

## The ABC's of Science

Day 2: Intro to Physical Science

Metric System:  
Temperature  
Volume  
Mass



And now....

## Temperature...

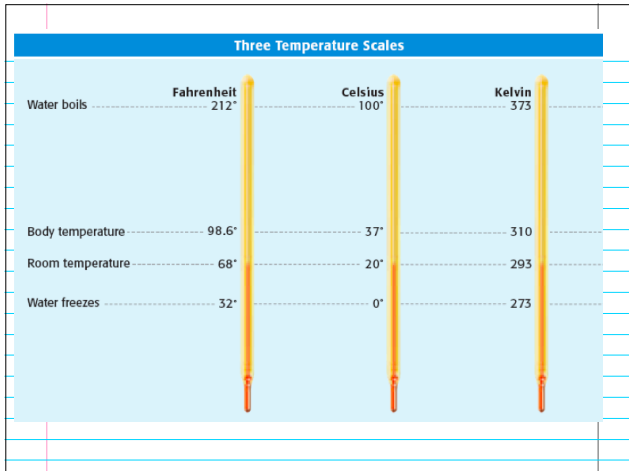
### 3. Eureka! Temperature



### Temperature

- In science, temperature is mainly measured using the Celsius temperature scale.
- The temperature scale is based on the freezing and boiling points of water.
- The freezing point of water is 0° C.
- The boiling point of water is 100° C.
- Human body temp is about 37° C.





## Measuring Temperature: You Try It!

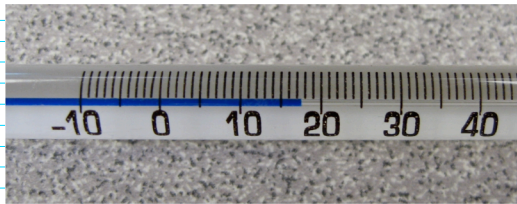
1. What is the temperature recorded by the thermometer?



Answer: 32 °C

## Measuring Temperature: You Try It!

2. What is the temperature recorded by the thermometer?



Answer: 17.5 °C

## Measuring Temperature: You Try It!

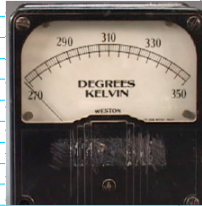
3. What is the temperature recorded by the thermometer?



Answer: 21 °C

## Measuring Temperature

- In the International System (SI), temperature is measured in Kelvin.
- The kelvin scale is based on absolute zero, the coldest possible temperature.
- This temperature corresponds to  $-273^{\circ}\text{C}$ 
  - $0^{\circ}\text{C} = 273\text{ K}$
  - $100^{\circ}\text{C} = 373\text{ K}$



And now....

Volume...

## 4. How to measure Volume

Measuring  
a volume

Musical Math DVD  
Peter Weatherall  
[www.kidsinglish.com](http://www.kidsinglish.com)  
[info@kidsinglish.com](mailto:info@kidsinglish.com)

150  
100  
50ml

## Volume

- Have you ever heard someone say "this shampoo gives my hair a lot of volume!!!"
- What does that mean?
- Volume means to **take up space**.
- Or, volume is the amount of space occupied by an object
- So if someone's hair has a lot of volume, that means it occupies a lot of space.



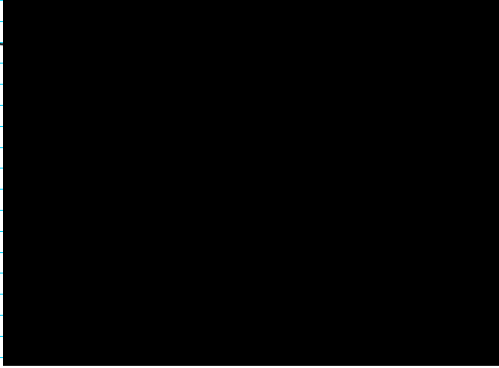
Volume



cubic meter ( $\text{m}^3$ )  
cubic centimeter ( $\text{cm}^3$ )  
liter (L)  
milliliter (mL)

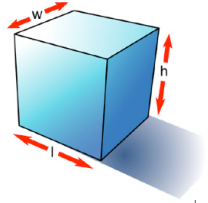
$1\text{ cm}^3 = 0.000001\text{ m}^3$   
 $1\text{ L} = 1\text{ dm}^3 = 0.001\text{ m}^3$   
 $1\text{ mL} = 0.001\text{ L} = 1\text{ cm}^3$

## 5. Volume of Rectangular Objects



## Volume of Solid Rectangular Objects

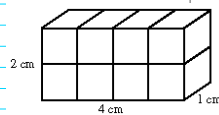
- For solid rectangular objects, the volume is the length x width x height.
- $V = l \times w \times h$
- A cubic meter ( $m^3$ ) is a unit of volume.
- A cubic meter is a very large unit - it contains 1,000,000 cubic centimeters.



