PHOTOELECTRIC EFFECT

PRIOR KNOWLEDGE

- Frequency: f

- Wavelength: λ

- Speed: v

- Wave equation: v = f x λ

- Light waves speed: c

ELECTROMAGNETIC SPECTRUM

	Radio	Microwave	Infrared	Visible light	Ultraviolet	X-rays	Gamma-rays
Wave length (m)	10^3	10^{-2}	10^{-5}	10^{-6}	10^{-8}	10^{-10}	10^{-12}

Frequency (Hz)	10^4	10^8	10^{12}		10^{15}	10^{16}	10^{18}	10^{20}

red   orange   yellow   green   blue   indigo   violet
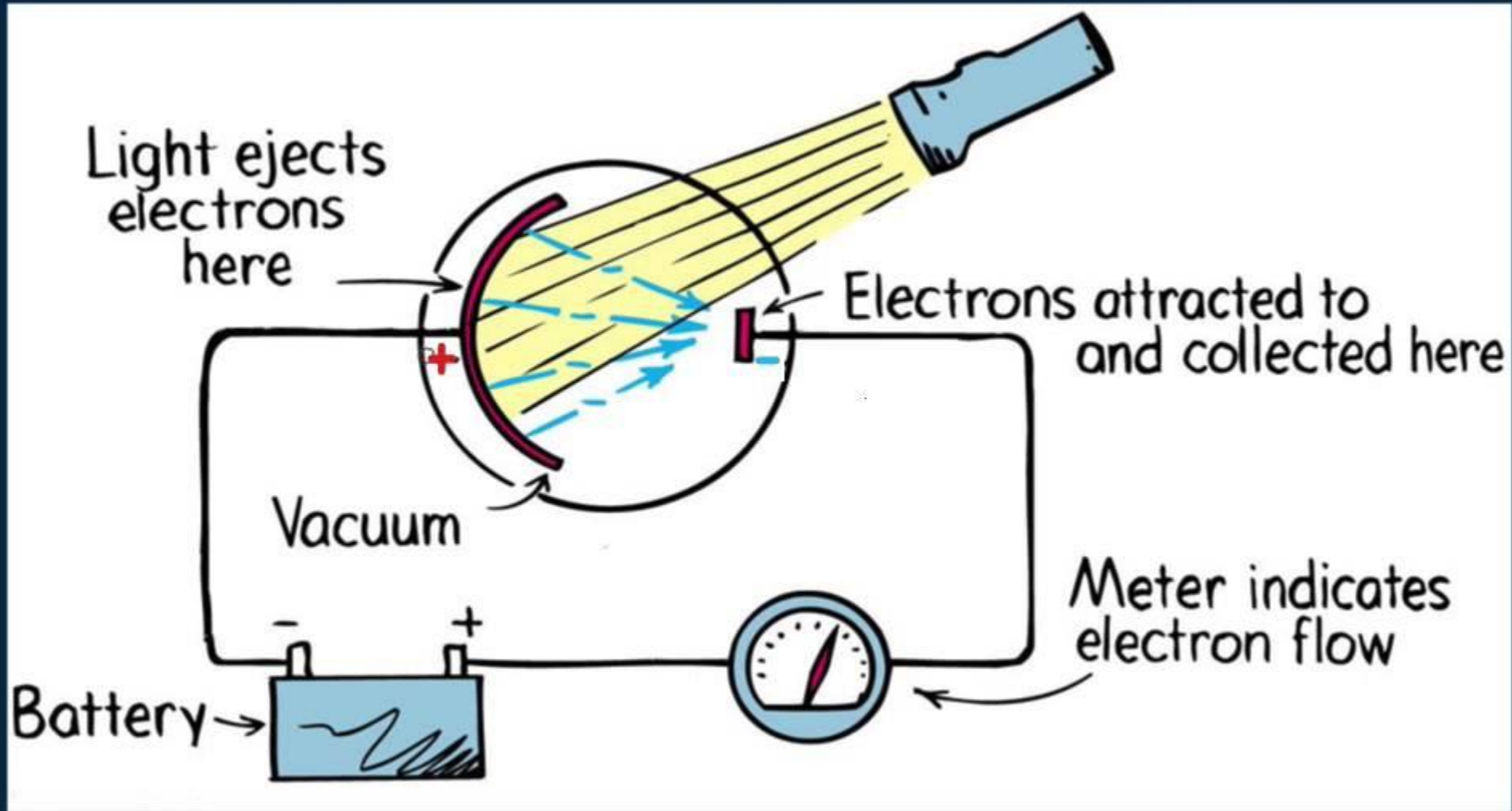
The electromagnetic spectrum
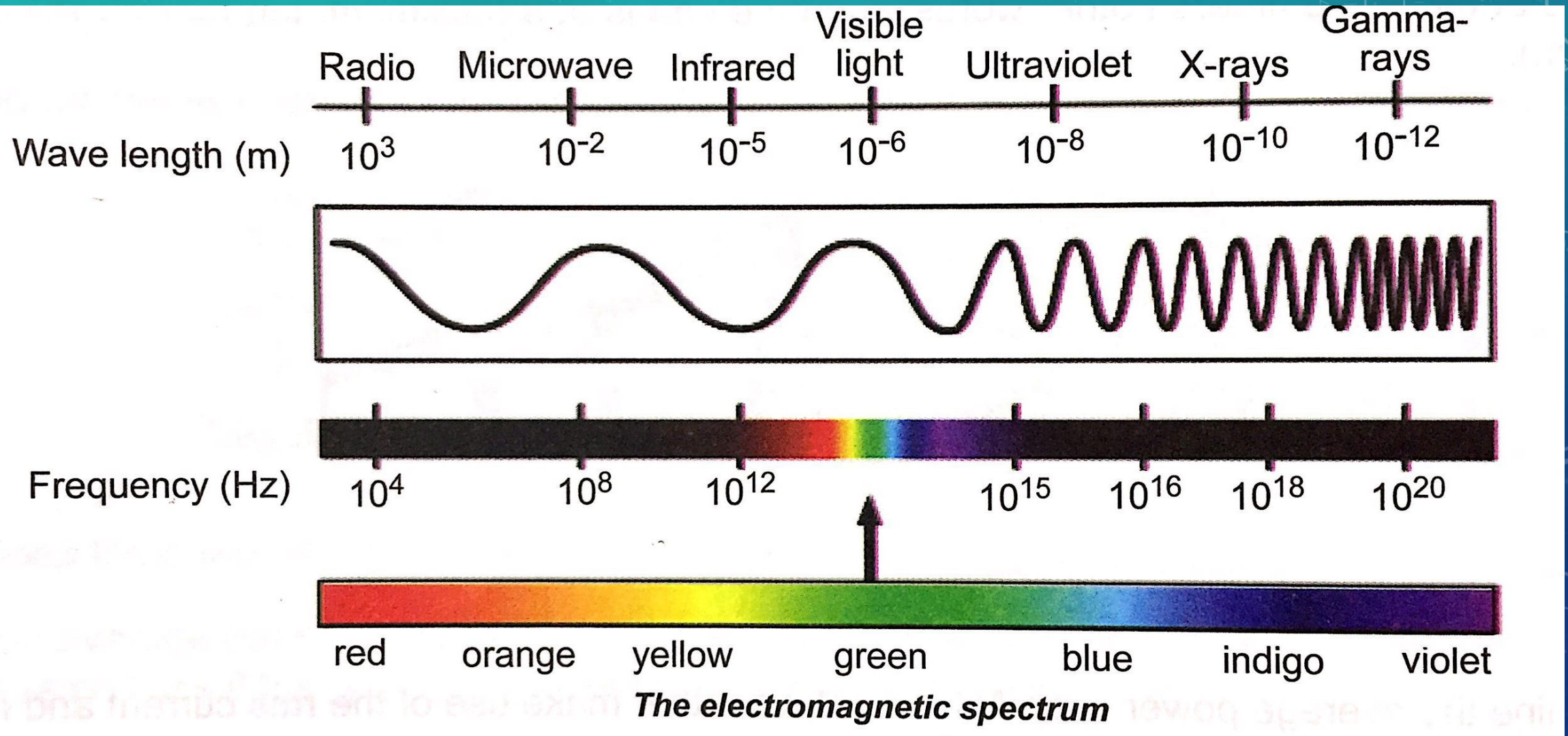
PHOTOELECTRIC EFFECT

- The process that takes place when light shines on a metal and it releases electrons(photo electrons)

