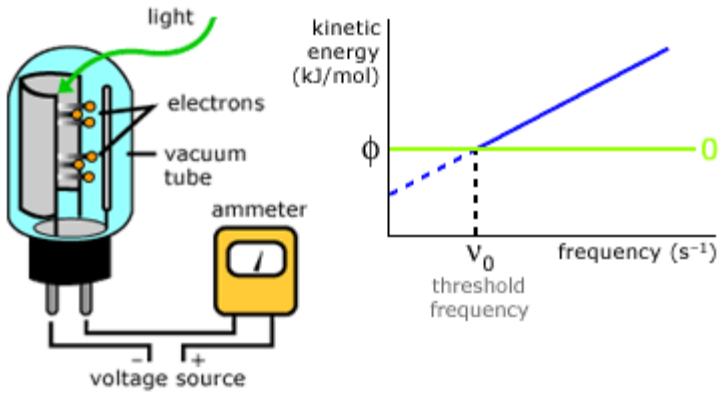
The Photoelectric Effect

key concepts:

- Shining **light** on a **metal** ejects **electrons**, increasing the **current** registered on an **ammeter**.
- Albert Einstein extended Planck's **quantum** theory to explain the **photoelectric effect**.

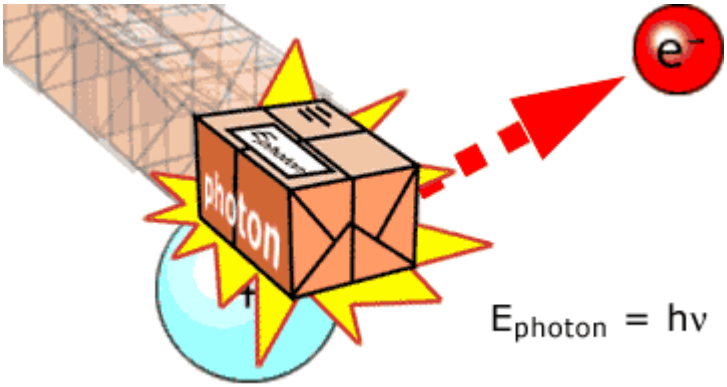


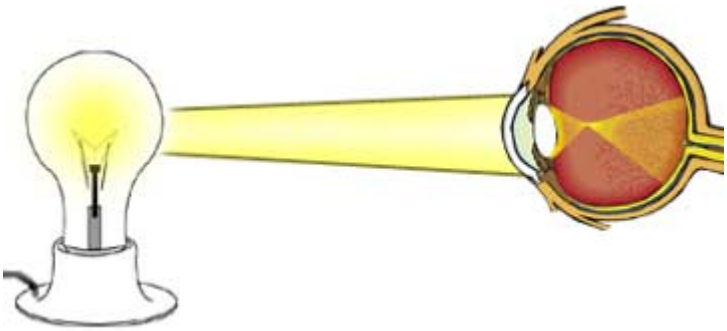
In the photoelectric effect, shining light on a metal ejects electrons, increasing the current registered on an ammeter.

Increasing the **intensity** of the light causes more electrons to be ejected, but does not change the **kinetic energy** of the ejected electrons.

However, increasing the **frequency** of light causes the electrons to be ejected with higher kinetic energies.

Below the **threshold frequency (ν_0)**, no electrons are ejected from the metal.





In 1905, Albert Einstein extended Planck's quantum theory to explain the photoelectric effect.

Einstein suggested that light was made up of discrete packets of **energy**, now called **photons**.

The energy of a photon (E_{photon}) is equal to **Planck's constant (h)** times the frequency of the photon (ν).

In the photoelectric effect, an electron is only ejected if the photon has enough energy to overcome the attraction between the electron and the **nucleus**. If the photon has more energy than is required, the leftover energy is converted to kinetic energy.

The energy required to eject an electron from a metal is equal to the energy of a photon of light at the threshold frequency (ν_0). This energy is the **work function (Φ)** of the metal.

Einstein's explanation of the photoelectric effect meant that light could be thought of as being made up of particles which are capable of moving electrons. This helped to explain other light-driven reactions, such as vision.