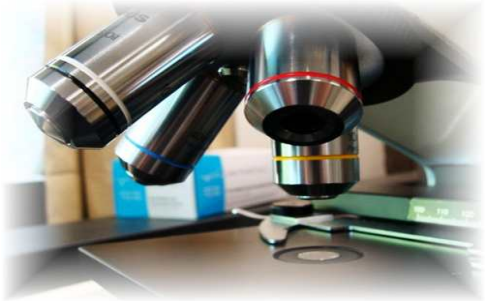

About Science Prof Online PowerPoint Resources

• Science Prof Online (SPO) is a free science education website that provides fully-developed Virtual Science Classrooms, science-related PowerPoints, articles and images. The site is designed to be a helpful resource for students, educators, and anyone interested in learning about science.

• The SPO Virtual Classrooms offer many educational resources, including practice test questions, review questions, lecture PowerPoints, video tutorials, sample assignments and course syllabi. New materials are continually being developed, so check back frequently, or follow us on Facebook (Science Prof Online) or Twitter (ScienceProfSPO) for updates.

• Many SPO PowerPoints are available in a variety of formats, such as fully editable PowerPoint files, as well as uneditable versions in smaller file sizes, such as PowerPoint Shows and Portable Document Format (.pdf), for ease of printing.

• Images used on this resource, and on the SPO website are, wherever possible, credited and linked to their source. Any words underlined and appearing in blue are links that can be clicked on for more information. PowerPoints must be viewed in *slide show mode* to use the hyperlinks directly.

• Several helpful links to fun and interactive learning tools are included throughout the PPT and on the Smart Links slide, near the end of each presentation. You must be in *slide show mode* to utilize hyperlinks and animations.

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Image: Compound microscope objectives, T. Port

