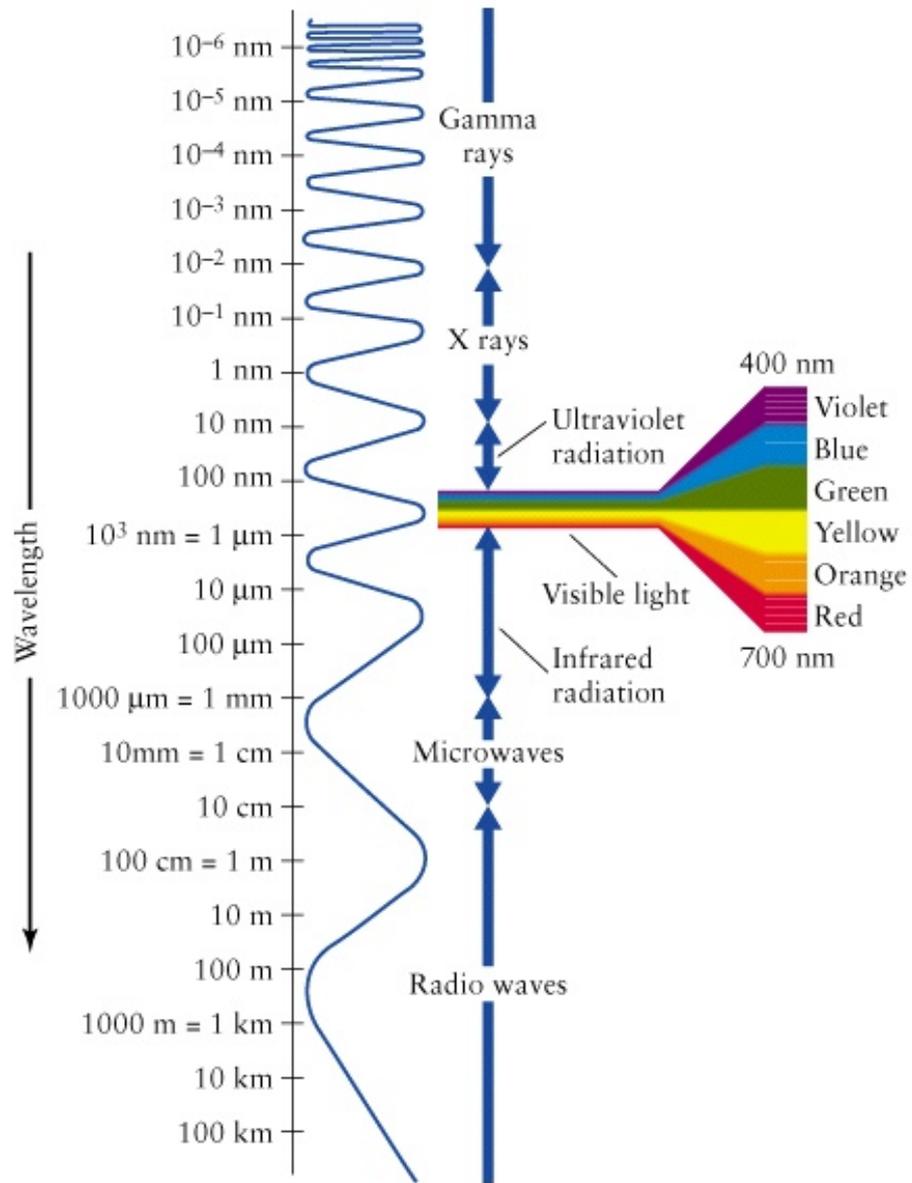


Light Calculations

Bromfield Honors Chemistry



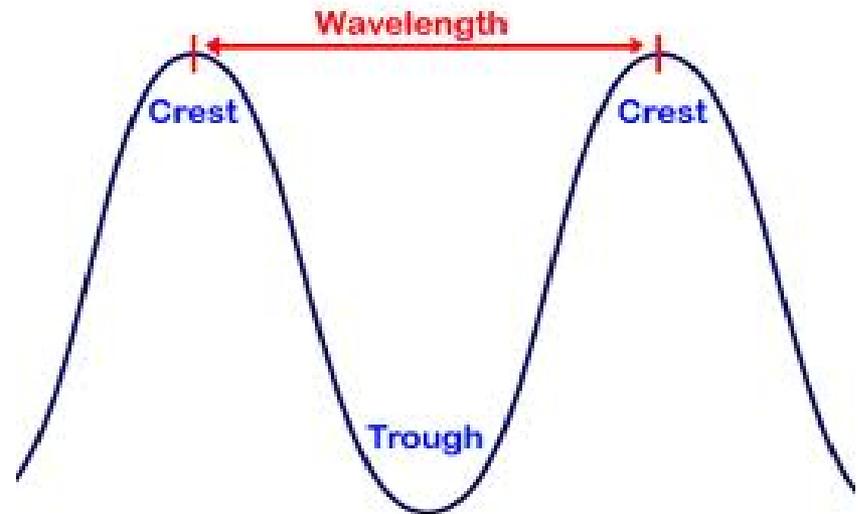
Electromagnetic Spectrum

Video: [Infrared](#)

Wavelength

- Distance between two successive crests (or troughs)

λ



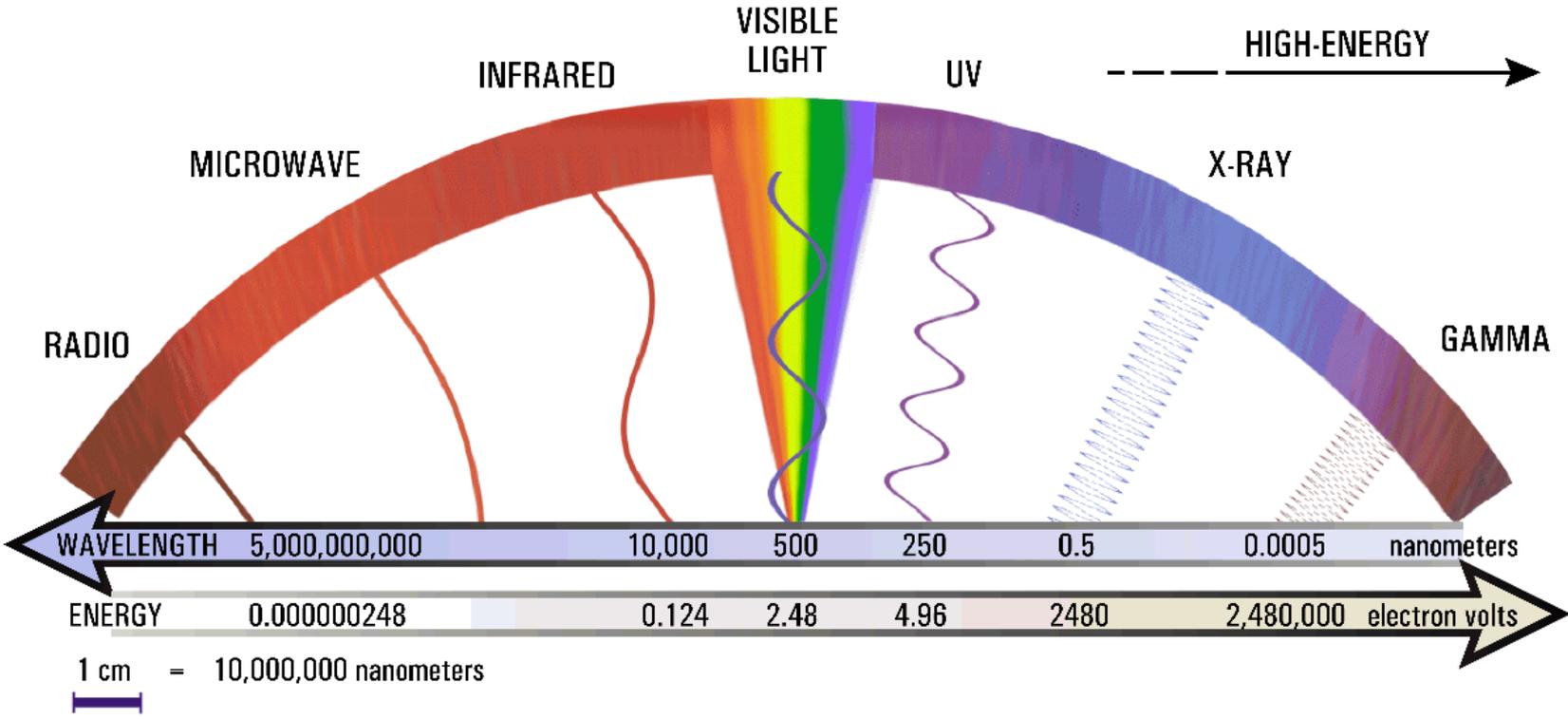
Frequency

- The number of crests that pass a certain point in space in a given amount of time
 - Cycles per second
 - Hertz (s^{-1})

- Animation

ν

Wavelength vs. Frequency



Equation

- $c = \lambda \nu$

- The speed of light, c , in a vacuum is constant:

- $3.00 \times 10^8 \text{ m/s}$

- Energy and wavelength are inversely proportional.