## You try it! Volume of Solid Rectangular Objects

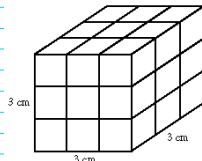
4. What is the volume of this solid?

- $V = l \times w \times h$
- $V = 4\text{ cm} \times 1\text{ cm} \times 2\text{ cm}$
- $V = 8\text{ cm}^3$

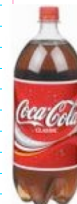
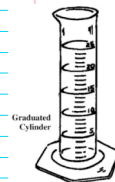


5. What is the volume of this solid?

- $V = 3\text{ cm} \times 3\text{ cm} \times 3\text{ cm}$
- $V = 27\text{ cm}^3$



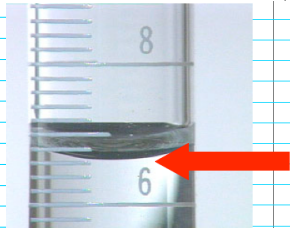
## Volume of Liquids



- For liquid objects, we use **graduated cylinders** to measure the volume.
- In cooking, we may also use measuring cups, teaspoons or tablespoons.
- The level of a liquid in a graduated cylinder shows the volume of the liquid.
- A **liter** (L) is that is usually used to express volume
- A soft drink bottle is a 2-liter bottle.
- For smaller volumes, we use:
  - milliliter (ml)
  - cubic centimeter ( $\text{cm}^3$ ).
- 1 liter contains 1000 milliliters or 1000 cubic centimeters.

## Accuracy is Everything

- To read the volume of the liquid, note the level at the **bottom** of the curve.
- We call this the **meniscus**.



## You try it!

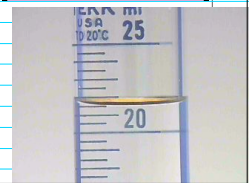
9. What is the volume in ml?

73 ml

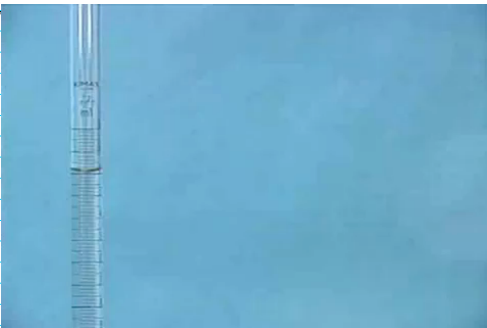


10. What is the volume in ml?

21.5 ml

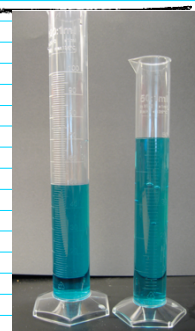


## 6. Reading the Meniscus



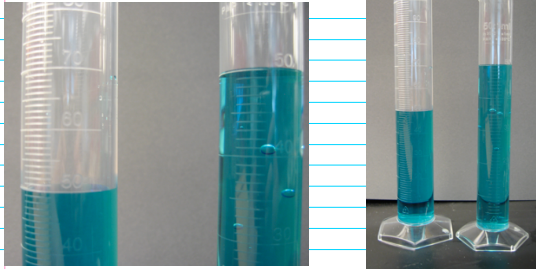
## Volume of Liquids

- Do these graduated cylinder have the same volume of liquid in them?
  - ✓ **YES! How can that be???**
  - ✓ One is a 100-mL cylinder & the other is a 50-mL cylinder.
- Which one is better to use to measure this liquid?
  - The **smaller** one!!!
- Why?
  - ✓ Better Accuracy!
  - ✓ The smaller the cylinder, the smaller the increments on the cylinder, which means a more accurate result.

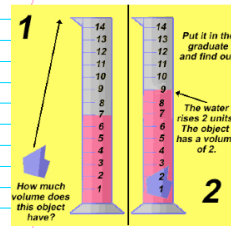


## Volume of Liquids- BUT look at this!

- Both of these cylinders have exactly 50 mL of water.



