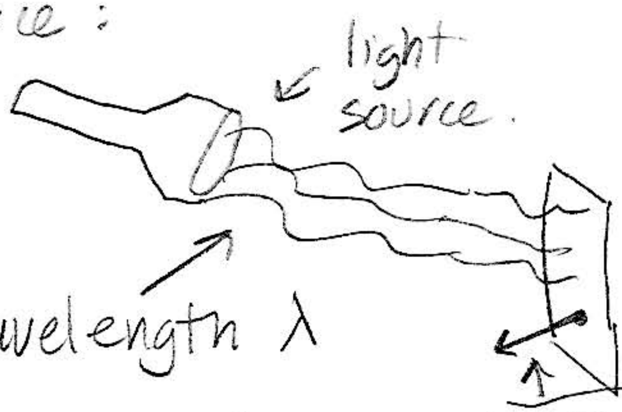
it can happen that nothing exits the surface.

However, if the frequency of the light is sufficiently high, electrons are ejected from the surface:



frequency: $\lambda \nu = c$

$\nu = \frac{c}{\lambda}$

e^- ejected, immediately
→ when ν is sufficiently high

How high? Depends upon the the material

Lithium: $\nu_{min} = 7 \cdot 10^{14}$ Hz

Copper: $\nu_{min} = 11 \cdot 10^{14}$ Hz

or wavelength: Lithium $\lambda_{max} = 430$ nm

Copper $\lambda_{max} = 280$ nm

Could take light of $\lambda = 630$ nm, of arbitrarily high intensity; e^- will not

so $$eV = h(\nu - \nu_{min})$$
$$V_0 = \frac{h}{e}(\nu - \nu_{min})$$

actually measure h/e, but e is known.

Resolution: • Light of frequency ν comes in packets of energy $h\nu$ - photons:

$\nu_{min} = 7 \cdot 10^{14}$ s, $\quad h\nu_{min} = 6.6 \cdot 10^{-27}$ erg-s $\cdot 7 \cdot 10^{14} \frac{1}{s}$

min for lithium $\qquad \simeq 4.6 \cdot 10^{-12}$ erg

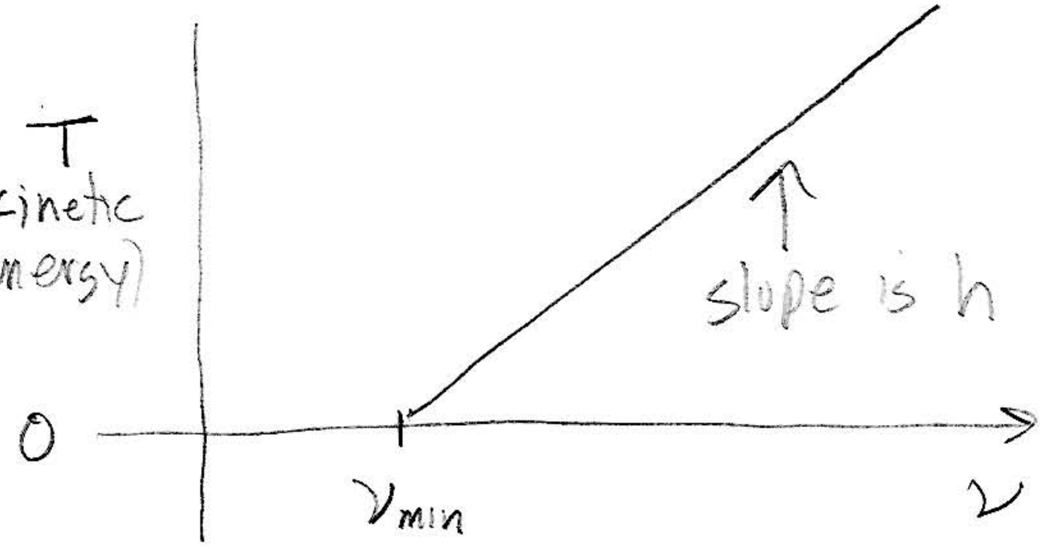
1 electron-volt $= 1.6 \cdot 10^{-12}$ ergs

$$h\nu_{min} = 2.9 \text{ eV}$$

Interpretation: each electron is bound in lithium with energy 2.9 eV. A photon must transfer this energy at least to liberate an electron; excess photon energy then goes into electron.

jump out (at least immediately)

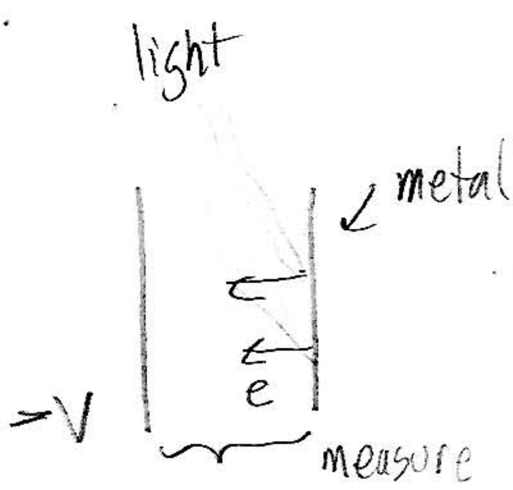
Can measure the energy of the electrons that are promptly ejected; as a function of frequency:



$T \propto \nu \quad , \quad = h(\nu - \nu_{min})$

yes, Planck's Constant!
<u>Same</u> as the one in the Black Body Spectrum.

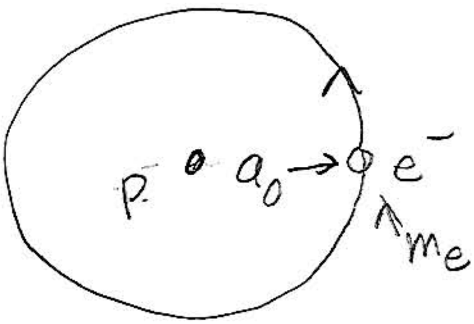
T measured:



when $I = 0$

$eV_0 = T$

The Bohr Atom



$$\underbrace{m_e \frac{v^2}{a_0}}_{m \cdot a} = \underbrace{\frac{e^2}{a_0^2}}_{\text{electrostatic force.}}$$

Bohr ansatz:

$$\text{action variable} \left(\begin{matrix}\text{ground}\\ \text{state}\end{matrix}\right) = L = m_e v a_0 = \frac{h}{2\pi}$$

why 2π?

works...

$$\hbar \equiv h/2\pi$$

$$v = \frac{\hbar}{a_0 m_e}$$

so $$m_e \frac{1}{a_0} \cdot \frac{\hbar^2}{a_0^2 m_e^2} = \frac{e^2}{a_0^2}$$

$$a_0 = \frac{\hbar^2}{m e^2} = \frac{h^2}{(2\pi)^2 \cdot m \cdot e^2}$$

$$\cong \frac{(7 \cdot 10^{-27})^2}{4 \cdot 10 \cdot 10^{-27}\,\mathrm{gm} \cdot (5 \cdot 10^{-10})^2}$$

$$\boxed{a_0 \simeq \frac{5 \cdot 10}{10^2} \cdot \frac{10^{-27}}{10^{-19}} = 5 \cdot \frac{10^{-28}}{10^{-19}} = \frac{1}{2} \cdot 10^{-8}\,\mathrm{cm}}$$