34 Photoelectric
Prelab

1) In 3-5 sentences, explain the photoelectric effect.

When light shines on a material, free charges - typically electrons - are emitted. These electrons - called photoelectrons - must have kinetic energy equal to those of the incident photons ~~due to conservation of energy~~. The ~~incident energy is dependent~~ minus the material's work function, the work function represents the energy required to emit the photoelectron, so our theory accounts for conservation of energy. Using this experimentally shows that increasing the frequency of light increases its energy. ~~It is based on the~~ Using this Einstein was able to derive $E=h\nu$.

2) In this lab, we are using the photoelectric effect to measure the stopping potential and the work function

3) Derive $V=h\frac{\nu}{e}-\Phi\frac{1}{e}$ from first principles.

$U=\frac{kQq}{r}$ ~~$=qEd=q\Delta V$~~ $\vec{E}=k\frac{Q}{r^2}\hat{r}$ so $U=q\vec{E}\cdot\vec{r}$

$V=Er$ so $U=eV$ $KE=h\nu$

so $\Phi=E=KE+U=-eV+h\nu$ becomes $eV=h\nu-\Phi$
which becomes $V=h\frac{\nu}{e}-\Phi\frac{1}{e}$.

4) Classically, physicists predicted that the energy of incident light waves would ~~be dependent~~ increase with amplitude and ~~decrease with~~ be independent of frequency, but the reverse turned out to be true. Similarly, the classical prediction ~~would have been for~~ was that the current would increase with frequency, since frequency was thought to correspond to the rate of photoelectron emission, and be independent of amplitude. However, increasing amplitude increases current ~~and~~ ~~does not affect~~ changing frequency doesn't affect current. These differences are because classically light is treated only as a wave, ~~but~~ whereas it often interacts (as it does in this case) as a beam of particles (photons).

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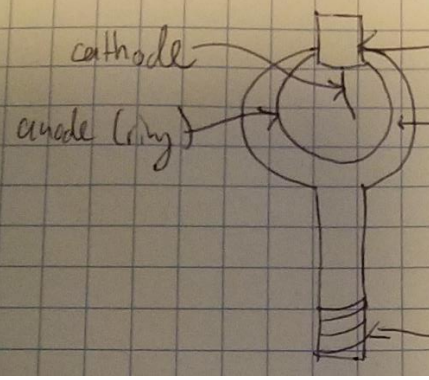
5)



brass cap so we can connect cathode

Glass Bulb (evacuated)

E14 base. So we can connect the anode.