N16 – Atomic Structure and Periodicity

Waves and Math

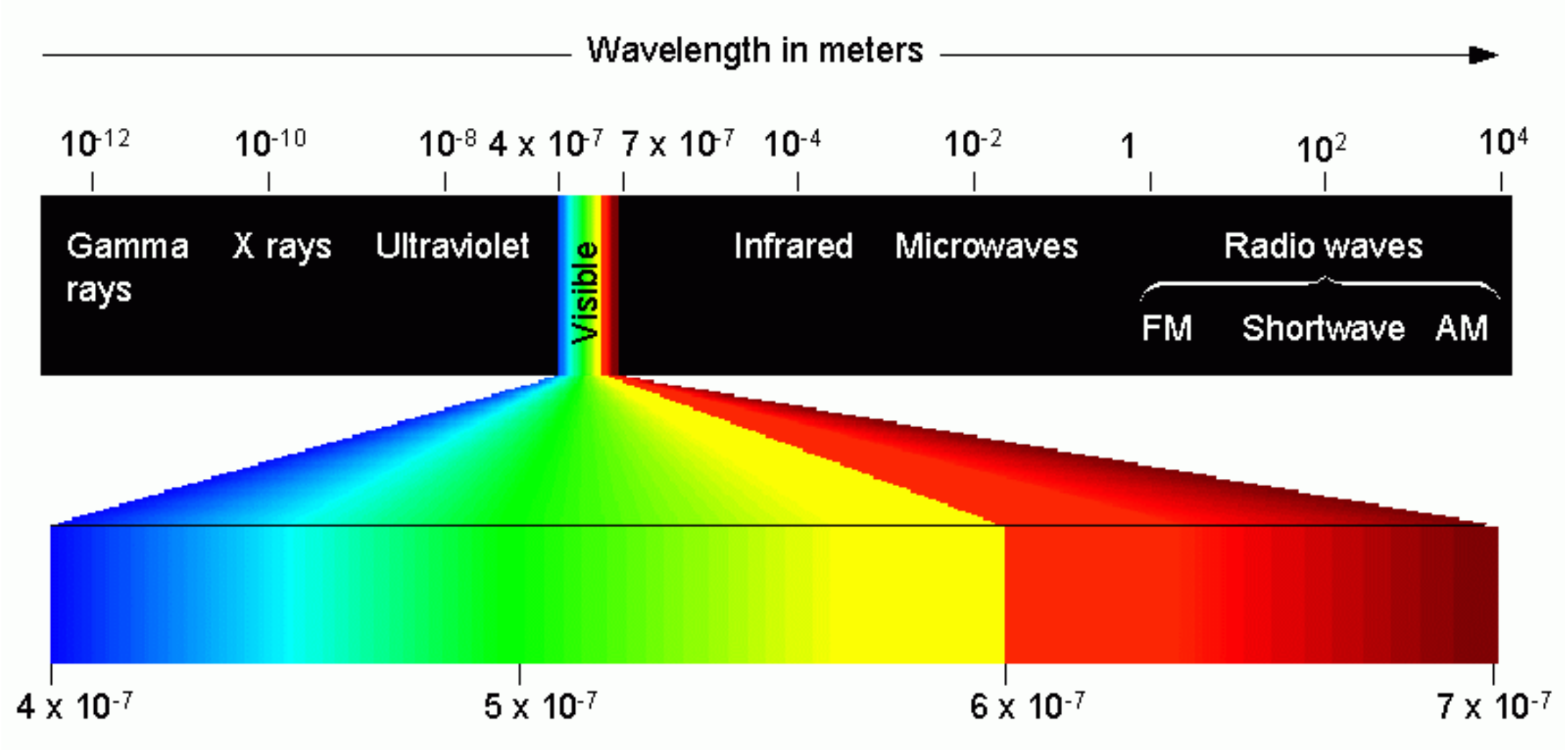
Link to YouTube Presentation: https://youtu.be/SWV-OEPv3R4

