**Lesson 7 – Activity Sheet Answers**

**Part 1**

**Demonstration 1: Comparing the mass of a candle and a piece of clay**

**Your teacher compared the mass of a wax candle and a piece of clay. The candle was heavier than the clay, but the candle floated, and the clay sank.**

**Use information from the next two demonstrations to explain why the candle floats and the clay sinks.**

**Demonstration 2: Comparing the mass of wax to the mass of an equal volume of water**

A cartoon of a hand pouring liquid into a blue object

Description automatically generatedYour teacher compared the mass of a wax candle to the mass of an equal volume of water.

1. **Which weighs more, wax or an equal volume of water?**

Water weighs more than an equal volume of wax.

1. **Which is more dense, wax or water? Explain:**

Water is more dense than wax. Density is mass per unit volume. If you weigh the same volume of two substances, the one that has more mass must be more dense. The water had more mass than an equal volume of wax, so water is more dense than wax.

**Demonstration 3: Comparing the mass of clay to the mass of an equal volume of water**

Your teacher compared the mass of clay to the mass of an equal volume of water.

1. **Which weighs more, clay or an equal volume of water?**

Clay weighs more than an equal volume of water.

1. **Which is more dense, clay or water? Explain:**

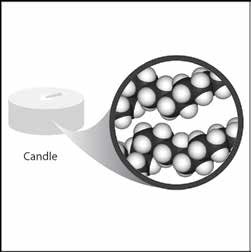
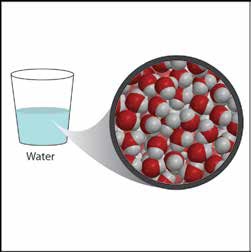
Clay is more dense than water. Density is mass per unit volume. If you weigh the same volume of two substances, the one that has more mass must be more dense. The clay had more mass than an equal volume of water, so clay is more dense than water.

1. **After seeing the demonstrations, how does density explain why wax floats on water and clay sinks in water?**

Even though the wax weighs more than the clay, the key thing is the density of wax compared to the density of water and the density of clay compared to the density of water. Since wax is less dense than water, the wax floats. Since clay is more dense than water, the clay sinks.

***EXPLAIN IT WITH ATOMS & MOLECULES***

1. **Water is made up of small molecules containing oxygen and hydrogen atoms. Water molecules are closely packed together. Wax is made of carbon and hydrogen atoms connected together in long chains. Explain on the molecular level why water is more dense than wax.**



Wax is less dense than water because it is composed of carbon and hydrogen atoms, while water is composed of oxygen and hydrogen atoms. Oxygen atoms are heavier and smaller than carbon atoms. Also, the molecules of water pack together more tightly than the molecules that make up wax. This makes wax less dense than water.

1. A close-up of a model of clay

   Description automatically generated**Clay is made of oxygen and heavier atoms such as silicon and aluminum. Explain on the molecular level why clay is more dense than water.**

Clay is more dense than water because it is composed of atoms like silicon and aluminum that have more mass than the oxygen and hydrogen atoms in water. These heavy atoms give clay more mass per unit volume, which means it is more dense than water.

***TAKE IT FURTHER***

1. **A giant log can float on a lake while a tiny grain of sand sinks to the bottom. Explain why a heavy object like the log floats while a very light grain of sand sinks.**

A log can float on water because it is lighter than an equal volume of water which means it is less dense than water.

A tiny grain of sand sinks because it is heavier than an equal volume of water which means it is more dense than water.

1. **Remember that the density of water is 1 g/cm3. Predict whether the following objects will sink or float.**

|  |  |  |
| --- | --- | --- |
| **Will these objects sink or float?** | | |
| Object | Density (g/cm3) | Sink or float |
| Cork | 0.2–0.3 | Float |
| Anchor | 7.8 | Sink |
| Wooden oar | 0.4 | Float |
| Apple | 0.9 | Float |
| Orange with peel | 0.84 | Float |
| Orange without peel | 1.16 | Sink |

1. **What can you say about the density of an orange peel?**

The density of the orange peel must be less than 1 g/cm3. In fact, it must be enough below 1 g/cm3 that it makes the density of the entire orange less than 1 g/cm3.

**How is the orange peel like a life jacket for the orange?**

A life jacket must have a low enough density so that it can make a person plus the life jacket float.

1. **If a peach has a volume of 130 cm3 and sinks in water, what can you say about its mass?**

If a peach has a volume of 130 cm3 and sinks in water, then its mass must be greater than 130 grams.

1. **If a banana has a mass of 150 grams and floats in water, what can you say about its volume?**

If a banana has a mass of 150 grams and floats in water, then its volume must be greater than 150 cm3.

**Part 2**

***DEMONSTRATION***

1. **Your teacher showed you one candle floating in water and another identical candle sinking in alcohol.**

**A couple of clear plastic cups with a candle in them

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**Do water and alcohol have the same or different densities?**

Alcohol and water do not have the same density.

**Which liquid is more dense?**

The water is more dense.

**How do you know?**

We know that water is more dense than alcohol because the candle floats in water, but sinks in alcohol. Because the candles are identical, the water must be more dense than the candle and the alcohol must be less dense than the candle.

1. **A cartoon of a scale with two cups of liquid

   Description automatically generatedYour teacher placed equal volumes of water and alcohol on a balance.**

**Explain how this demonstration proves that water is more dense than alcohol. Be sure to mention both volume and mass.**

When equal volumes of water and alcohol are placed on a balance, the water is heavier. This must mean that water is more dense. According to D=m/v, if the volume of the two samples is the same, the sample with the greater mass must be more dense.

**Part 3**

**Activity – Does a Carrot Sink or Float?**

* 1. **Is the carrot more or less dense than the fresh water?**

The carrot is more dense than fresh water because it sinks in fresh water.

A hand pouring a glass of water

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* 1. **Is the carrot more or less dense than saltwater?**

The carrot is less dense than saltwater because it floats in saltwater.

* 1. **Does adding salt change the density of the water? How do you know?**

Yes, adding salt made the water more dense. We know because after adding the salt, the carrot which had sunk in fresh water, began to float.

* 1. **What would you expect if you placed equal volumes of water and saltwater on opposite ends of a balance?**

If you placed equal volumes of water and saltwater on opposite ends of a balance, the saltwater would be heavier because it is more dense.

* 1. **Adding salt to water increases both its mass and volume; which do you think it increases more, the mass of the water or the volume? Explain Why.**

Adding salt to water increases the mass more than the volume, which makes the water more dense. This must be true. If it were the other way around, and adding salt increased the volume more than the mass, the water would actually have become less dense when the salt was added, and the carrot would have remained at the bottom of the cup.

***TAKE IT FURTHER***

**Even though a carrot slice normally sinks in water, you made it float by adding mass to the water and increasing the water’s density. Does the mass of anything change in the Lava Lamp?**

No, the mass of everything in the Lava Lamp stays the same. It is a completely closed system.