

## The ABC's of Science

Intro to Physical Science  
Measurement, Temperature,  
Volume, Mass



Page 5  
in your  
Little  
BOOK

### Think Metric

Learning metric without conversion tables  
[www.think-metric.com](http://www.think-metric.com)

The infographic shows various objects with their metric measurements: CD ROM (120 mm), 65 mm, 155 mm, Dime Edge (1 mm), Basketball player (200 cm), 4 year old child (100 cm), Dime (18 mm), Penny (19 mm), Nickel (21 mm), Quarter (24 mm), 355 ml Soda can (120 mm), Golf ball (43 mm), Tennis ball (66 mm), Soccer ball (200 mm), A 355 ml can of soda weighs (355 grams), 120 mm, 150 cm, 1 Factory house (100 m), 1 Factory house (300 cm), 11 Football fields = 1,000 m.

Kilometer (kilometre) is pronounced KIL-oh-mee-ter, with the accent on the FIRST syllable

## Let's talk Metric

- Here in America we use ye olde English system: foot, yard, and mile.
- However, MOST countries use another system called the International System of Units
- This is the modern form of the metric system.

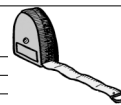
## It all depends on the foot!

- Numbers and units are used to make measurements.
- The distance from your desk to my desk could be 25 shoe lengths or 30 shoe lengths.
- It depends on how big the shoe is.
- Think of Shaq's foot versus Mini-Me.



## It all depends on the foot!

- In order to measure accurately, we have to use standard units.
- In other words, everyone has to use the SAME system or units.
- Otherwise, it just gets confusing.
- A **standard** is a fixed quantity used by everyone when measuring.



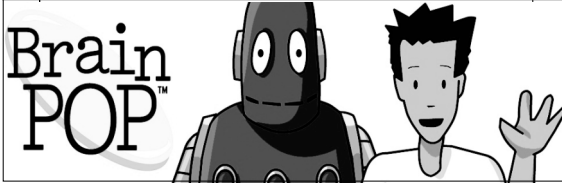
## Advantages to the Metric System

There are two advantages to using the metric system:

1. It helps scientists **share & compare** their results & observations.
  - If I conducted an experiment here in America, even a scientist in Zimbabwe would be able to understand my measurements.
2. All units are based on the number **10**.
  - Changing from one unit to another is easy!

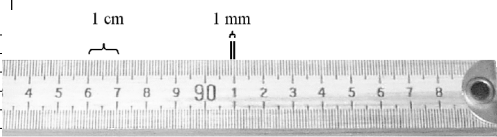
## Math-terpiece Theater

BrainPop: Metric vs. Customary  
go to <http://www.brainpop.com> log in: MMS308 password: marshall

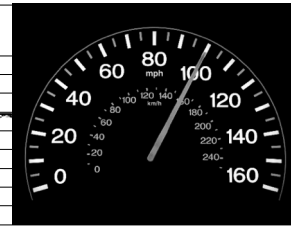


## Metric System: Length

- The **meter (m)** is the SI unit of length.
  - A meter is about the distance from a doorknob to the floor.
  - A driver golf club is also about a meter in length.
- The meter is divided into 100 equal parts called **centimeters (cm)**.
- There are 100 centimeters in a meter:
  - $100 \text{ cm} = 1 \text{ m}$

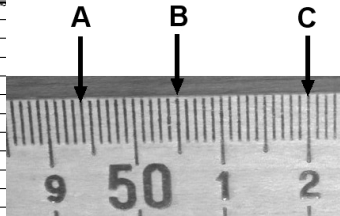


- An even smaller unit is a millimeter (mm).
- The prefix "milli-" means 1/1000, so...
  - ✓  $1000 \text{ mm} = 1 \text{ m}$
  - ✓  $10 \text{ mm} = 1 \text{ cm}$



- Long distances are measured in kilometers (km).
- In the US, we measure speed by miles per hour (mph). In most other countries, they measure in kilometers per hour (km/h).

**You Try It!** Arrows A, B, & C are all pointing to a particular place on a meter stick. Name the value & include units. See pg5 in your LB



- Point A = 49.4 cm or 494 mm
- Point B = 50.5 cm or 505 mm
- Point C = 52.0 cm or 520 mm

**You try it!** What is the most appropriate unit for a scientist to use to measure the following?


- Distance from San Diego to New York
  - km
- Length of your eyelash
  - mm
- Distance from A306 to the office
  - m
- Length of your arm
  - cm
- Height of this building
  - m
- Length of a grain of salt
  - $\mu\text{m}$

And now....

# Temperature...

## Temperature: pg 6 LB (Little Book)


- 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.



Three Temperature Scales			
	Fahrenheit	Celsius	Kelvin
Water boils	212°	100°	373
Body temperature	98.6°	37°	310
Room temperature	68°	20°	293
Water freezes	32°	0°	273

## Measuring Temperature: You Try It!

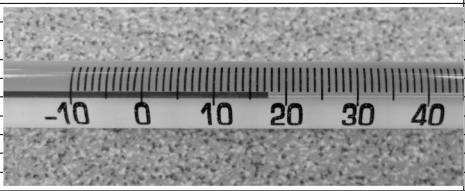
1. What is the temperature recorded by the thermometer?