N16 – Atomic Structure and Periodicity

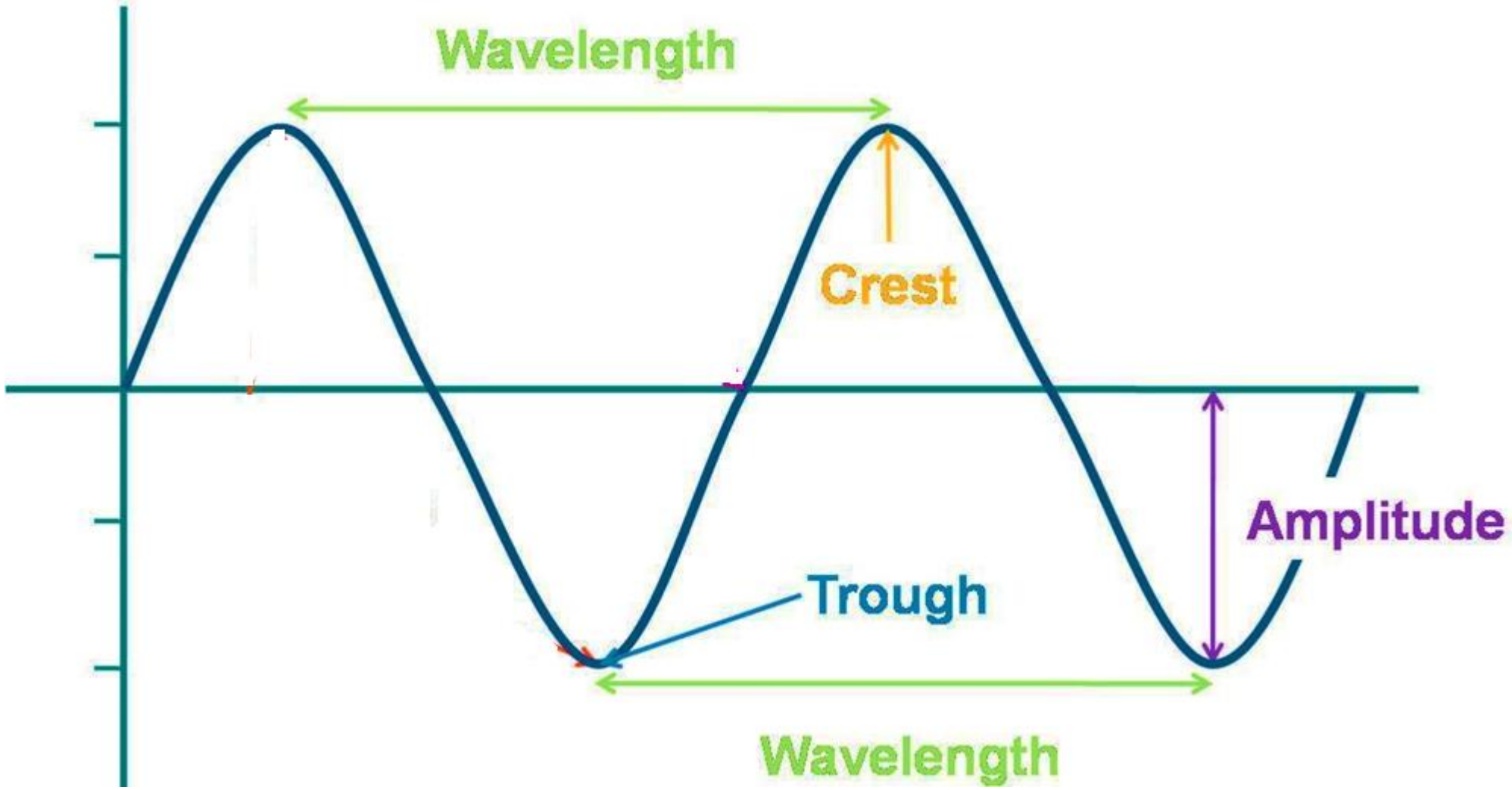
Waves and Math

Target: I can calculate things related to energy waves such as wavelength, frequency, and energy as they relate to chemistry concepts.

