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QUANTUM THEORY REVIEW SHEET

Do you know **who** said this?

- Light is emitted in discrete bundles called quanta. PLANCK
- A particle of light will be called a photon. EINSTEIN
- Photons have momentum. COMPTON
- The positive charge in an atom is located at a central dense core. RUTHERFORD
- Atoms only emit light when electrons fall from a higher to lower energy level. BOHR

What is meant by the term...?

threshold frequency - min freq --- to emit e^- from metal.

photon - particle of light

photoelectric effect light shines on metal causes e^- to be ejected

Compton effect photon collides with e^- & scatters; showed photons have momentum

Can you **calculate**...?

the energy of a photon if you know its frequency or wavelength,

Ex1 What is the energy (in eV and Joules) of a photon with a frequency of 5.0×10^{14} Hz?

$$E = hf = 3.13 \times 10^{-19} \text{ J} = 2.1 \text{ eV}$$

Ex2 What energy does a photon of wavelength 4.0×10^{-7} m possess?

$$E = \frac{hc}{\lambda} = 4.97 \times 10^{-19} \text{ J}$$

the energy in eV of something if you know its energy in Joules and vice versa

Ex3. How many eV of energy is possessed by a photon with 4.8×10^{-19} J of energy?

$$\underline{3.0 \text{ eV}}$$

the momentum of a photon if you know its frequency or wavelength

Ex4 What momentum does a red photon of wavelength 6.5×10^{-7} m have?

$$p = \frac{h}{\lambda} = \underline{1.02 \times 10^{-27} \text{ kg m/s}}$$

Heisenberg's Uncertainty Principle- You cannot know with certainty both the momentum and position of an electron.

NOTE: Since light exerts pressure (has momentum!) **seeing** an electron means **moving** it.