PHOTOELECTRIC EFFECT

Light ejects electrons here

Electrons attracted to and collected here

Vacuum

Meter indicates electron flow

Battery
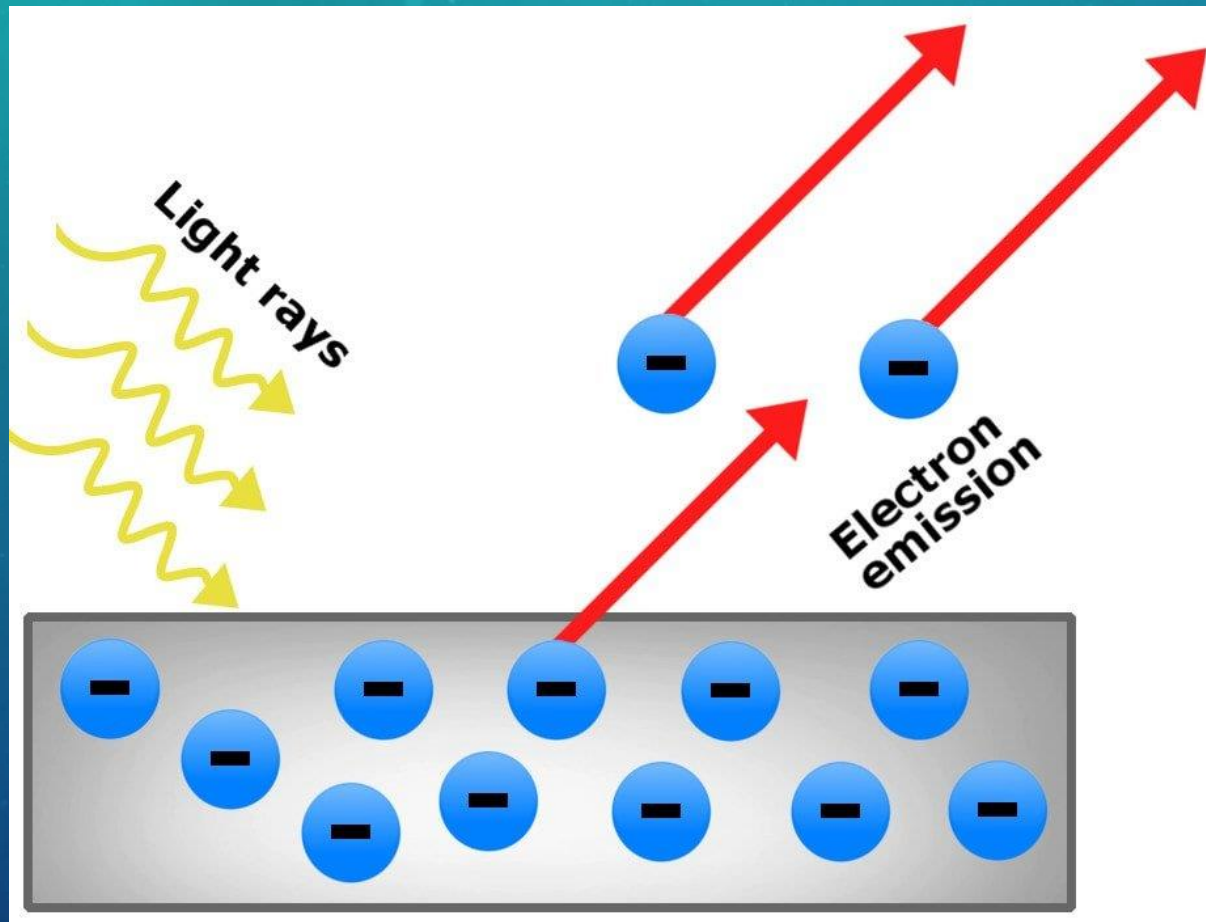
INFLUENCING FACTORS

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- 1. Light intensity: more electrons per second(number of electrons)
- Light intensity is directly proportional to current

- 2. Light frequency: determines if electrons will be released and determine the energy of the released electrons

CUT OFF FREQUENCY OF THE METAL

- **Threshold frequency/ cut off frequency (f_0):** each metal has lowest frequency at which electrons are just released.

- (incident light frequency must be **more** that threshold frequency)

- $$E = hf$$

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

- <u>**Workfunction (W_o):**</u> minimum energy needed for an electron to be released from the surface of a metal

- $$W_o = hf_0$$

- Energy of photons: Work function + max kinetic energy of photo electrons

- $E = W_0 + E_k$

- $hf = hf_0 + \dfrac{1}{2}mv^2$

12. Thabo gets a solar calculator (that uses the photoelectric effect to deliver an electrical current) as a gift. The metal used in the solar cells of his calculator has a work function of $3{,}58 \times 10^{-19}$ J.

