation of Orange Life Jacket

An unpeeled orange will float because it is less dense than water. A peeled orange will sink because, without its peel, it is more dense than water. The peel of the orange is not very dense (loosely packed mass in a larger volume or space). The pulpy part of the peel is squishy which generally indicates there are air pockets within peel. These air pockets in the peel make it less dense than the inside part of the orange, which is mostly water in the form of juice. The peel actually acts like a life jacket. Just like when a person puts on a life jacket to help them float, the peel of the orange ensures it is less dense than the water so it will float. The orange has an orange life jacket!

After you are done with the initial experiment, you might let the children test just a piece of the peel by itself and then a slice of orange by itself. The piece of peel should still float while the piece of orange should still sink. If you take the pulpy part of the peel off



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the very outside part, you may be able to get a piece of the peel to sink. Remember, the weight of an object does not determine if it will sink or float. The density of an object determines if it will sink or float. So even though the very outside orange part of the peel without the pulpy white part might be very light, it will sink if it is more dense than the water.