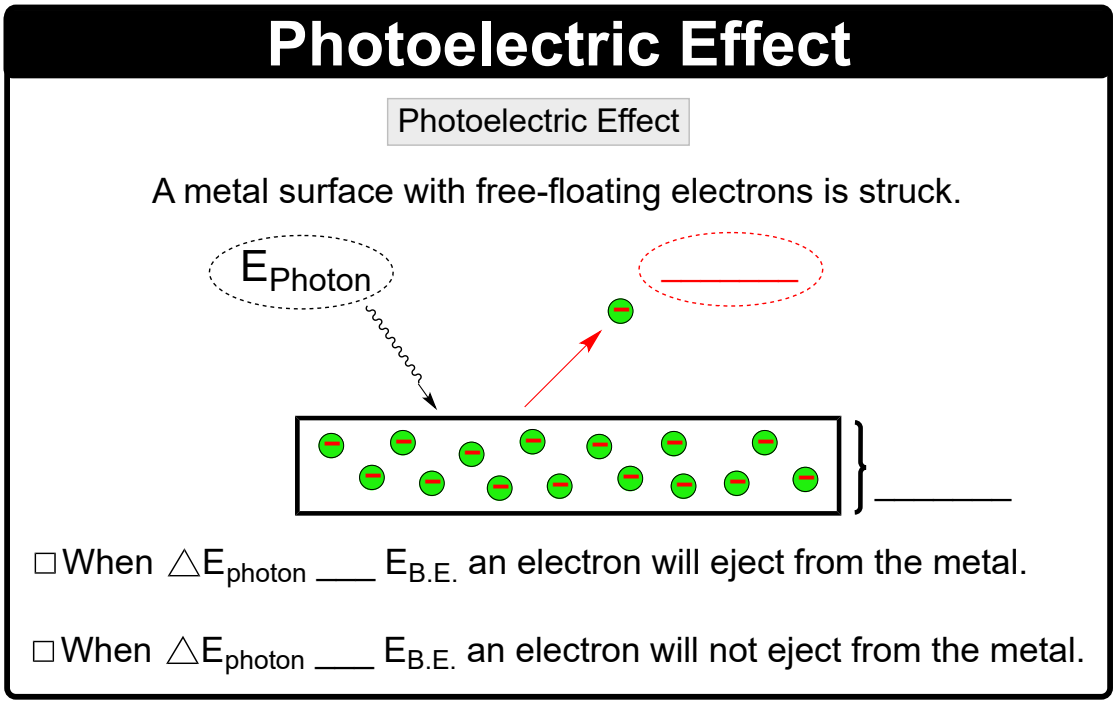
CONCEPT: PHOTOELECTRIC EFFECT

- Einstein theorized that if a photon met an energy requirement and struck a metal surface then electrons could be ejected.



□ **Binding Energy ($E_{B.E.}$)**: The minimum amount of energy needed to eject an electron from a metal.

- Also known as the _____ *frequency* (*work function)* of the metal.

□ **Kinetic Energy ($E_{K.E.}$)**: The energy an object has due to its speed or motion.

□ The Photoelectric Effect Formula: **Total Energy (E_{Photon})** = _____ + _____ (surplus energy)

EXAMPLE: The binding energy of electrons on a metal surface are 7.15×10^{-19} J. If an outside energy source with 4.33×10^{-17} J strikes the metal surface, what would be the kinetic energy of an ejected electron?

CONCEPT: PHOTOELECTRIC EFFECT

Photoelectric Effect Formula Expanded

● The formula expands when we are given the additional variables of _____ and _____.

Photoelectric Effect

Photoelectric Effect Formula (Expanded)

The energy of a photon can be seen as:

$$E_{photon} = \_\_\_\_\_ + \_\_\_\_\_$$

□ E_{photon} = ___ • ___

□ $E_{B.E.}$ = binding energy of the metal.

□ $E_{K.E.} = \frac{1}{2}$ ___ • ___

□ 1 electronvolt (eV) = _____ J

□ If energy is given in **eV** then we must use the **conversion factor** to change units into **Joules**.

EXAMPLE: When the surface of metal is exposed to photons at a frequency of 7.13×10^{16} s^{-1}, electrons are emitted with a maximum kinetic energy of 6.30×10^{-19} J. Calculate the work function of the metal.

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PRACTICE: A metal with a threshold frequency of 2.15×10^{15} s^{-1} emits an electron with a velocity of 7.03×10^{6} m/s when radiation of 4.88×10^{15} s^{-1} strikes the metal's surface. Calculate the mass of the electron.

PRACTICE: An ultraviolet photon with a wavelength of 320 nm strikes a metal surface. The emitted electron has a kinetic energy of 3.0×10^{-2} eV. What is the binding energy of the electron in kJ/mol? 1 electron volt (eV) = 1.602×10^{-19} J.