## Volume of Solid Irregular Objects



- So, how would I measure the volume of an irregular object such as a key?
- I can't measure the sides and I can't use a measuring cup.
- But I CAN still use a graduated cylinder.
- Simply submerge the object in the graduated cylinder and record the difference in water level.
- We call this the **displacement** method.
- You will practice it during our lab this week

## 7. Volume

InteGreat  
Science: Volume  
Displacement

And now....

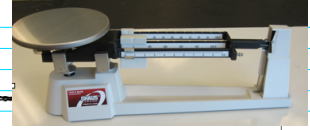
Mass...

## 8. Weight vs Mass



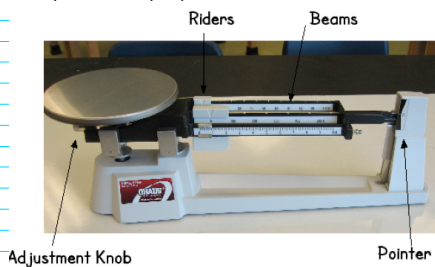
## Mass Review

- Mass is the amount of **matter** in an object.
- It's measured on a **balance** (also called a triple beam balance).
- Mass is measured in grams or kilograms.
- A science book is about 1.3 kilograms.
- A large paperclip is about 1 gram.



## Balance's Parts to Know

- They are very delicate and prone to breakage.
- NEVER pick one up by the balance beams!

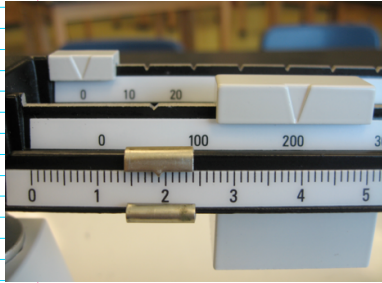


## Review: Reading the Balance: You Try It!



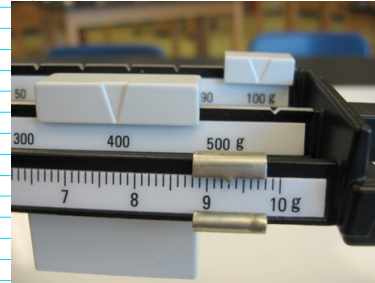
1. What does this balance read?  
✓323.5 grams

## Reading the Balance: You Try It!



2. What does this balance read?  
✓201.9 grams

## Reading the Balance: You Try It!



3. What does this balance read?  
✓509.3 grams

## Measurement Review

• Brainpop: Measuring Matter  
go to <http://www.brainpop.com> BEFORE 5PM log in: MMS308 password: marshall



How did you do??

**BrainPOP MEASURING MATTER**

**SCORE: 10/10**

- If a substance has a large mass and a small volume, what can you conclude about it?
  - A It's very dense
  - B It will float in water
  - C It is made out of rock or metal
  - D It has a low density
2. What is the difference between weight and mass?
  - A Weight depends on gravity and mass depends on gravity
  - B Weight depends on gravity and mass depends on volume
  - C Mass depends on gravity and weight is constant
  - D Weight depends on gravity and mass is constant
3. Which of the following units is rarely, if ever, used in science?
  - A Centimeter
  - B Gram
  - C Quart
  - D Milliter
4. If you wanted to measure an irregular object's volume, which of the following devices could you use?
  - A
  - B
  - C
  - D
5. One side of a cube is 5 cm long. What is the cube's volume?
  - A 5 cubic cm
  - B 15 cubic cm
  - C 125 cubic cm
  - D 125 cubic cm
6. In the context of the movie, what is the best option for "spoons"?
  - A Spoonless
  - B Antifiber
  - C Yacht
  - D Quantity
7. What is always true of an object with a lot of mass?
  - A It contains a lot of matter
  - B It has a large volume
  - C It has a high density
  - D It cannot be accurately measured
8. Which of the following is a measurement of an object's weight?
  - A 10 centimeters
  - B 10 kilograms
  - C 10 newtons
  - D 10 grams per cubic cm
9. What is the relationship between cubic centimeters and milliliters?
  - A They are equivalent
  - B Cubic centimeters measure length, milliliters measure volume
  - C They are both dependent on an object's mass
  - D They are both dependent on an object's density
10. An object's mass is 50 g, and its volume is 10 cubic cm. What is its density?
  - A 50 g/cubic cm
  - B 5 g/cubic cm
  - C 60 g/cubic cm
  - D 40 g/cubic cm



## Homework Problems

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- At the end of this lecture are 2 pages of problems called:  
Now it's Your Turn: Metric Measurement
- These problems will be due on: Monday
- Remember tomorrow (or Wed) is a lab day.
- Be sure you are wearing appropriate shirts & shorts, ladies.