Physics Reference

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Contents

Chapter 1

Introduction

This chapter will offer reference and information that applies to the entire book.

1.1 Structure of This Book

1.1.1 Categories

Each section of this book will focus on one of these general categories

- **Units/Notation -** The way we quantize real world phenomena and how we represent them on paper.
- **Laws/Models -** Representations real world phenomena that have predictive power on some scale.
- **Methods -** Strategies making predictions using these models this could be a formula or a computational technique

1.1.2 Standard Units

In physics it's often important to have precisely defined units for the purposes of making very accurate measurements or simply having a coherent unit system. It's possible to derive all necessary units from five measurements of **length, mass, time, current, and temperature**. The standard SI units for these properties are listed bellow:

Type	Unit	Definition
Length	Meter(m)	Length of distance light in a vacuum travels in $\frac{1}{299792458}$ seconds
Mass	Kilogram(kg)	Defined by fixing the Planks constant $h = 6.62607015 \times 10^{-34} kg\ m^2 s^{-1}$
Time	Second(s)	Defined by fixing the ground-state hyperfine transition frequency of the caesium-133 atom, to be $9192631770 s^{-1}$
Current	Ampere(A)	Defined by fixing the charge of an electron as $1.602176634 \times 10^{-19} A \cdot s$
Temperature	Kelvin(K)	Defined by fixing the value of the Boltzmann constant k to $1.380649 \times 10^{-23} kg \cdot m^2 s^{-2} K^{-1}$

Chapter 2

Newtonian Physics

Chapter 3

Electricity and Magnetism

3.1 Electronics

Definition 3.1.1. Electric Field force per unit charge or N/C

Definition 3.1.2. Voltage or *Potential* is the change in energy per unit charge brought on by traveling through an electric field or J/C or simply V

Remark. The units N/C is equivalent to V/m

Formula 3.1.1. Power can be derived from units of current and voltage for the following formula where P is power(W), V is voltage(V), and I is current(A).

$$P = VI$$

Law 3.1.1. Ohms Law models the voltage drop across a purely resistive load with the following formula where V is voltage(V), I is current(A), and R is resistence(Ω).

$$V = IR$$

Definition 3.1.3. The **Ohm** is defined by **Ohms Law** as V/A

Definition 3.1.4. Resistivity($\Omega\,\mathrm{m}$) is used to calculate how much resistance we expect from a material use the following formula where R is resistence(Ω), ρ is **Resistivity**($\Omega\,\mathrm{m}$), l is length(m), and A is cross sectional area(m^2).

$$R = \rho \frac{l}{A}$$

Chapter 4

Thermodynamics

Chapter 5

Relativity

Chapter 6

Quantum Physics

Chapter 7

Condensed Matter Physics

Chapter 8

Particle Physics

Chapter 9

Nuclear Physics