Today's Lecture

- ✓Announcements
- ✓Units of in Measurement

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Announcements

- Office hours
  - Mon, Wed, 11:30-12:30 am
  - Sun,Tue,Thu 12:00-1:00 pm
- Reading
  - Chapter 1, focus on Sections **(1.4),** (1.5) and (1.6)
- Suggested Problems
  - 23,25,27,29,31,33,35,37,39,41,43,45,47,49,51,53, 59,61,67,69

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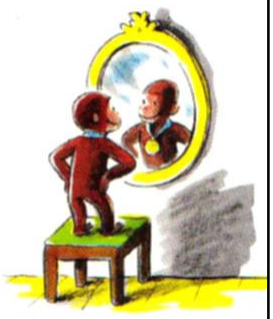
Things you are proud of...

- ??????????????????????



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Units of Measurement

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SI Units

Physical Quantity	Name of Unit	Abbreviation
Mass	Kilogram	kg
Length	Meter	m
Time	Second	s[a]
Temperature	Kelvin	K
Amount of substance	Mole	mol
Electric current	Ampere	A
Luminous intensity	Candela	cd

[a]The abbreviation sec is frequently used.

- *Système International d'Unités*
- A different base unit is used for each quantity.

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Metric System

Prefixes convert the base units into units that are appropriate for the item being measured.

Prefix	Abbreviation	Meaning	Example
Giga	G	10^9	1 gigameter (Gm) = 1×10^9 m
Mega	M	10^6	1 megameter (Mm) = 1×10^6 m
Kilo	k	10^3	1 kilometer (km) = 1×10^3 m
Deci	d	10^{-1}	1 decimeter (dm) = 0.1 m
Centi	c	10^{-2}	1 centimeter (cm) = 0.01 m
Milli	m	10^{-3}	1 millimeter (mm) = 0.001 m
Micro	μ[a]	10^{-6}	1 micrometer (μm) = 1×10^{-6} m
Nano	n	10^{-9}	1 nanometer (nm) = 1×10^{-9} m
Pico	p	10^{-12}	1 picometer (pm) = 1×10^{-12} m
Femto	f	10^{-15}	1 femtometer (fm) = 1×10^{-15} m

[a]This is the Greek letter mu (pronounced "mew").

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Sample Exercise 1 Using Metric Prefixes

What is the name given to the unit that equals **(a)** 10^{-9} gram, **(b)** 10^{-6} second, **(c)** 10^{-3} meter?

Practice Exercise

(a) What decimal fraction of a second is a picosecond, ps? **(b)** Express the measurement 6.0×10^{3}m using a prefix to replace the power of ten. **(c)** Use exponential notation to express 3.76 mg in grams.

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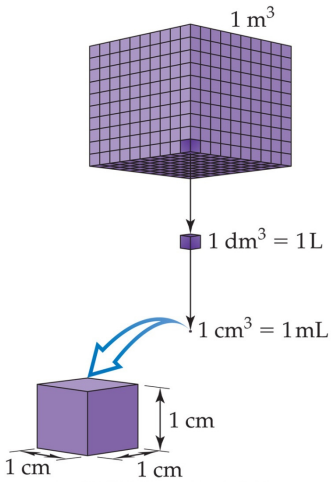
Volume

- The most commonly used metric units for volume are the liter (L) and the milliliter (mL).
  - A liter is a cube 1 dm long on each side.
  - A milliliter is a cube 1 cm long on each side.



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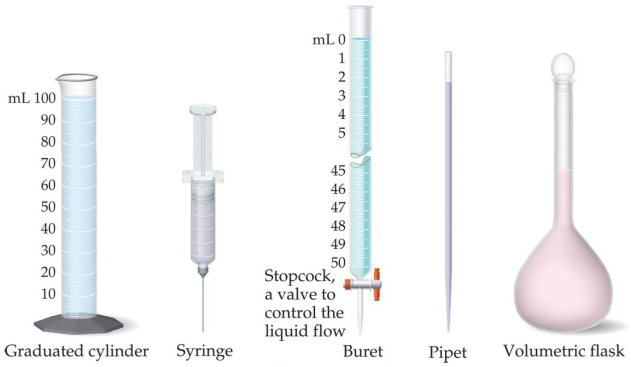
Uncertainty in Measurements

Different measuring devices have different uses and different degrees of accuracy.