Metric Basics

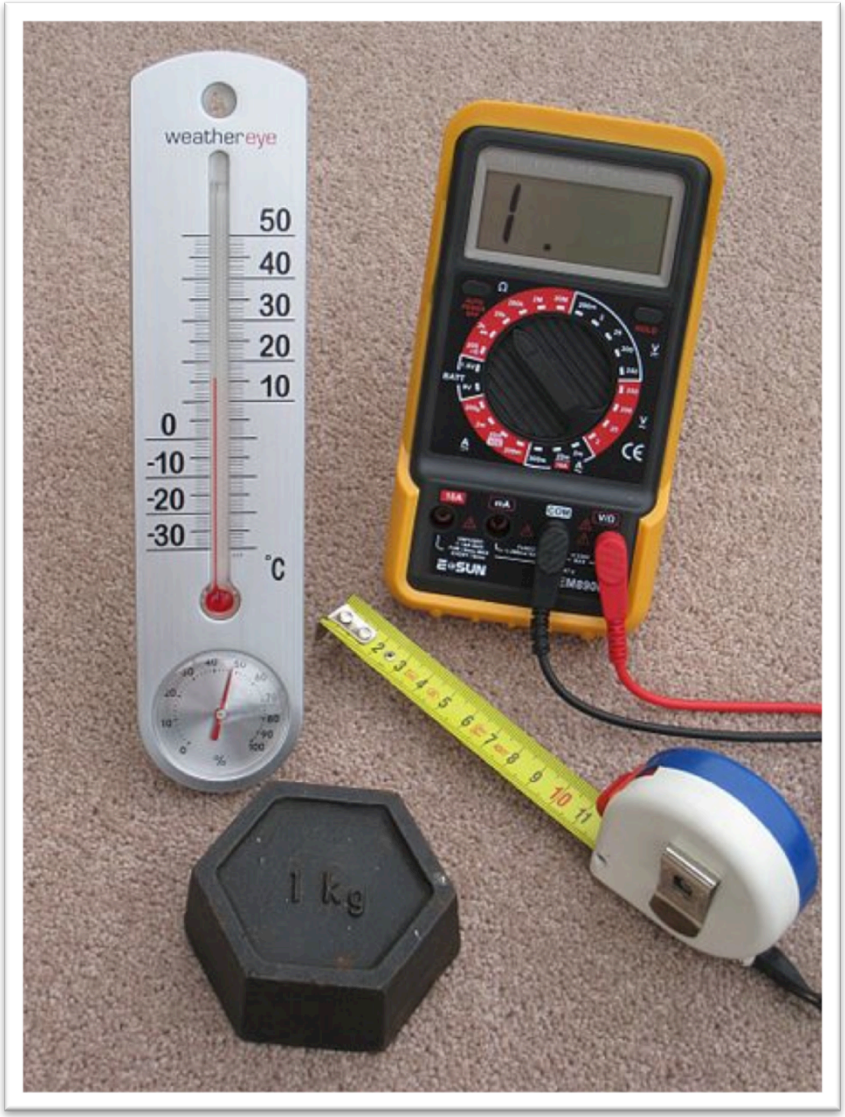
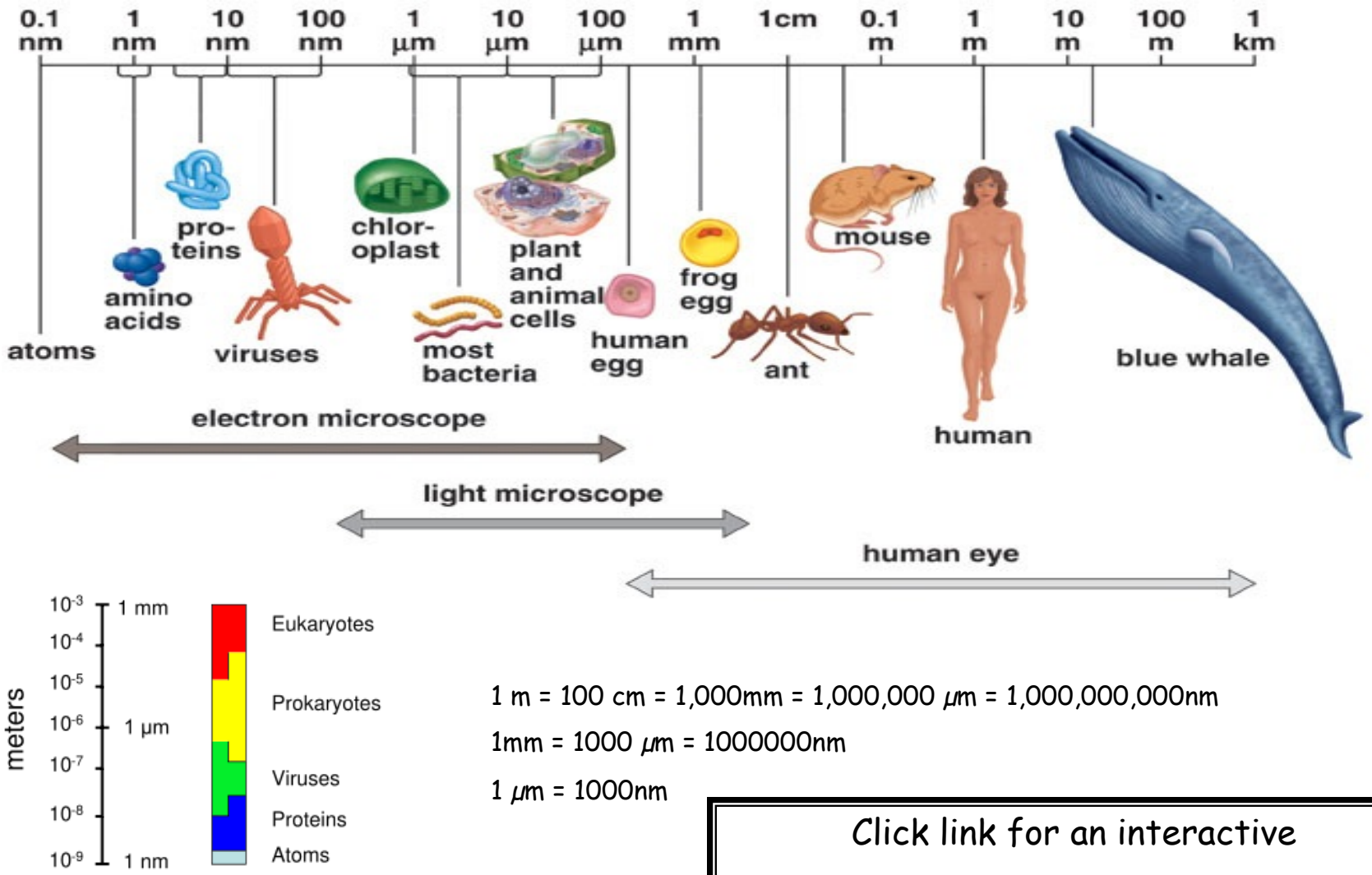


