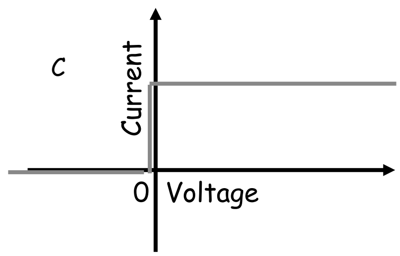
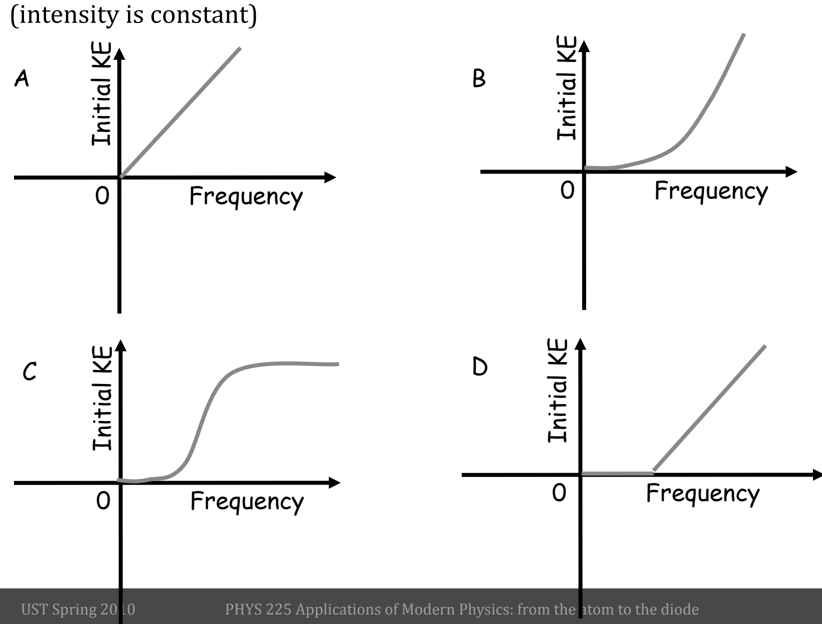
If light is a wave…

C



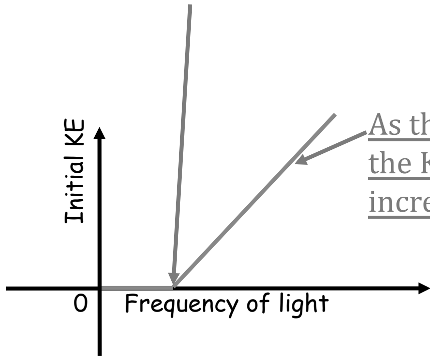
# of electrons / sec = constant

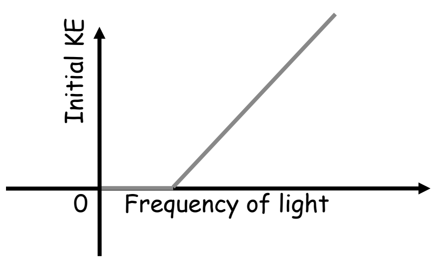
Given the previous assumptions, predict what happens to the initial KE of the electrons as the *frequency* of light changes?
(intensity is constant)

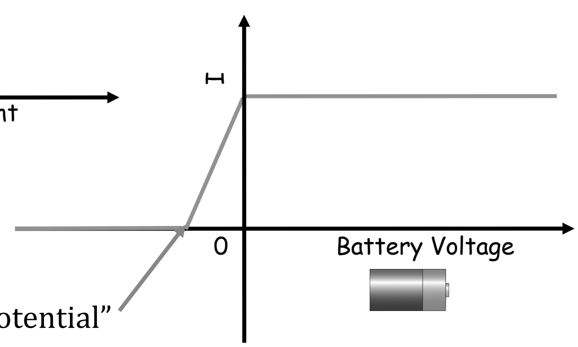


There is a minimum frequency below which the light cannot kick out electrons… even if wait a long time

As the *frequency* of light increases, the KE of electrons being popped off increases.