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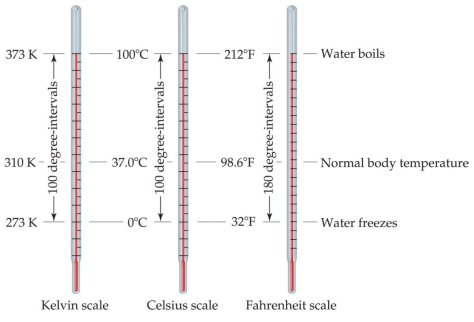
Temperature



By definition temperature is a measure of the average kinetic energy of the particles in a sample.

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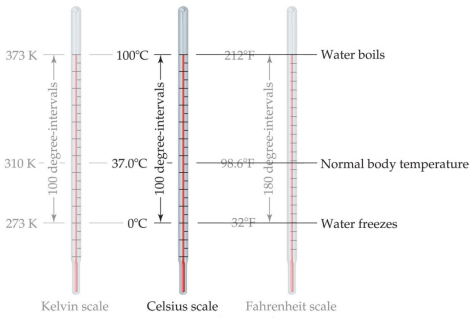
Temperature



- In scientific measurements, the Celsius and Kelvin scales are most often used.
- The Celsius scale is based on the properties of water.
  - 0°C is the freezing point of water.
  - 100°C is the boiling point of water.

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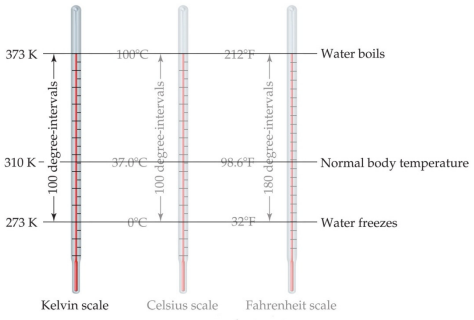
Temperature



- The Kelvin is the SI unit of temperature.
- It is based on the properties of gases.
- There are no negative Kelvin temperatures.
- K = °C + 273.15

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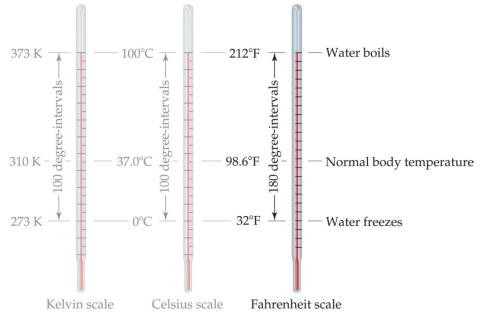
Temperature



- The Fahrenheit scale is not used in scientific measurements.
- °F = 9/5(°C) + 32
- °C = 5/9(°F – 32)

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Sample Exercise 2 Converting Units of Temperature

If a weather forecaster predicts that the temperature for the day will reach 31 ° C, what is the predicted temperature **(a)** in K, **(b)** in ° F?

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Practice Exercise

Ethylene glycol, the major ingredient in antifreeze, freezes at –11.5ºC . What is the freezing point in **(a)** K, **(b)** ° F?

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Density

Density is a physical property of a substance.

$$d = \frac{m}{V}$$

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Sample Exercise 3 Determining Density and Using Density to Determine Volume or Mass

(a) Calculate the density of mercury if 1.00×10^2 g occupies a volume of 7.36 cm^3.
(b) Calculate the volume of 65.0 g of the liquid methanol (wood alcohol) if its density is 0.791 g/mL.
(c) What is the mass in grams of a cube of gold (density = 19.32 g/cm^3) if the length of the cube is 2.00 cm?

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Practice Exercise

(a) Calculate the density of a 374.5-g sample of copper if it has a volume of 41.8 cm^3.
(b) A student needs 15.0 g of ethanol for an experiment. If the density of ethanol is 0.789 g/mL, how many milliliters of ethanol are needed?
(c) What is the mass, in grams, of 25.0 mL of mercury (density = 13.6 g/mL)?

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Next Lecture

- Uncertainty in Measurements
- Dimensional Analysis
  - Chapter 1
    - focus on Sections (1.4) and (1.5)and (1.6)

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