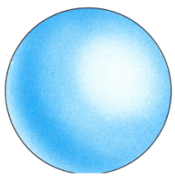
Electromagnetics & Waves

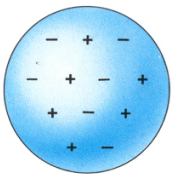
Fission, Fusion & Decay

A Summary

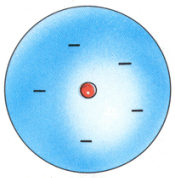
Robert Millikan
Oil Drop Experiment
Charge of Electron



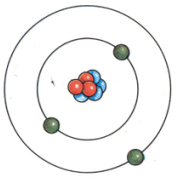
John Dalton
Studied Gases
Nature of Atoms
Billiard Ball Model



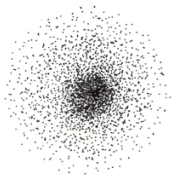
JJ Thomson
Cathode Ray Tube
Electron
Plum Pudding Model



Ernest Rutherford
Gold Foil Experiment
Dense Positive Nucleus
Nuclear Model



Niels Bohr
Studied Light
Electron Orbits
Planetary Model

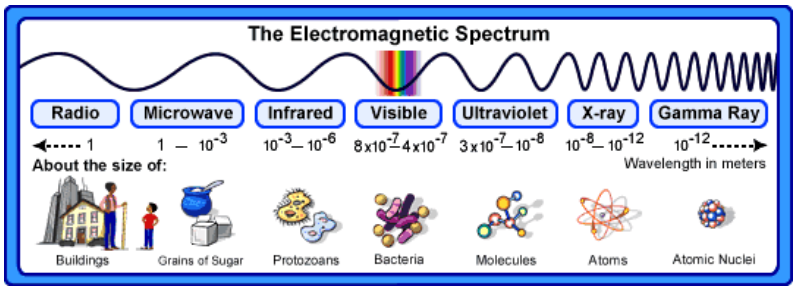


Erwin Schrodinger
Mathematical Models
Wave Mechanics
Charge Cloud Model

Electromagnetics & Waves

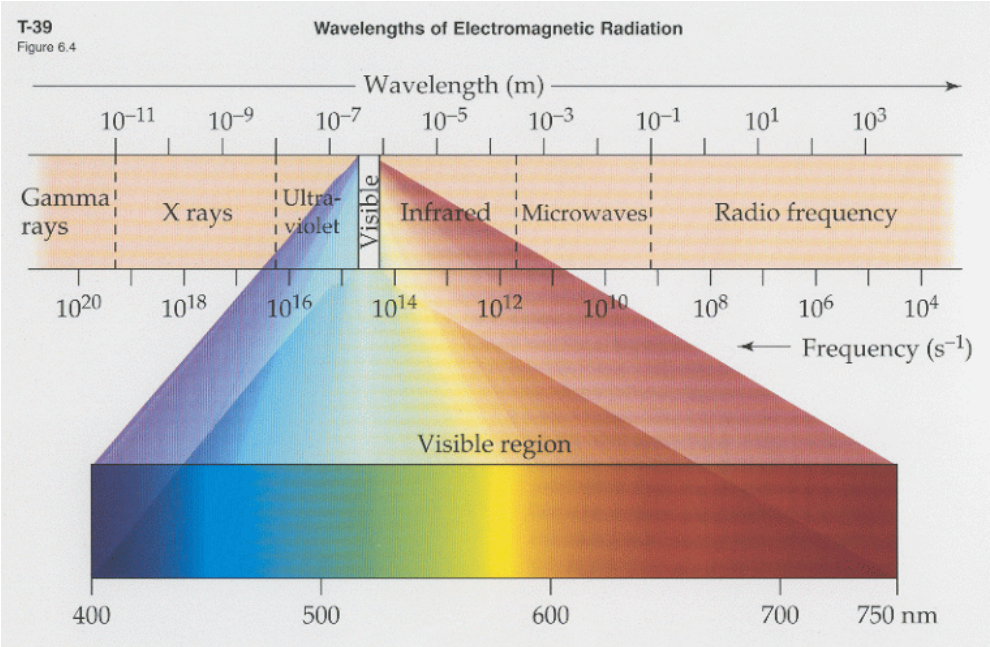
Electromagnetic Radiation

- The source of much of our understanding of electronic structures comes from our study of light emitted and absorbed by substances
- Light is a type of electromagnetic radiation
- Electromagnetic radiation
  - A form of energy that has wave characteristics and travels through a vacuum
  - Travels at the speed of light
    - 2.998 x 10^8 m/s
- Many types.....