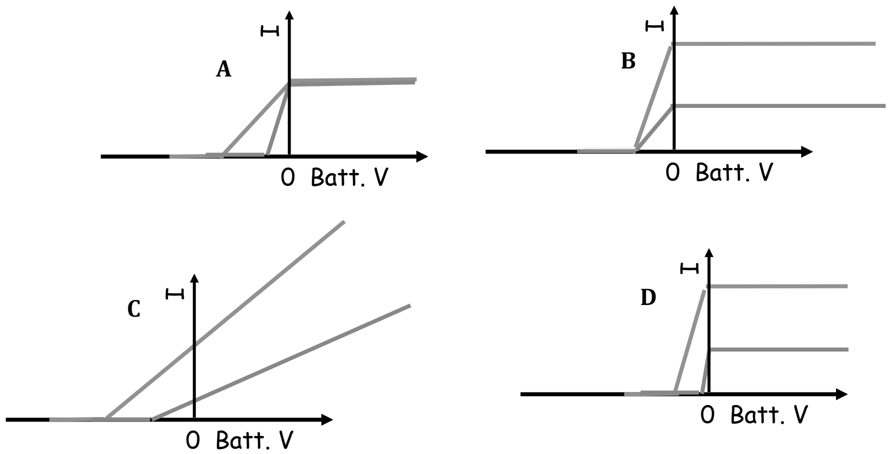






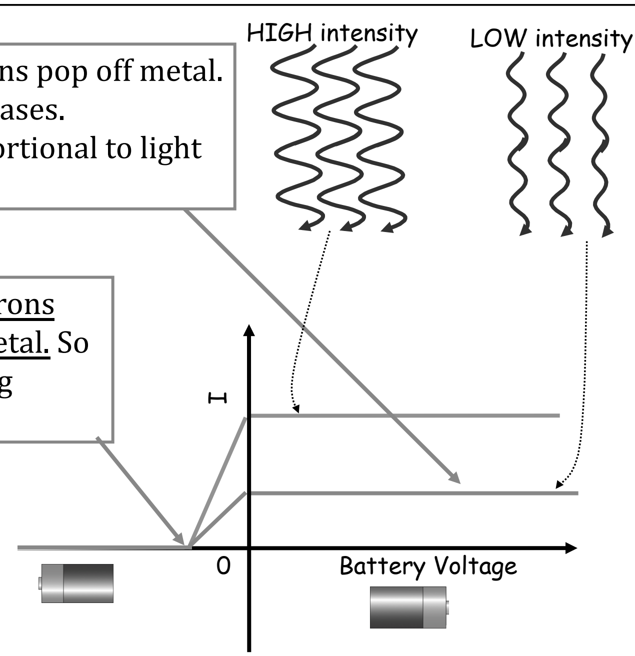
what happens if we change the metal?

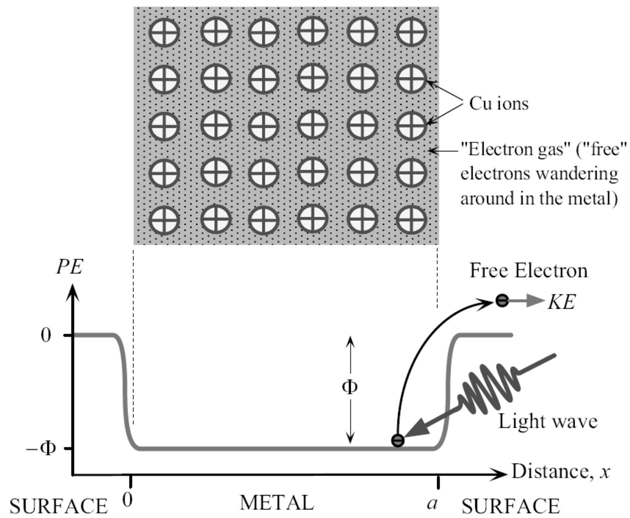
Which graph represents **low** and **high** intensity curves?



Fewer electrons pop off metal.
Current decreases.
Current proportional to light intensity.

<u>Same KE electrons popping off metal.</u> So same "stopping potential".





From *Principles of Electronic Materials and Devices, Third Edition*, S.O. Kasap (© McGraw-Hill, 2005)

Photoemitted electron's maximum *KE*:

$$KE_{\max} = h\upsilon - \Phi_0$$

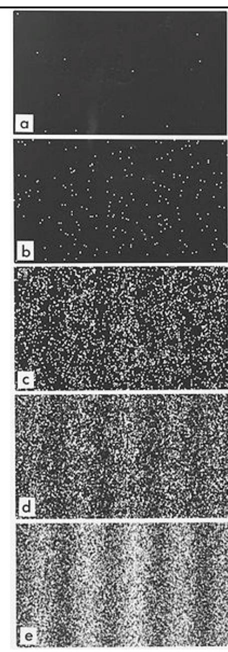
Work function

From *Principles of Electronic Materials and Devices, Third Edition*, S.O. Kasap (© McGraw-Hill, 2005)

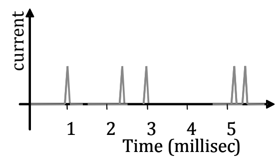
So, is light a wave or a particle?

Yes!

What if you did a double slit experiment with only one photon going through at a time?



Application: Photomultiplier tubes



http://www.phy.duke.edu/~bw30/sat_acad/overview.html

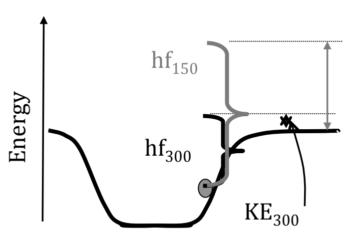
What would be the best choice of these materials to make this out of?

	Φ
A. Platinum	6.35 eV
B. Magnesium	3.68 eV
C. Nickel	5.01 eV
D. Lead	4.14 eV
E. Sodium	2.28 eV

A photon at 300 nm will kick out an electron with an amount of kinetic energy, KE_{300}. If the wavelength is halved to 150 nm and the photon hits an electron in the metal with same energy as the previous electron, the energy of the electron coming out is

A. less than ½ KE_{300}.
B. ½ KE_{300}
C. = KE_{300}
D. 2 x KE_{300}
E. more than 2 x KE_{300}

e. more than 2 x KE_{300}



KE = photon energy-energy to get out
= hf – energy to get out
if λ is ½ then, f twice as big, $E_{phot} = 2hf_{300}$

New $KE_{new} = 2hf_{300}$ - energy to get out

Old $KE_{300} = hf_{300}$ - energy to get out

so KE_{new} is more than twice as big.