Answer: 32 °C

## Measuring Temperature: You Try It!

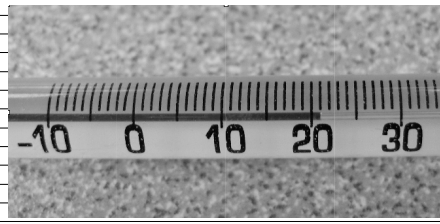
2. What is the temperature recorded by the thermometer?



Answer: 17.5 °C

## Measuring Temperature: You Try It!

3. What is the temperature recorded by the thermometer?



Answer: 21 °C

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)

## 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 (m <sup>3</sup> )	1 cm <sup>3</sup> = 0.000001 m <sup>3</sup>
cubic centimeter (cm <sup>3</sup> )	1 L = 1 dm <sup>3</sup> = 0.001 m <sup>3</sup>
liter (L)	1 mL = 0.001 L = 1 cm <sup>3</sup>
milliliter (mL)	

### 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<sup>3</sup>) 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

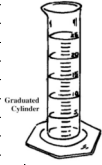
4. What is the volume of this solid?

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

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



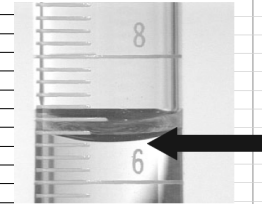
Graduated Cylinder



- 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 (cm<sup>3</sup>).
- 1 liter contains 1000 milliliters or 1000 cubic centimeters.

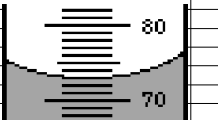
## Accuracy is Everything

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

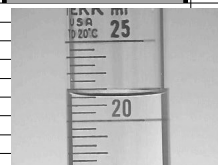


## You try it!

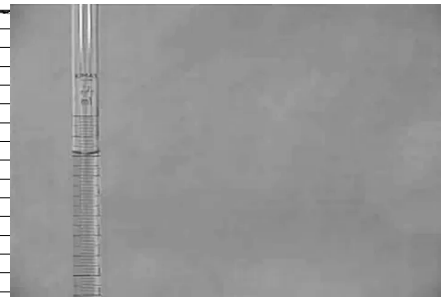
9. What is the volume in ml?  
73 ml



10. What is the volume in ml?  
21.5 ml

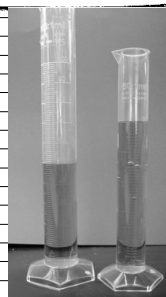


## 6. Reading the Meniscus



## Volume of Liquids

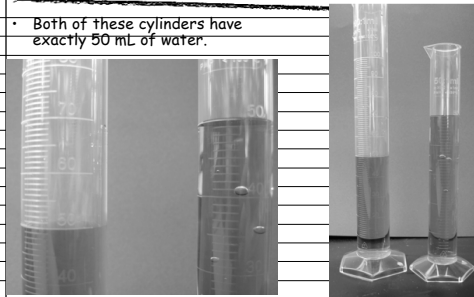
- Do these graduated cylinder have the same volume of liquid in them?
  - ✓ **YES! How can that be???**
  - ✓ One is a 100-mL cylinder & the other is a 50-mL cylinder.
- Which one is better to use to measure this liquid?
  - The **smaller** one!!!
- **Why?**
  - ✓ Better Accuracy!
  - ✓ The smaller the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



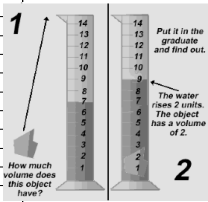
## Volume of Liquids-

**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

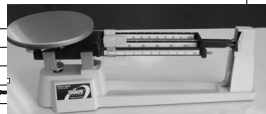
And now....

Mass...

## 8. Weight vs Mass



## Mass Review

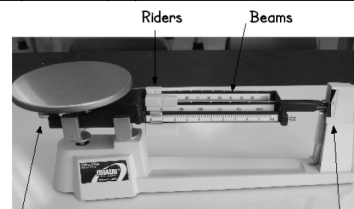


- Mass is the amount of **matter** in an object.
- It's measured on a **balance** (also called a triple beam balance).
- Mass is measured in grams or kilograms.
- A science book is about 1.3 kilograms.
- A large paperclip is about 1 gram.



## Balance's Parts to Know

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




Adjustment Knob

Pointer

**Review:**

**Reading the Balance: You Try It!**

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1. What does this balance read?

✓323.5 grams

**Reading the Balance: You Try It!**

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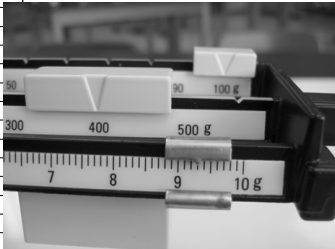


2. What does this balance read?

✓201.9 grams

**Reading the Balance: You Try It!**

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3. What does this balance read?

✓509.3 grams

**Measurement Review**

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

