Chp 2: Lect 3 Density: Student Copy

2 ec pts printing

1.What is density? 2. How do you measure density?

Eureka!!! Density: Take notes:

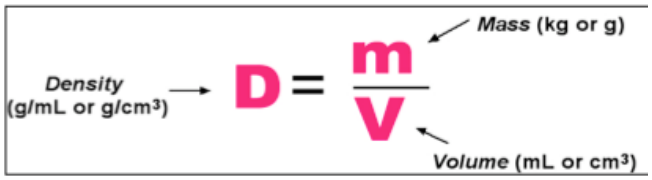
_____

_____

_____

What is density?

Think about the many kinds of matter you come into contact with every day. Wood, cement, aluminum, plastic, foam, liquids, steel, etc. In solids, we have huge differences. A block of steel and a block of aluminum may be the same size, but one has a lot more mass than the other. Density describes how much _____ is in a given _____ of a material. Steel has a high density; 7.8 grams of mass per cubic centimeter. Aluminum has a lower density; 2.7 grams/ cm^3. Liquids & gases are matter & have density too.



Measuring Density

The more matter you place into a defined volume, the _____ it becomes. For example, New York City is DENSELY populated because there are a lot of people in a small area. 20 people in an elevator is DENSER than 2 people in an elevator. Notice our units…cm^3

Which one is denser?

If each box has the same volume, and each ball has the same mass, which box would weigh more? Why? Which weighs more? 100 pounds of lead or 100 pounds of feathers?

Lead and Feathers

Although 100 pounds of feathers may take up much more room than 100 pounds of lead, they both still weigh _____ The steel is heavier for its size, due to the fact that it is denser!!!

Thus, a material such as feathers takes up much more room (volume) than a denser material such as steel, for the same mass or weight.

Density of Common Materials

Density is a property of materials - independent of shape or quantity. For example, a steel nail and a steel cube have different amounts of matter and therefore different masses. They also have different volumes. However, if you calculate density by dividing mass by volume, the result is the same for both the nail and the cube. Solids that are _____, such as steel, typically have _____ density. High density means there are many atoms per cubic centimeter. _____materials typically have _____ density. Solids with low density, such as cork or foam, are often used as cushioning material. Low density means there are relatively large spaces between atoms.

Why does density vary? The density of a material depends on two things:

1. the _____of each atom or molecule 2. on _____the atoms are packed

A diamond is made of carbon atoms and has a density of 3,500 kg/m3. The carbon atoms in diamonds are closely packed.

Why does density vary?

Paraffin wax is mostly carbon, but the density of paraffin is only 870 kg/m3. The density of paraffin is low because the carbon atoms are mixed with hydrogen atoms in long molecules that take up a lot of space.

Calculating Density Problems: Follow the video as we do them

Here are 3 density problems to do… 1.A student determines the density of manganese to be 5.54 g/cm^3. If a sample had a mass of 3.43g what was the volume?	
2. A cube 5.7cm on a side has a mass of 630 g. Find the Density!	
3. The density of a gas is 0.0043 g/cm3. Find the mass of 280 cm^3 of this gas.	

Object	Method	You Try It!
Cube or Rectangular Prism	**1. Find mass** • Use a _____ • Units: _____or kg **2. Find volume** • Use a ruler • Measure all 3 _____: length, width, height • Units: _____, m^3, km^3 • Use this equation: Volume = length x width x height V = l x w x h **3. Density = mass / volume** • Units: _____	**Wood Block**
Cylinder	**1. Find mass** **2. Find volume** • Use a ruler • Measure the height & _____ • Divide the diameter in half to find the _____ • Units: cm^3, m^3, km^3 • Use this equation: Volume of a cylinder = 3.14 x radius^2 x height V = $\pi r^2 h$ **3. Density = mass / volume** • Units: g/cm^3	**Wood Cylinder**
Irregular Object	**1. Find mass** **2. Find volume** • _____method o Fill a graduated cylinder with water. o Drop the object in without splashing water. o Calculate the change in volume! • Units: _____, L **3. Density = mass / volume** • Units: _____	**Two Plastic Bears**

Finding Density Video

Density = _____/volume How _____ something is.

Volume = amount of _____ something takes up = L x W x H **OR** if we can't do that we can use the displacement or _____ method. It is measured in milliliters (mL) or cm^3

Mass = how much _____ something is made of , and it is measured in grams (g)

Write down the notes from calculating the <u>rectangular objects:</u>

Measuring for volume**:** **L** = _____ **W** = _____ **H** = _____ **Volume** = _____

Density = g/ml = _____/ _____= _____g/ml

Rock: mass = _____**divided by volume=** _____**ml**__(using the displacement method) _____= ___ml

Density = _____ g / _____mL Density of the rock = _____g/ml

Which density is more- the rectangle or the rock? _____

Which would you hypothesize would float & why?? _____

Buoyancy & Density Lect 4: What is buoyancy? What is the relationship between density & buoyancy?

California Content Standards #8. **Density and Buoyancy:** All objects experience a buoyant force when immersed in a fluid.
a. Students know density is mass per unit volume.
b. Students know how to calculate the density of substances (regular and irregular solids and liquids) from measurements of mass and volume.
c. Students know the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced.
d. Students know how to predict whether an object will float or sink.

