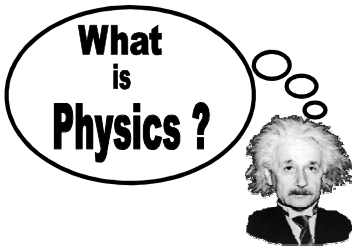


The Measure of Science

What is Physics?

- Physics is the study of the physical world at its most fundamental level.
- Attempts to describe nature in an objective way through measurements.
- Physics is concerned with the two primary components of all things.

Areas of Physics

- There are six major areas of physics.

Mechanics	Motion and its causes
Thermodynamics	Heat and Temperature
Waves	Types of repetitive motion
Electromagnetism	Electricity, Magnetism, Light
Relativity	High speed particles
Quantum Mechanics	Submicroscopic particles

Scientific Method

- An organized system of determining answers to questions using observation, experimentation and analysis.
- There are many “methods” to solving a particular problem.

Scientific Method

- In general, most scientific methods can be broken into these parts:

Problem
Hypothesis
Experiment
Theory ⟷ Law

Experiments

- Controlled Experiment

  an experiment in which we only change one variable at a time

- System

  the object(s) and actions we choose to observe during an experiment.

Physics and Math

- Physics is the practical application of algebra.
- To succeed in physics you should already know how to:
  - Use significant digits correctly
  - Convert between metric units
  - Graph and analyze data
  - Manipulate algebraic equations

Scientific Notation

- Used to eliminate repeated zeros
- The exponent is the number of spaces the decimal point is from the “ones” position.
- For example:
  3200000000 =
  0.0005943 =
- Remember: a positive exponent represents a number larger than 1, a negative exponent => less than 1

SI Units

- Fundamental (Base) Units
  - seven basic units of measure
  - kg, s, m, K, A, cd, mol
- Derived Units
  - Unit containing any combination of fundamental units
  - Developed through the mathematic manipulation of base units (ex: m/s)

SI Unit Prefixes

pico	p	10^{-12}	tera	T	10^{12}
nano	n	10^{-9}	giga	G	10^{9}
micro	m	10^{-6}	mega	M	10^{6}
milli	m	10^{-3}	kilo	k	10^{3}
centi	c	10^{-2}	hecto	h	10^{2}
deci	d	10^{-1}	deka	da	10^{1}

Converting Units – Example

- Convert the following:
  - 1523 g to kg

    1.523
  - 348 cm to m

    3.48
  - 8.34 µA to A

    .00000834

Arithmetic with Scientific Notation

- Putting it in your calculator
  - Use the EE button on your calculator to replace the "x 10" in the number:

    $9.52 \times 10^{3} + 2.62 \times 10^{2} =$

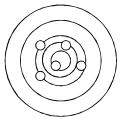
    $3.2 \times 10^{-2} \times 2.0 \times 10^{3} =$

    $9.6 \times 10^{-4} / 3.2 \times 10^{3} =$

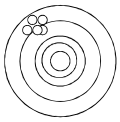
Accuracy vs. Precision

- Precision
  - How exact the measurement is
  - High likelihood of repeatability
- Accuracy
  - How close the number is to the accepted value

Accuracy vs. Precision



Accurate



Precise

Accurate & Precise

Significant Digits

- Valid digits are determined by the precision of the device.
- The last digit is always assumed to be estimated
- General Rules
  - Non-zero digits are always significant
  - All final zeros after the decimal are sig.
  - Zeros between 2 sig.digits are sig.
  - Zeros used only for spacing the decimal are not significant.

How Many Sig. Figs

- 0.000580 - 3
- 97600 - 3
- 43578.008 - 8
- 8009 - 4

Math with Significant Digits

- Your answer should have the same amount of significant digits as the measurement having the least total amount of significant digits.

Operations with Significant Digits

- Note:
  - The text considers trailing zeros to be significant.
  - For example: 20 has two significant digits

Manipulating Equations

- Solve for a
  $F = ma$
- Solve for a
  $v_f = v_i + at$
- Solve for a
  $d = v_i t + \frac{1}{2} at^2$

Return to Honors Physics Notes