Which of the following waves has the longest wavelength?



Which of the following waves has the longest wavelength?



Which of the following waves has the highest frequency?



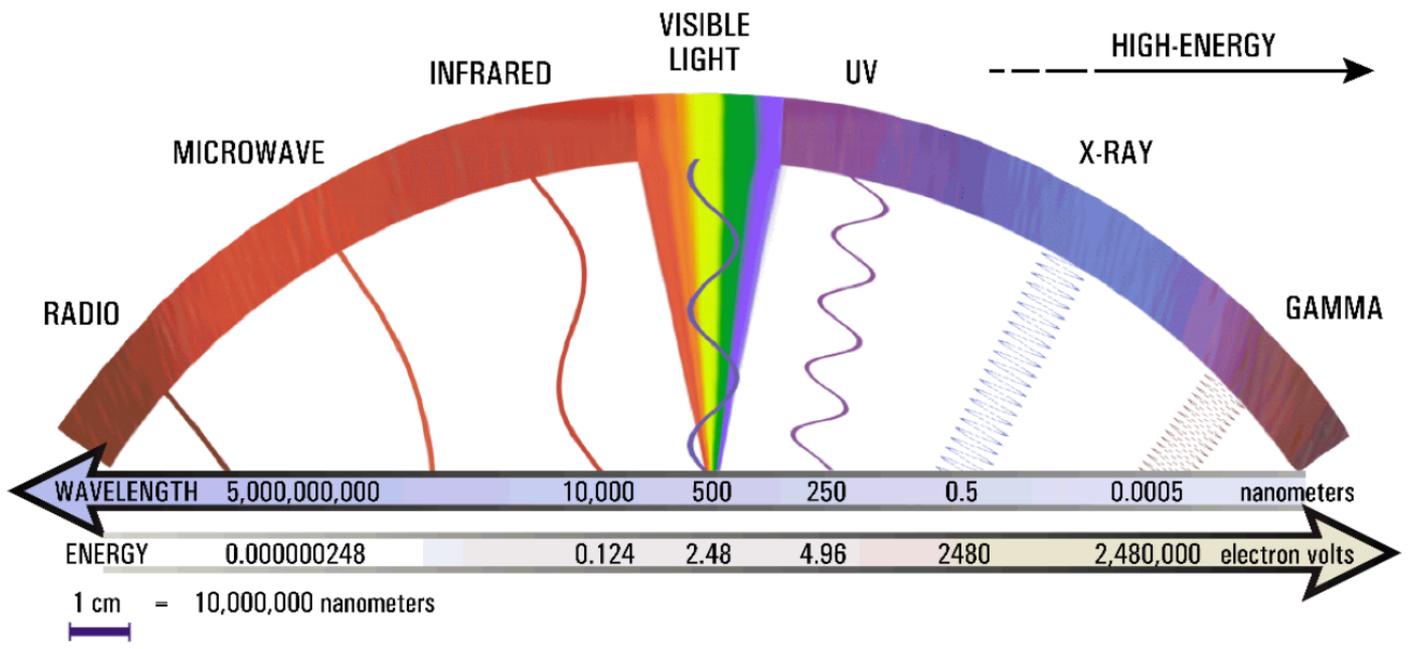
Which of the following waves has the highest frequency?



Example.

- A certain blue light has a frequency of 6.91×10^{14} Hz. What is the wavelength of the light?

Energy vs. wavelength



Energy video

- As wavelength increases....

- As frequency increases...

Which of the following waves has the lowest energy?



Which of the following waves has the lowest energy?



Energy

- $E = h\nu$

- Planck's constant

$$h = 6.626 \times 10^{-34} \text{ J s}$$

Max Planck

- Since $c = \lambda\nu$,
- $\nu = c/\lambda$

- Combine them:

$$E = \frac{hc}{\lambda}$$

Example

- The energy for a quantum of light is 3.42×10^{-19} J. What is the wavelength of this light?