Electromagnetics & Waves

The Wave Nature of Light



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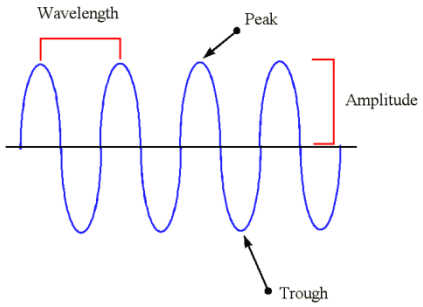
The Wave Nature of Light



- Waves are described by two factors
  - Wavelength (ƛ, lambda)
    - The distance between two repeated point
    - Measured in units of length
  - Frequency (ν, nu)
    - The number of crests that pass a fixed point in 1 second
    - Measured in hertz (s^{-1}) (cycles per second)

Electromagnetics & Waves

Relating Frequency and Wavelength

- The product of the frequency and wavelength of a wave will always equal its speed
  - speed = ƛν
  - speed = (m) (1/s) = m/s
  - c = ƛν
- The yellow light given off by a sodium vapor lamp used for public lighting has a wavelength of 589 nm. What is the frequency of the radiation?

Electromagnetics & Waves

Quantized Energy

- Energy can only be released (or absorbed) by atoms in “chunks” of some minimum size - Max Planck
- These chunks are termed quantum
  - Fixed amount
  - Photons
- The energy of a single photon is dependent on frequency
- $E = h\nu$
  - E = energy
  - h = Planck’s constant
    - 6.63×10^{-34} J-s (joule-seconds)
- Matter can only absorb or emit energy in multiples of $h\nu$

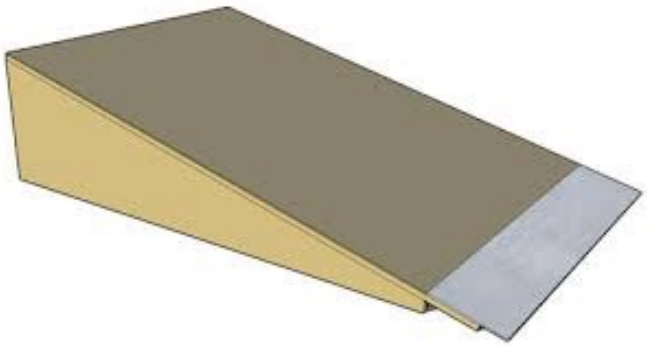
Electromagnetics & Waves

Quantized Energy and Photons

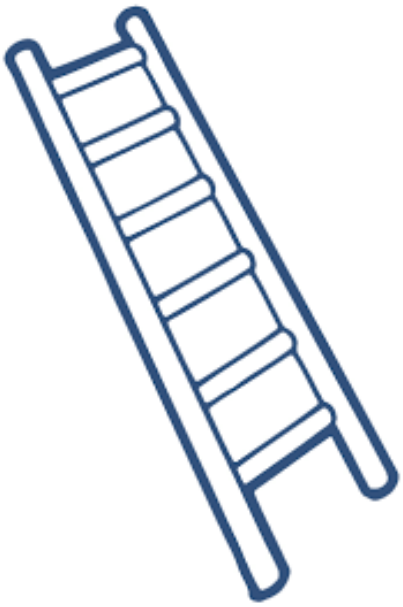
- Calculate the smallest increment of energy, that is, the quantum of energy, that an object can absorb from yellow light whose wavelength is 589 nm.

Electromagnetics & Waves

Continuous vs Quantized Energy



Continuous



Quantized

Electromagnetics & Waves

Homework

- 6.2/6.3/6.13/6.14/6.15/6.16/6.19/6.21/6.23/6.27/6.33