


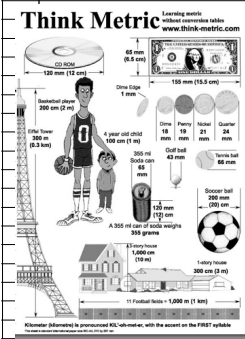
The ABC's of Science

Intro to Physical Science

Measurement, Temperature, Volume, Mass



Let's talk Metric



Think Metric
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 www.think-metric.com

Cover of Homework: Don't forget!
~~Name 3 things that are about 1 meter long~~
 Name 3 things that are measured in centimeters
 Name 3 things that are small enough to be measured in millimeters

What are the ABC's of Science:


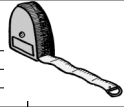
1. The metric system
2. Lab Safety
3. The Scientific Method

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 or the SI system (which stands for *Système Internationale d'Unités*)
- 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
- 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!

1. Metric Measurement

Write 3 sentences about what you learn

Try This...

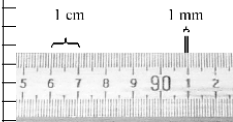
- 1 kilometer is equal to 1000 meters.
 - Kilo-meter prefix = kilo or 1000 unit = meter, measuring distance
 - Therefore: 1 kilometer = 1000 meters.
- 5 kilometers is equal to 5000 meters
 - $5 \times 1000 \text{ meters} = 5,000 \text{ meters}$
- 10 kilometers is equal to 10,000 meters
 - $10 \times 1000 \text{ meters} = 10,000 \text{ meters}$
- Later, we'll practice converting from one to another.

Common SI Units		
Length	meter (m) kilometer (km) deci-meter (dm) centimeter (cm) millimeter (mm) micrometer (µm) nanometer (nm)	1 km = 1,000 m 1 dm = 0.1 m 1 cm = 0.01 m 1 mm = 0.001 m 1 µm = 0.000001 m 1 nm = 0.000000001 m
Volume	cubic meter (m ³) cubic centimeter (cm ³) liter (L) milliliter (mL)	1 cm ³ = 0.000001 m ³ 1 L = 1 dm ³ = 0.001 m ³ 1 mL = 0.001 L = 1 cm ³
Mass	kilogram (kg) gram (g) milligram (mg)	1 g = 0.001 kg 1 mg = 0.000001 kg
Temperature	Kelvin (K) Celsius (°C)	0°C = 273 K 100°C = 373 K

Metric System: Length

- The **meter (m)** is the SI unit of length.
 - A meter is about the distance from a door knob 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...
 - ✓ $1000 \text{ mm} = 1 \text{ m}$
 - ✓ $10 \text{ mm} = 1 \text{ cm}$

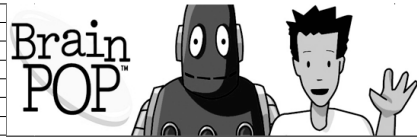
- Long distances are measured in kilometers (km).
- In the US, we measure speed by miles per hour (mph). In most other countries, they measure in kilometers per hour (km/h).



Math-terpiece Theater

BrainPop: Metric vs. Customary

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



Brain POP METRIC VS. CUSTOMARY

August 9, 2011
Elaine

1 Which units measure the same basic quantities?

- A Miles and feet
B Celsius and kilograms
C Inches and centimeters
D Meters and feet

2 What is the system by which we can convert between metric and customary units?

- A None of them
B A base 4 algorithm
C A base 10 system
D A mix between multiplication and division

3 What are metric measurements often from customary measurements?

- A Metric measurements are based on powers of 10; customary measurements are not.
B Metric measurements are divided into fractions; customary measurements are divided into decimals.
C Metric measurements are measured in base 4; customary measurements are measured in base 10.
D Another in base metric units larger than a kilometer; the same kilometers are in a yard?

4

5 For the first part, the United States uses the customary system, while other countries use the metric system.

- A Measuring distances between cities and states
B Surveying large areas of land
C Following cooking recipes
D Trading with other countries

SCORE: 10/10

6 Which of the following lengths is the length of a football field?

- A 100 yards
B Approximately 100 meters
C 100 feet
D Roughly 1/3 of a mile

7 If a ruler calls for 3 and 3/4 cups of flour, you can tell that it is a ruler.

- A The customary system
B The metric system
C Both the customary system and the metric system
D Neither the customary system nor the metric system

8 If it's 15 kilometers between your house and your school, how many miles is it?

- A 1.2 miles
B 100 meters
C 1,200 meters
D 0.200 meters

9 Which of the following is a true statement?

- A In the customary system, measurements are often expressed as fractions.
B In the metric system, measurements are often expressed as fractions.
C In the customary system, measurements are often expressed as fractions.
D Fractions are equally common in both the metric and customary systems.