Image: Four Metric Instruments, Wiki

Size of Living Things



1 m = 100 cm = 1,000mm = 1,000,000 µm = 1,000,000,000nm

1mm = 1000 µm = 1000000nm

1 µm = 1000nm

Click link for an interactive

"Size of Microscopic Things"

animation on Cells Alive.

The Whole World Uses the Metric System … Except US

- Have you ever been outside of the United States?
- Almost every other country in the world uses the Metric System.
- It can be confusing and frustrating for Americans when gasoline is sold in **liters**, temperature is in **celsius**, and distance is in **kilometers**.
- You are familiar with some metric measurements…Name some.

Image: USA on globe, Wiki

Science & The Metric System

Scientists once faced the same problem…

When different units of measurement were used in different countries, this led to confusion. (In 1999, NASA probe to Mars was lost because of a conversion error).

Watch This!

Bill Nye on the Metric System

Understanding the Metric System from Smith Math Academy

Metric Conversion Rap from The Metric Crew

So scientists agreed to use the **metric system**, which is much easier to convert.

For example …

- Metric system: Based on units of ten. 1 meter = 100 centimeters, just like one dollar = 100 cents.
- English system: Based on a hodgepodge of numbers… 3ft in a yard, 12 inches in a foot, etc. (A yard was once based on the length of the kings arm-span and foot based on the size of the king's foot, which changed wherever there was a new king!)

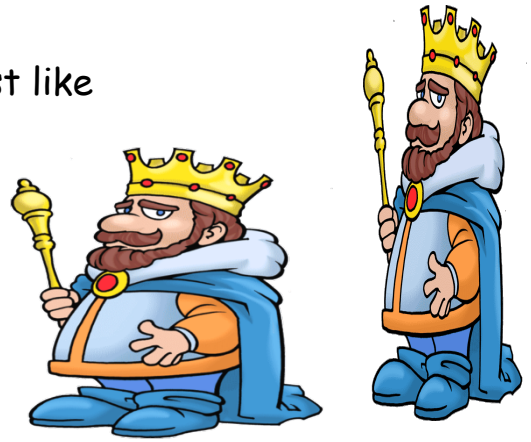
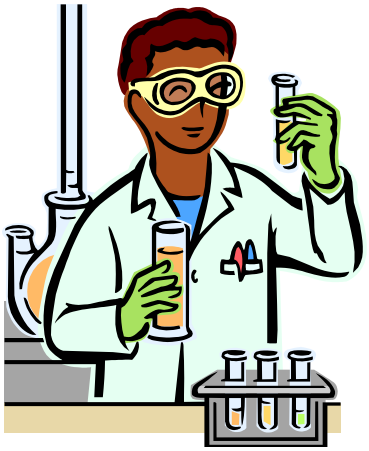


Image: This monarch caterpillar measures ` 4.5cm, T. Port

Important Measurements We Will Be Using in Lab



Take a look at "How the Metric System Works", bottom of page 1, Metric Tutorial Part 1.

Measurement	Metric Base Unit	English Unit
Mass (weight)	gram (g)	Oz., Pound, Ton
Volume	liter (L)	Tsp., Pint, Gallon
Length	meter (m)	Inch, foot, yard
Temperature	degree Celcius (°C)	Fahrenheit (°F)
Density	g/mL = g/cc	lb/gallon

Metric Prefix Examples

Small amount example:

- **Milli-** prefix used when measuring small amounts.
- A **milli-** is one-thousandth of the original unit and is noted as a **small letter m** before the base unit.
- Relationship between milli- and its base unit is *always* 1000 times. So, if you take 5 x 200mg tablets in medication = 1000 mg total = 1g!

