Chapter 1: The Nature of Science and Physics

1 Introduction

The type of Physics that you'll be interested in in AP Phyiscs 1 is classical mechanics. Classical mechanics is the branch of physics that involves the laws of motions and the relationships of energy.

- **Physics** is concerned with describing the interactions of energy, matter, space, and time, and it is especially interested in what fundamental mechanisms underlie every phenomenon
- A **model** is a representation of something that is often too difficult (or impossible) to display directly.
- To a scientist, a **theory** is a testable explanation for patterns in nature supported by scientific evidence and verified multiple times by various groups of researchers.
- A **law** uses concise language to describe a generalized pattern in nature that is supported by scientific evidence and repeated experiments.

2 Physical Quantities and Units

A **Physical quantity** is something that can be measured. Take, for example, distance, time, or speed; these are all physical quantities.

A **dimension** is associated with every measured of calculated quantity. For instance, the size of a string has the dimension length; the enclosure of a circle has dimension area; the amount of space a cube takes up has the dimension volume.

Measurements of physical quantities are done in **units**, which are standardized quantities for consistent measure. You'll be familiar with the units the meter or the second.

Remark 1

People often mix up units and dimensions: a dimension is the physical quantity being measured, while a unit is the standard used to measure said quantity. You can measure the area of a square in or cm^2 or in^2, but the sqaure will always have dimension area.

There are many unit systems around the world, however the system that is used and agreed upon by the scientific community is the metric system: **SI Units**.
And while there are dozens of units, the three most fundamental units, that most other units you'll encounter are derived from, are these:

- meter(m): dimension length
- kilogram (kg): dimension mass
- second (s): dimension time

For history on these units I advise you to read the textbook. Additionally, here is a table with metric prefixes that would be convient to know.

Common Prefixes used with SI Units			
Prefix	Symbol	Meaning	Order of Magnitude
giga-	G	1 000 000 000	10^{9}
mega-	M	1 000 000	10^{6}
kilo-	k	1 000	10^{3}
hecto-	h	100	10^{2}
deka-	da	10	10^{1}
	base unit	1	10^{0}
deci-	d	0.1	10^{-1}
centi-	c	0.01	10^{-2}
milli-	m	0.001	10^{-3}
micro-	μ	0.000 001	10^{-6}
nano-	n	0.000 000 001	10^{-9}

Figure 1: Metric Prefixes

3 Accuracy, Precision, and Significant Figures

Accuracy is how close a measurement is to the correct value for that measurement. **Precision** is how consistent a measurement is. For instance, a measurement 1.01m of a known 1 m stick is accurate, while measurements 1.32m, 1.31m, 1.30m are precise.

Error propagation (uncertainty) is not included in the AP Physics curriculum, but for the few of you that are still interested, here are some neat sites.

1. geol.lsu.edu

2. sites.science.oregonstate.edu
3. Physics Crash Course: Error Propagation