

## Mass, Volume, & Density

*A little review with something new*



## Let's start at the beginning...

- All objects are made of matter.
- **Matter** is anything that has mass and takes up space.

## **Matter** is not...

Which of these is *not* matter?

- Air
- Your body
- Sound
- Table

## **Matter** is not...

- Air
- Your body
- Sound**
- Table

## Matter & Mass

- Different objects contain different amounts of matter.



- **Mass** is how much matter an object contains.



## More about *Mass*

- The standard unit of mass is the *kilogram* (kg) or *gram* (g).



A penny has a mass of 2-3 grams.

## How we measure *mass*

- The instrument we use to measure mass is called a **balance**.
- We will use triple beam balances and electronic balances in this class.



## Weight a minute!

- **Weight** is the downward pull on an object due to gravity.
- The standard unit for weight is the *Newton* (N).

## Mass and Weight

Challenge question 1:

On the moon, gravity is 1/6 as strong as it is on Earth. How would your **weight** be different on the moon?



- It would be less on the moon.
- It would be more on the moon.
- It would be the same on the moon.



## Mass and Weight...

Your weight...

- It would be less on the moon.
- It would be more on the moon.
- It would be the same on the moon.

## Mass and Weight again

Challenge question 2:

On the moon, gravity is 1/6 as strong as it is on Earth. How would your **mass** be different on the moon?



- It would be less on the moon.
- It would be more on the moon.
- It would be the same on the moon.



## Mass and Weight...

Your mass...

- a. It would be less on the moon.
- b. It would be more on the moon.
- c. It would be the same on the moon.

## What about volume?

▪The amount of space that matter in an object takes up is called volume.

These two objects have the same volume.



## Measuring volume

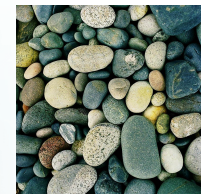
To find the volume of a “regularly” shaped object, like this brick, you use the formula:

$$V = L \times W \times H$$



What if the object is not easy to measure?

To find the volume of an “irregularly” shaped object, like these rocks, you use the displacement method.





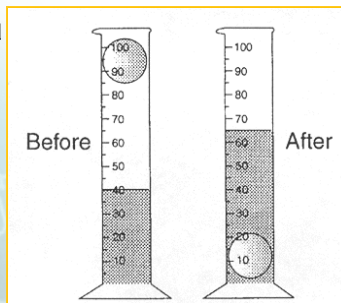
## Eureka!

- Back in 287-212 B.C., a mathematician named Archimedes made a discovery!
- He figured out that when he got in a bathtub, the water level rose because his body took up space.



## Apply it to *volume*...

- We can use this method called **displacement** to find the volume of irregular objects.
- We use a graduated cylinder and read the volumes before and after the object goes in.
- The difference is the object's **volume**.

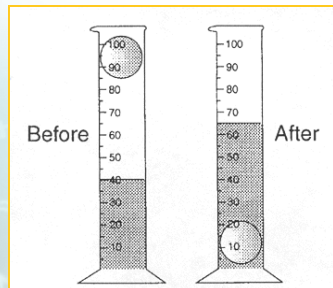


## What's the *volume*?

Challenge question #3:

What is volume of the ball if the beginning level of water is 40 ml and the ending level of water is 65 ml?

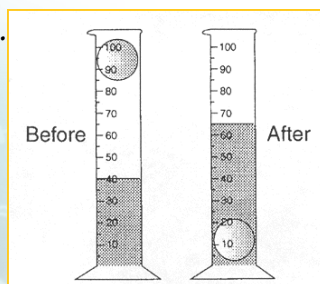
- a. 25 ml
- b. 40 ml
- c. 65 ml
- d. 105 ml



## The *volume* is...

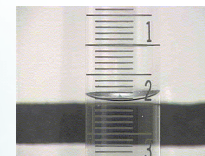
The volume of the ball is..

- a. **25 ml**
- b. 40 ml
- c. 65 ml
- d. 105 ml



## Bonus Question

When you read the level of water in a graduated cylinder, you should read it from the curve at the bottom. What is this curve called?



## Density

- **Density** is the amount of mass in a certain volume.
- $D = M / V$
- The units for density always have two parts:
  - a mass part (kg or g)
  - and
  - a volume part (ml or  $\text{cm}^3$ )

## The Density of Water

- The density of water is  $1.0 \text{ g/cm}^3$  or  $1.0 \text{ g/ml}$
- Objects with a density LESS than 1 will float on water.
- Objects with a density GREATER than 1 will sink in water.