Larger amount example:

- **Kilo-** is 1000x larger than what you start with.
- Adding the prefix kilo- always increases a base unit (such as m, g, L) by 1000 times so: 1 kilometer = 1000 meters, 1 kilograms = 1000 grams, 1 kiloliter = 1000 liters.

Check your understanding of the magnitude of these two prefixes by doing the problems near the bottom of page 2 of the Metric Tutorial Part 1.

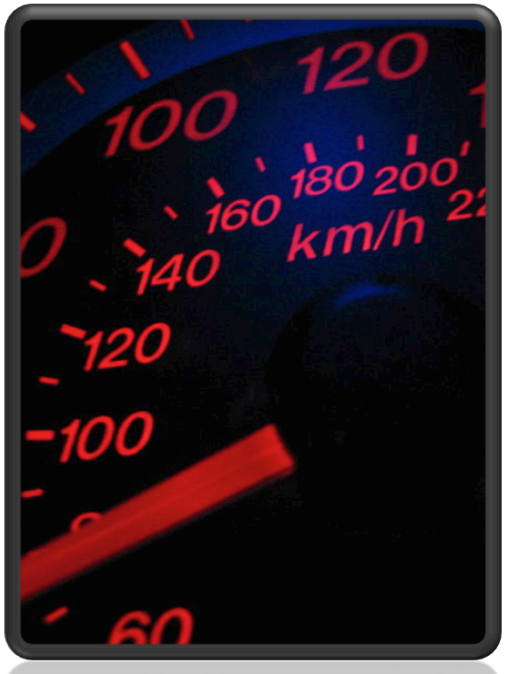


Image: Speedometer sowing miles/h and km/h, Wiki

Metric Prefixes and Magnitude

PREFIX	SYMBOL	FACTOR
tera-	T	1,000,000,000,000 (one million million, or a trillion)
giga-	G	1,000,000,000 (one thousand million, or a billion)
mega-	**M**	**1,000,000 (one million)**
kilo-	**K**	**1000**
hecto-	**h**	**100**
deca-	**D**	**10**
(BASE UNIT)		**1**
deci-	**d**	**0.1 (one tenth, 1/10)**
centi-	**c**	**0.01 (one hundredth, 1/100)**
milli-	**m**	**0.001 (one thousandth, 1/1000, 10^{-3})**
micro-	**μ**	**0.000001 (1/100,000 or 10^{-6})**
nano	n	0.000000001 (1/1,000,000,000, 10^{-9})
pico	p	0.000000000001 (1,000,000,000,000, 10-12)

The Importance of Metric Conversions in Science and Medicine

- Knowing how to convert amounts is essential in science, especially medicine.
- Incorrect conversions of medication dosages can lead to "death by decimal".
- Although a doctor prescribes the medication amount and a pharmacist dispenses it, it's the responsibility of everyone who handles or administers that medication to insure the safety of the patient.
- First, let's practice converting between metric prefixes, using the table below.
- Then do Metric Conversion Practice on back page of Metric Tutorial Part 2.

Prefix	kilo- (K)	hecto- (h)	deca (D)	**Base Unit** (g, m L)	deci – (d)	centi- (c)	milli – (m)
Value	X 1000	X 100	X 10	X 1	X 0.1 (1/10)	X 0.01 (1/100)	X 0.001 (1/1000)

Image: Medication being dispensed intravenously, Wiki

Confused?

Here are some links to fun resources that further explain Metrics:

- US Metric Association
- Metric Measurement Millionaires Game
- Worldwide Metric Conversion
- Access to Flashcards and Games on Metrics
- Quizzes and more Worksheets on Metrics
- Metric Mania Conversion Practice Worksheet
- Length Lab Worksheet
- There are also many free apps that do metric conversions.

Smart Links