10 If a granola bar has 7.7 grams of protein in it, how many milligrams of protein does it contain?

A 77

B 0.77

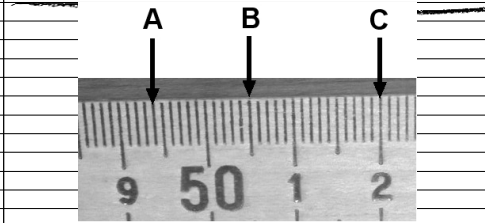
C 0.7

D 0.700

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 arm
 - cm
- Length of your eyelash
 - mm
- Height of this building
 - m
- Length of a grain of salt
 - µm
- Distance from A306 to the office
 - m

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



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

And now....

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**.



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!

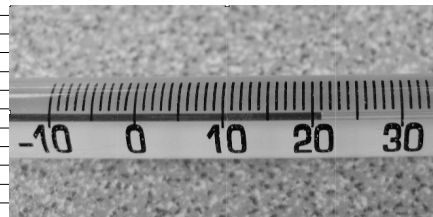
1. What is the temperature recorded by the thermometer?



Answer: 32 °C

Measuring Temperature: You Try It!

3. What is the temperature recorded by the thermometer?




Answer: 21 °C

And now....

Volume...

Video 2: How to measure Volume


A fun video to watch- no notes needed!!




Measuring a volume
Musical Math DVD
 Peter Weatherall
www.kidsinglish.com
info@kidsinglish.com

Volume

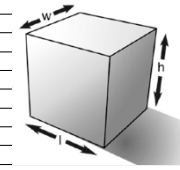
- Have you ever heard someone say "this shampoo gives my hair a lot of volume!!!"
- What does that mean?
- Volume means to **take up space**.
- Or, volume is the amount of space occupied by an object
- So if someone's hair has a lot of volume, that means it occupies a lot of space.



Volume		cubic meter (m ³) cubic centimeter (cm ³) liter (L) milliliter (mL)	1 cm ³ = 0.000001 m ³ 1 L = 1 dm ³ = 0.001 m ³ 1 mL = 0.001 L = 1 cm ³
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Volume of Solid Rectangular Objects

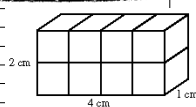
- For solid rectangular objects, the volume is the length x width x height.
- V = l x w x h**
- A cubic meter (m³) is a unit of volume.
- A cubic meter is a very large unit - it contains 1,000,000 cubic centimeters.



You try it! Volume of Solid Rectangular Objects

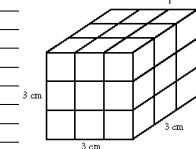
4. What is the volume of this solid?

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



5. What is the volume of this solid?

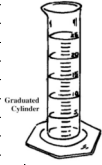
- $V = 3\text{cm} \times 3\text{cm} \times 3\text{cm}$
- $V = 27\text{cm}^3$



5. Volume of Rectangular Objects

Please write 3 sentences in your notes for this video.

Volume of Liquids



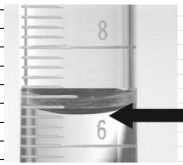
Graduated Cylinder



- 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 (cm³).
- 1 liter contains 1000 milliliters or 1000 cubic centimeters.

Accuracy is Everything

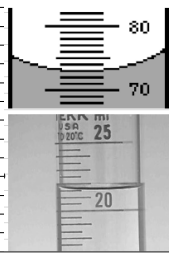
- To read the volume of the liquid, note the level at the **bottom** of the curve.
- We call this the **meniscus**.



You try it!

9. What is the volume in ml?

73 ml



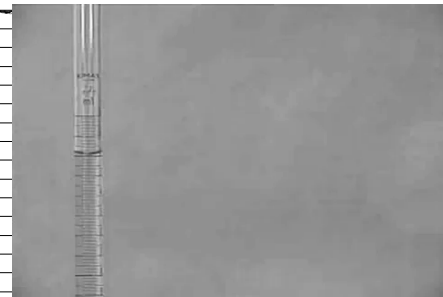
10. What is the volume in ml?