Types of Electromagnetic Radiation



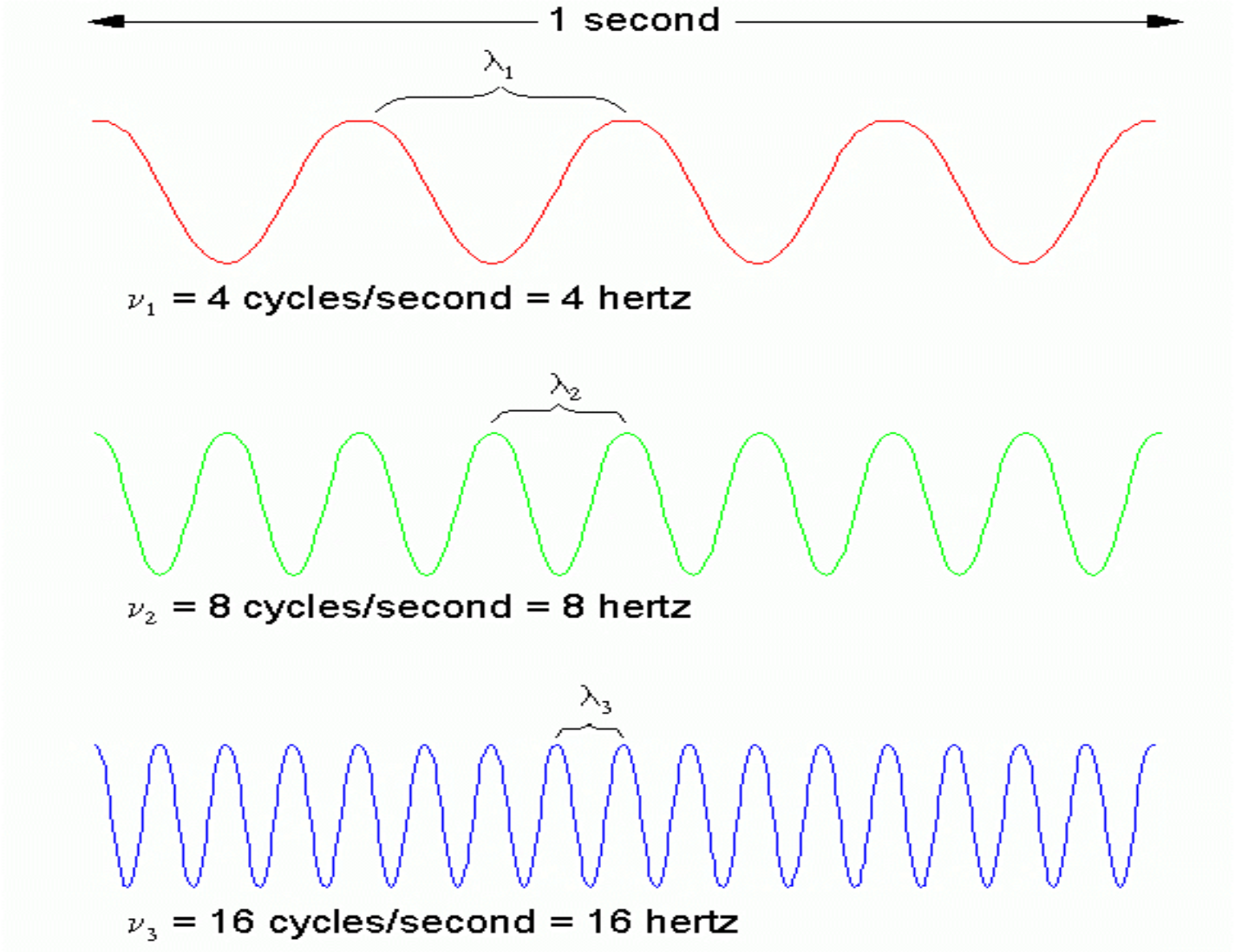
Parts of a Wave



Relationship between λ , ν and E

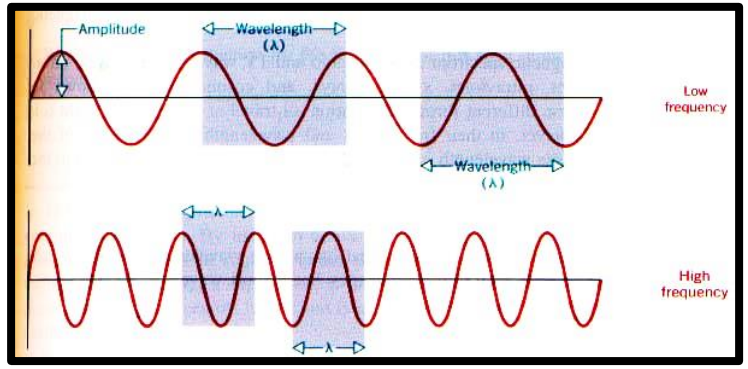
Long Wavelength = Low Frequency = Low ENERGY

Short Wavelength = High Frequency = High ENERGY



Electromagnetic Radiation

Propagates through space as a wave – moving at the speed of light



$$c = \nu\lambda$$

- c = **speed of light, a constant** (3.00 x 10^8 m/s)
- ν = **frequency, in units of hertz** (hz, sec^{-1})
- λ = **wavelength** (meters)