  12.1 Calculate the wave length of the light that must be just enough to make the calculator work.

GRAPHS ITO PHOTOELECTRICEFFECT
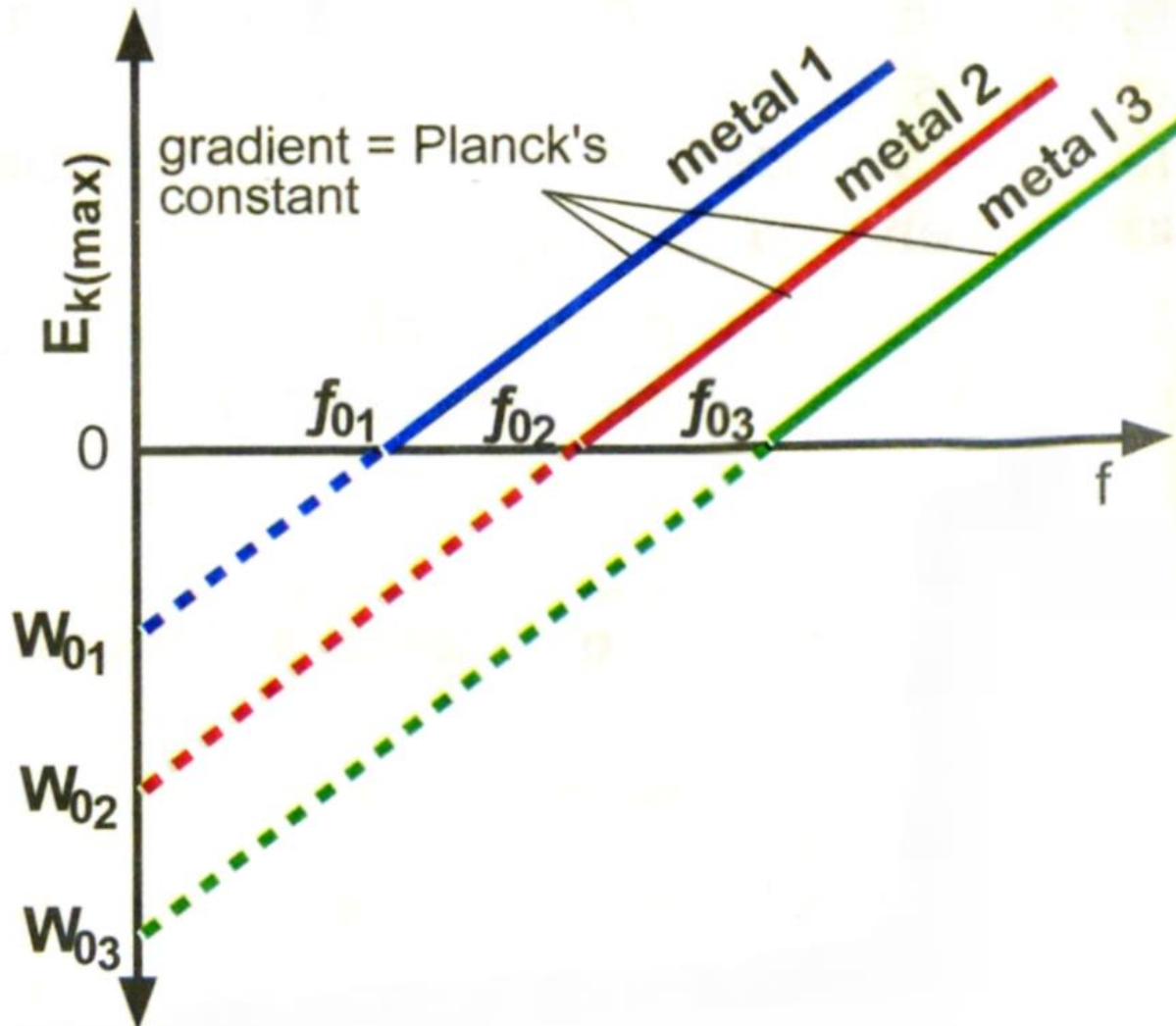
- Intercept on x-axes: f_0
- Intercept on y-axes: W_0
- Gradient: planck's constant