

Question #41307 – Chemistry – Organic Chemistry

Question:

Calculate the wavelength (1/m), frequency (hz) and energy (kJ/mol) of visible light of wavelength 400 nm.

Answer:

To calculate all this values we will use the next formulas:

$$E = h\nu, \nu = c/\lambda$$

where **E** is for energy in J, **h** is for the Plank's constant ($h = 6,63 \cdot 10^{-34}$ J·s), **ν** is for the light frequency in Hz, **c** is for the speed of light ($3 \cdot 10^8$ m/s) and **λ** is for the wavelength of the light in meters.

- 1) Wavelength in 1/m.

$$1/400 \text{ nm} = 1/400 \cdot 10^{-9} \text{ m} = 1/4 \cdot 10^{-7} \text{ m} = 0.25 \cdot 10^7 \text{ 1/m} = \mathbf{2.5 \cdot 10^6 \text{ m}^{-1}}$$

- 2) Frequency **ν** in Hz.

$$\nu = c/\lambda = (3 \cdot 10^8 \text{ m/s}) / (4 \cdot 10^{-7} \text{ m}) = 0.75 \cdot 10^{15} \text{ Hz} = \mathbf{7.5 \cdot 10^{14} \text{ Hz}}$$

- 3) Energy in kJ/mol.

$$E = h\nu = 6,63 \cdot 10^{-34} \text{ J} \cdot \text{s} * 7.5 \cdot 10^{14} \text{ Hz} = 49.725 \cdot 10^{-20} \text{ J} = 4.9725 \cdot 10^{19} \text{ J} = \mathbf{4.9725 \cdot 10^{16} \text{ kJ}}$$