"It's all about the electrons, baby!"

- Certain elements emit visible light when heated in a flame.
- Analysis of the emitted light revealed that an element's chemical behavior is related to the arrangement of the electrons in its atoms!

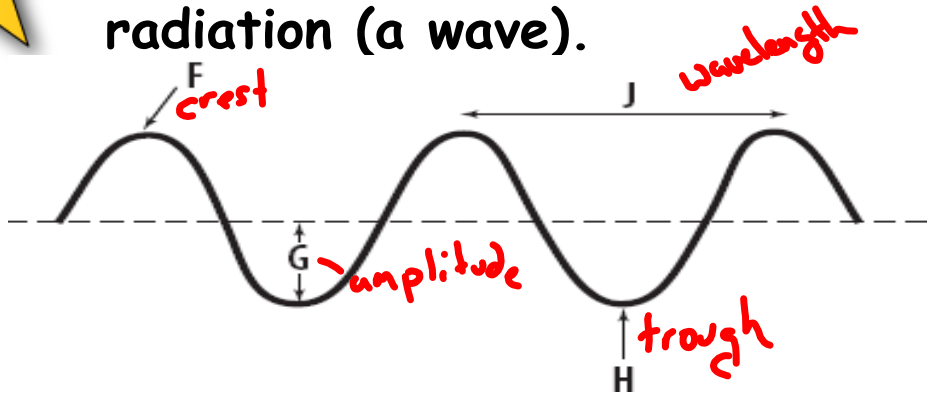
The Physics of Light

Sometimes light acts like a particle, sometimes like a wave

https://ed.ted.com/lessons/is-light-a-particle-or-a-wave-colm-kelleher

Wave Nature of Light

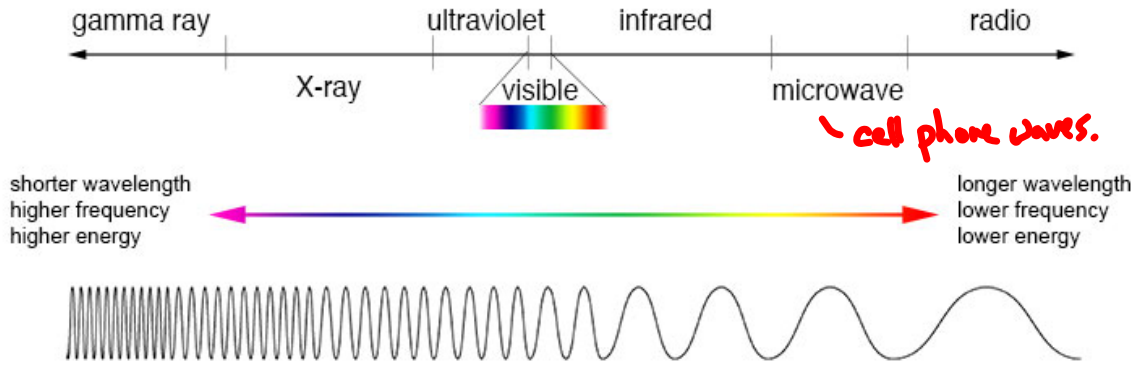
Visible light is a type of **electromagnetic radiation (a wave).**



wavelength (λ) (λ)

frequency (v) - wave speed.

wave speed (c) = 3.00×10^8 m/s



wavelength (λ) = m

frequency (v) Hz = $\frac{1}{s}$ = s^{-1}

wave speed (c) = 3.00×10^8 m/s

$c = \lambda v$

Calculating wavelength, frequency, and wave speed

1) What is the frequency of green light, which has a wavelength of 4.90×10^{-7} m?

$C = \lambda \nu$

$\frac{(3.00 \cdot 10^8 m/s)}{4.90 \cdot 10^{-7} m} = \frac{(4.90 \cdot 10^{-7} m)\nu}{4.90 \cdot 10^{-7} m}$ 3E 8 / 4.9E-7

$6.12 \cdot 10^{14}$ $1/s = s^{-1} = Hz$

Microwaves are used to transmit information. What is the wavelength of a microwave with a frequency of 3.44×10^9 Hz

8.72×10^{-2} m $C = \lambda \nu$

$\frac{3.00 \cdot 10^8 m/s}{3.44 \times 10^9 s^{-1}} = \frac{\lambda \cdot 3.44 \times 10^9 s^{-1}}{3.44 \times 10^9 s^{-1}}$

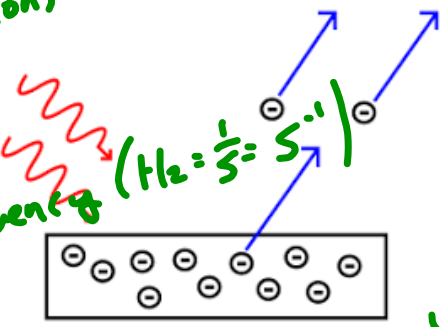
Particle Nature of Light

Quantum - minimum amount of energy gained or lost by an electron.

$E_{quantum} = h\nu$

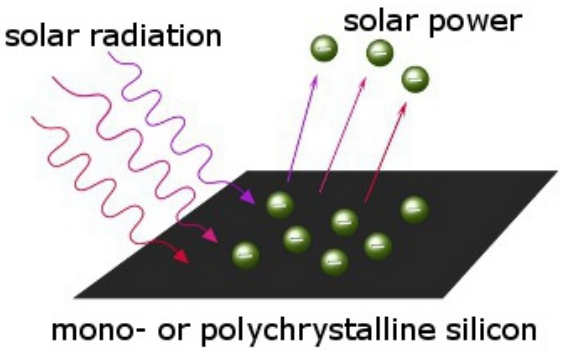
$E_{photon} = h\nu$

$h = 6.626 \times 10^{-34}$ Js



photoelectric effect

This explains the photoelectric effect!



$E_{quantum} = hv$

$E_{photon} = hv$

$h=6.626 \times 10^{-34} Js$

$E_{quantum} = h\nu$

$E_{photon} = h\nu$

$h = 6.626 \times 10^{-34} Js$

5) What is the energy of a type of radiation with a frequency of $6.32 \times 10^{20} s^{-1}$

$$E = h\nu$$
$$= (6.626 \cdot 10^{-34} J \cdot s)(6.32 \cdot 10^{20} s^{-1})$$
$$= 4.19 \cdot 10^{-13} J$$