Summary of experimental results, photoelectric effect

- When light shines on a clean metal surface, electrons can be emitted from the surface.
- Only light with frequency greater than some threshold (minimum frequency) causes ejection of electrons.
- At frequencies high enough to eject electrons, the number of electrons ejected (the measured electric current) depends on intensity of the light.
- The kinetic energy of the ejected electrons increases with the frequency of the light but does not depend on the intensity of the light.

Einstein's theoretical interpretation

- The quantized energies that Planck postulated for vibrations that create blackbody radiation can be applied to light; that is, light occurs in quanta.
- Light striking the metal surface is a stream of particles (later called **photons**) whose energies are proportional to their frequencies, according to Planck's formula, $E = h\nu = hc/\lambda$.
- One photon causes ejection of one electron.
- Because electrons at a metal surface are attracted by atomic nuclei in the metal, freeing an electron requires that an incident photon have enough energy to overcome the attraction. This explains the threshold frequency because photon energy is proportional to frequency.
- Intensity of light is proportional to the number of photons; the number of ejected electrons increases with intensity, because the more incoming photons, the more collisions with and ejections of electrons.
- Because the photon energy increases with frequency, photons with higher frequencies impart greater kinetic energy to the escaping electrons.