

MP

pqi

Contents

Welcome

This is my personal understanding and notes about Medical physics.

Chapter 1

Introduction

1.1 Physics constants

The constants are available from the [NIST website](#) supported by National Institute of Science and Technology (NIST).

The important **constants** used in medical physics are:

- Avogadro constant: $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$
- Speed of light in vacuum: $c = 2.998 \times 10^8 \text{ m/s}$
- Atomic mass constant: $u = 1.661 \times 10^{-27} \text{ kg} = 931.5 \text{ MeV}/c^2$
- Elementary charge: $e = 1.602 \times 10^{-19} \text{ C}$
- Electron rest mass: $m_e = 9.109 \times 10^{-31} \text{ kg} = 0.5110 \text{ MeV}/c^2$
- Proton rest mass: $m_p = 1.673 \times 10^{-27} \text{ kg} = 1.007 \text{ u} = 938.3 \text{ MeV}/c^2$
- Neutron rest mass: $m_n = 1.675 \times 10^{-27} \text{ kg} = 1.009 \text{ u} = 939.6 \text{ MeV}/c^2$
- Planck constant: $h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s} = 4.136 \times 10^{-15} \text{ eV}\cdot\text{s}$

The SI system of units

The **7 base quantities** and their units are

- Length: meter (m)
- Mass: kilogram (kg)
- Time: second (s)
- Electric current: ampere (A)
- Temperature: kelvin (K)
- Amount of substance: mole (mol)
- Luminous intensity: candela (cd)

1.2 Atomic Representation

Atoms = Nucleus (neutron and protons)¹ + Orbital electrons²

¹Rutherford interpreted the results of the [gold foil experiment](#) or [Geiger-Marsden experiment](#) and established the Rutherford model of atom, which constitutes a tiny (10^{-15} m), heavy nucleus which consists of protons and/or neutrons. He also won [the Nobel Prize in Chemistry 1908](#) “for his investigations into the disintegration of the elements, and the chemistry of radioactive substances”. He discovered three types of radiation: α , β , and later γ radiation.

²In 1913, Bohr proposed a theory for the hydrogen atom based on **quantum theory** that (a) electrons orbit around the nucleus; (b) electrons orbits at a certain discrete set of distances from the nucleus without radiation and energy loss; (c) electrons can only gain and lose energy by jumping from one allowed orbit to another, absorbing or emitting electromagnetic radiation