Careful! Sometimes in nm = x 10^{-9} m

Careful! Sometimes in MHz = x 10^6 Hz

Energy of EMR

Energy (E) is directly proportional to the frequency (ν) of the radiation

$$E = h\nu$$

E = **Energy, in units of Joules** ($kg \cdot m^2/s^2$)

h = **Planck's constant** (6.626×10^{-34} $J \cdot s$)

ν = **frequency, in units of hertz** (hz, sec^{-1})

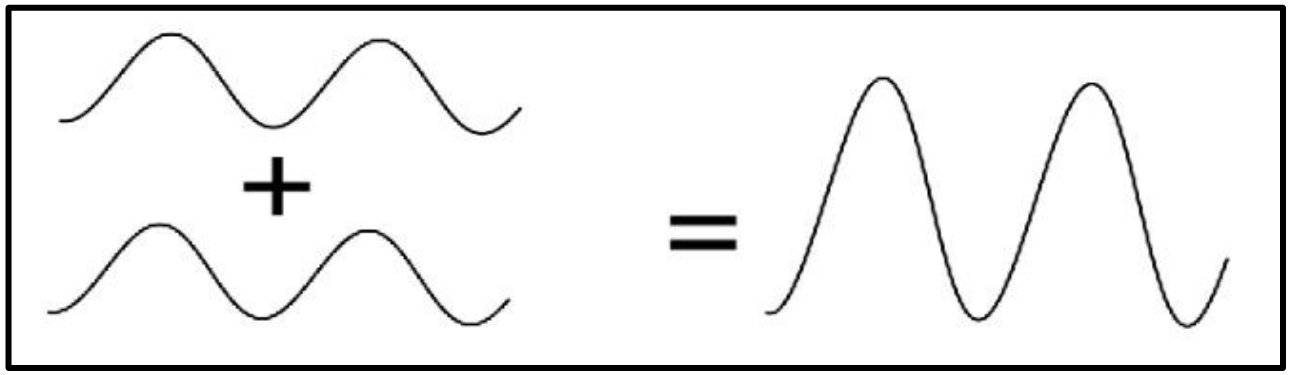
Game of Rearranging and Substitution!

Common Arrangements:

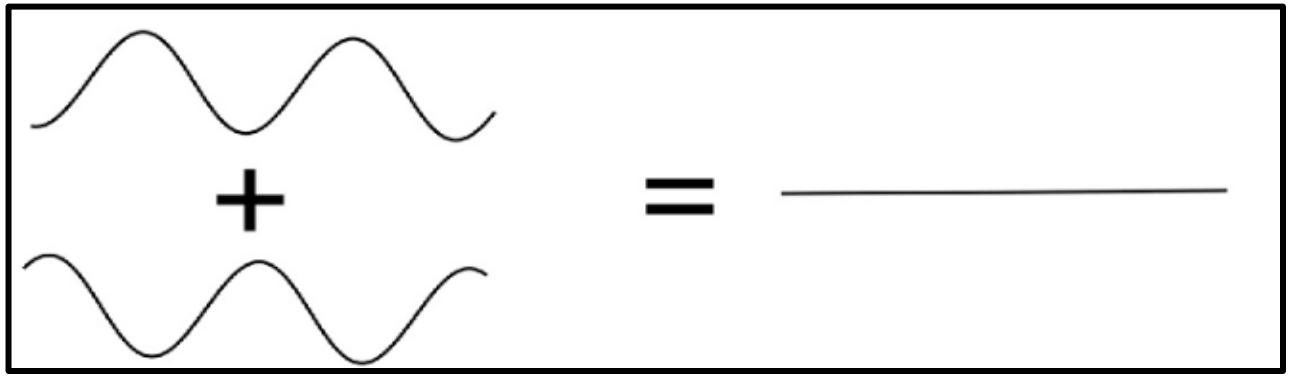
$c = \nu\lambda$	$E = h\nu$
$E = \frac{hc}{\lambda}$	$\lambda = \frac{hc}{E}$

Wave Interference

Linear Superposition – when waves come together the result is the sum of the waves



In Phase
Constructive Interference
Additive



Out of Phase
Destructive Interference
Cancellation

Game of Rearranging and Substitution!

Other Useful Equations:

de Broglie Equation

$$\lambda = \frac{h}{mv}$$

m = particle mass

Bohr Equation

$$E = -2.178\ x\ 10^{-18} J \left(\frac{Z^2}{n^2}\right)$$

Z = nuclear charge (atomic #)

n = energy level

Energy Change Between Two Energy Levels

$$E = -2.178\ x\ 10^{-18} J \left(\frac{Z^2}{n_{final}^2} - \frac{Z^2}{n_{initial}^2}\right)$$

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