Video: Eureka!!! Buoyancy! Take notes: _____

_____

_____

_____

Will it float or sink?
The largest ship in the world is the Jahre Viking, an oil-carrying tanker. This super-sized ship is 1,504 feet long and 264 feet wide, longer than 5 football fields laid end-to-end. If the Empire State building was laid on its side, the Jahre Viking would be longer by 253 feet! Crew members use bicycles to get from place to place on the ship. The Jahre Viking is largely constructed of steel, so how can a big, heavy ship like this actually float?

Soda Experiment:

Let's look at something we're more familiar with….Soda!
Write down 2 similarities between these two cans. _____
Write down 2 differences._____
Predict what happens when a can of regular coke and a can of diet coke are placed into tap water.
Hypothesis:_____
What did you see? _____
_____
What happened and why? _____
_____
More "stuff" (matter) is crammed into the same amount of space, or VOLUME, and that increases the MASS. The relationship of Mass to Volume is Density.

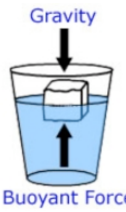
Video: Density & Buoyancy! Take notes: _____

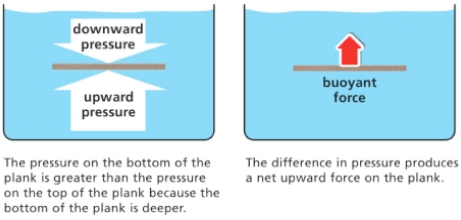
_____

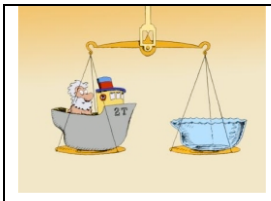
_____

Buoyant Force

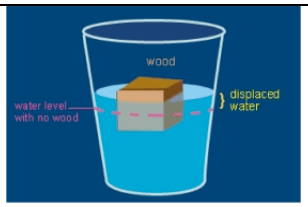
Why do ice cubes float in water? Even though gravity forces an ice cube down, water exerts an upward force on the ice. This upward force is called buoyancy. All objects submersed a fluid, whether it be a liquid or gas, experience this buoyant force. The buoyant force exists because of pressure differences in fluids. In any fluid, the greater the depth, the greater the pressure. In the 2nd picture, a thin plank of wood has been pushed underwater.





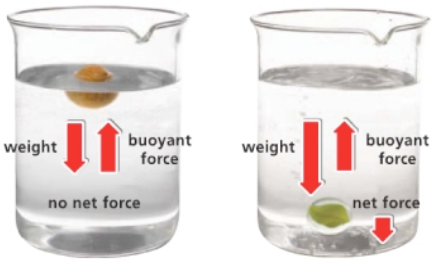


Archimedes' Principle: More than 2000 years ago, a Greek scientist named Archimedes created a law about buoyancy. The Archimedes' Principle states that the buoyant force on an object in a fluid is equal to the weight of the displaced fluid. Example: Suppose a block displaces 250 mL of water. 250 mL of water weighs about 2.5 N. According to the principle, the buoyant force (pushing upwards) on the block is 2.5 N.



Floating & Sinking

An object will float in a fluid if the buoyant force is equal or greater than the object's weight. A cork floats because the weight is less than the buoyant force.
An object sinks if the object's weight is greater than the buoyant force.
A marble sinks because its weight is more than the buoyant force.
The Magic Ice Cube
Trial 1: Ice Cube in water
Trial 2: Watch as I place a second ice cube in another beaker
What happened? _____
_____



BUOYANCY

1 What is the name of the force that keeps you afloat?

A Buoyancy
B Electromagnetism
C Density

2 What is an object's buoyancy if it floats in water?

A Negative
B Neutral
C Positive

3 What is an object's buoyancy if it sinks in water?

A Negative
B Neutral
C Positive

4 If an object neither sinks nor floats in water, what is its buoyancy?

A Negative
B Neutral
C Positive

5 Which one of these has neutral buoyancy?

A A boat
B A fish
C A rock

6 What determines whether an object will float or sink?

A Its size
B Its volume, relative to the mass of the liquid it's in
C Its density, relative to the density of the liquid it's in

7 If you drop a cube in a bucket of water, the amount the water level rises is equal to:

A The volume of water displaced by the cube
B The mass of the cube
C The weight of the water

8 Compared with the molecules within a freshwater lake, the molecules of a heavy stone are:

A Farther apart
B Closer together
C Equally close together

9 How do you calculate an object's density?

A Break it in half
B Divide its weight by its height
C Divide its mass by its volume

10 Which of these is densest?

A A sheet of paper
B A brick
C A cloud of nitrogen

Density Problems

You can also rearrange the formulas as:

Density: D= m/v (mass / volume) **Mass: m= D x V** **Volume: V = m/D**

1. Find the density of a substance with a mass of 5kg and a volume of 43 m^3	2. Suppose you have a lead ball with a mass of 454g. What is its volume? (density of lead is: 11.35 g/cm^3)
3. What is the mass of a 15mL sample of mercury? (density of mercury is: 13.55 g/cm^3)	4. A block of pine wood has a mass of 120g and a volume of 300 cm^3. What is the density of wood?