21.5 ml



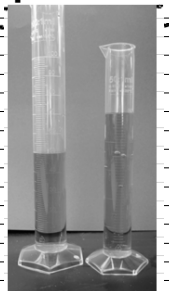
6. Reading the Meniscus

write 2 sentences about what you learned



Volume of Liquids

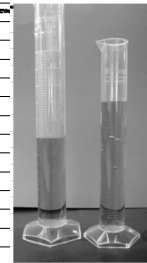
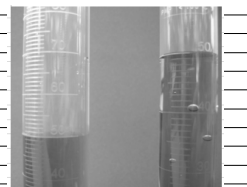
- Do these graduated cylinder have the same volume of liquid in them?
 - ✓ **YES! How can that be???**
 - ✓ One is a 100-mL cylinder & the other is a 50-mL cylinder.
- Which one is better to use to measure this liquid?
 - The **smaller** one!!!
- Why?
 - ✓ Better Accuracy!
 - ✓ The smaller the cylinder,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



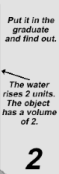
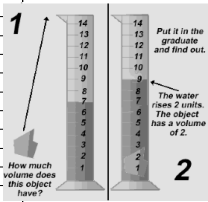
Volume of Liquids-

BUT look at this!

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



Volume of Solid Irregular Objects



Put it in the graduate and find out.

The water rises 2 units. The object has a volume of 2.

2

- 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....

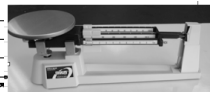
Mass...

8. Weight vs Mass

Write 2 sentences about this video on your notes.



Mass Review

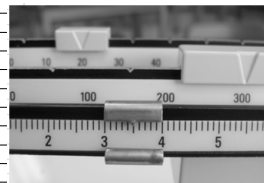


- Mass is the amount of **matter** in an object.
- It's measured on a **balance** (also called a triple beam balance).
- Mass is measured in grams or kilograms.
- A science book is about 1.3 kilograms.
- A large paperclip is about 1 gram.



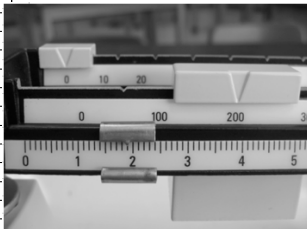
Review:

Reading the Balance: You Try It!



1. What does this balance read?
✓323.5 grams

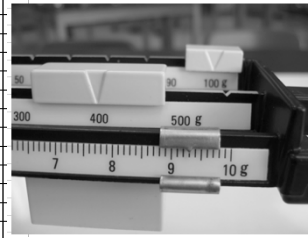
Reading the Balance: You Try It!



2. What does this balance read?

✓ 219 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> log in: MMS308 password: marshall

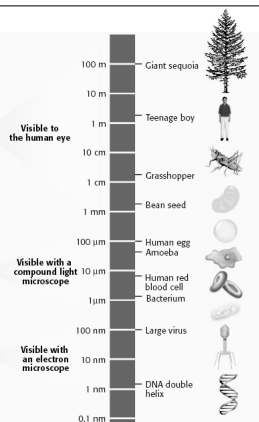


Brain POP MEASURING MATTER

SCORE: 10/10

How did you do??

- If a substance has a large mass and a small volume, what are the particles about it?
 - It's very dense
 - It will float on water
 - It is made out of rock or metal
 - It has a low density
- What is the difference between weight and mass?
 - Weight depends on density and mass depends on gravity
 - Weight depends on gravity and mass depends on volume
 - Mass depends on gravity and weight is constant
 - Weight depends on gravity and mass is constant
- Which of the following units is rarely, if ever, used to measure mass?
 - Centimeter
 - Gram
 - Quart
 - Kilogram
- If you wanted to measure an irregular object's volume, which of the following devices could you use?
 - ✓ 1
 - 2
 - 3
 - 4
- One side of a cube is 5 cm long. What is the cube's volume?
 - 5 cubic cm
 - 15 cubic cm
 - 125 cubic cm
 - 100 cubic cm
- In the context of the matter, what is the best answer for "properties"?
 - Masses
 - ✓ 1
 - Volume
 - Quantity
- What is always true of an object with a lot of mass?
 - It contains a lot of matter
 - It has a large volume
 - It has a high density
 - It cannot be accurately measured
- Which of the following is a measurement of an object's weight?
 - 10 centimeters
 - 10 kilograms
 - ✓ 10 newtons
 - 10 grams per cubic cm
- What is the relationship between cubic centimeters and milliliters?
 - They are equivalent
 - ✓ 1
 - Cubic centimeters measure length, milliliters measure volume
 - They are both equivalent to an object's mass
 - They are both equivalent to an object's density
- If an object's mass is 10 g, and its volume is 10 cubic cm, what is its density?
 - 100 g/cubic cm
 - ✓ 1 g/cubic cm
 - 10 g/cubic cm
 - 10 g/cubic cm



You try it!

This will help you on the first page of your notes

- Name 3 things that are about one meter long.
 - Golf Club, Chair, Flag, 6th graders...
- Name 3 things that are measured in centimeters
 - Paperclips, babies, toes, fingernail
- Name 3 things that are small enough to be measured in millimeters
 - Camera film, pencil lead, wire diameter, insects