Energy of Waves

Key formulas

$c = \nu\lambda$

$\mathbf{E = h\nu = hc/\lambda}$

$\mathbf{E = mc^2}$

$$\mathbf{E = RZ^2}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

Symbols and constants

Where

λ = wavelength

ν = frequency in hz or s^{-1}

c = speed of light = 3.00×10^8 m/s

h = Planck's Constant = 6.63×10^{-34} J s

R = Rydberg constant = 2.18×10^{-18} J

Z = Atomic number

$\mathbf{n_1}$ and $\mathbf{n_2}$ are quantum numbers

N = Avogadro's number = 6.02×10^{23} mol^{-1}

Units

s = second

nm = nanometer

kJ = kilojoule

hertz = hz = s^{-1}

Exercises: Do the following problems in your notebook. Show your calculations.

1. KXL a local am radio station broadcasts on a frequency of 750 kilohertz. (750,000 s^{-1}) Calculate the wavelength and energy of the radio wave emitted by KXL.
2. Ultra violet radiation from the sun is often quite intense in the range of 320-400 nanometers. Calculate the frequency and energy of UV radiation if its wavelength is 360 nm.
3. An argon laser emits light with a wavelength of 489 nm. Calculate its energy in kilojoules per mole.
4. A laser emits light with a frequency of 4.69×10^{14} s^{-1}. Calculate its energy in kilojoules per mole
5. In a spectra experiment, a line for the red line of hydrogen was recorded at 645 nm. Calculate its frequency and energy in kJ per mole.