Midterm: Info

- TOMORROW, Feb 11, 7:30 – 9:00 PM, HERE !
  Other accomodation: Email is sent.

- Format of exam:
  - Multiple choice (~ 60% of pts)
  - Long answer questions (~ 40% of pts)
  - Info sheet included (mainly constants)

- Bring:
  - Pencil and calculator
  - 3 x 5 note card, both sides, handwritten notes

- Info on course website, Sample problems on D2L

Some useful equations
- not included in exam booklet -

$E = h f$ (for single photon)
$E = N h f$ (for laser beam/pulse with N photons)

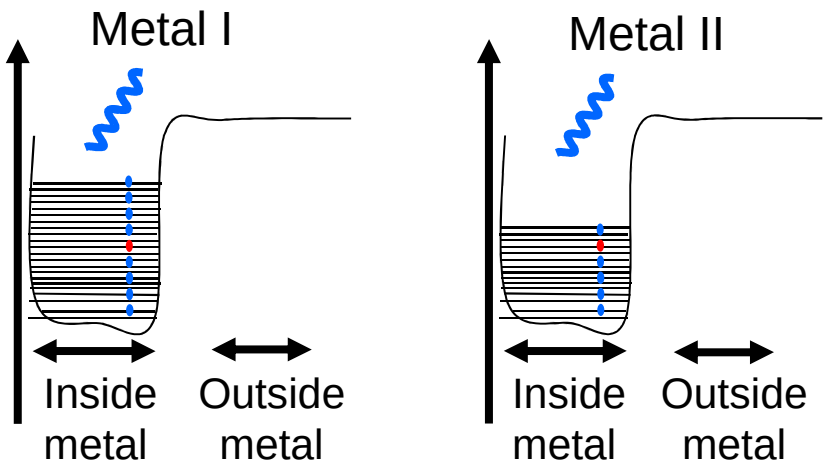
$E \sim |\text{E-field}|^2$

$c = \lambda f$; $E = hc / \lambda$

$E_{in} = E_{out}$ (energy conservation); $hf = KE_{max} - \phi$

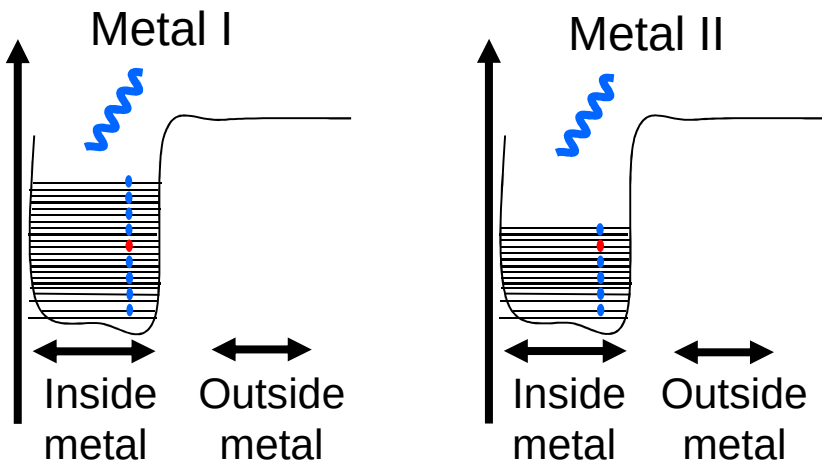
Power = Energy / time
Intensity = Power / area

Formulas from electrostatics (Work, force, …)



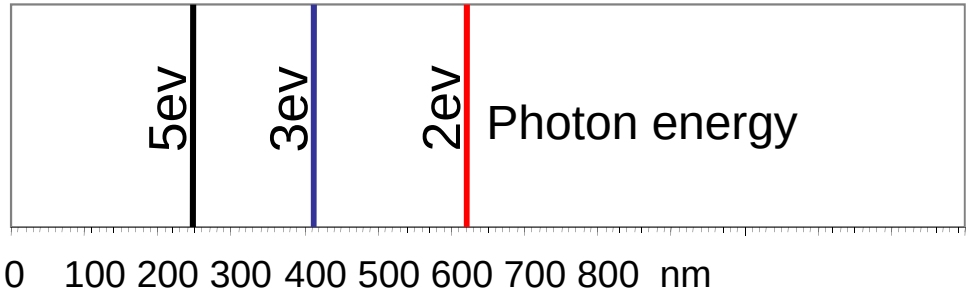
In each case the blue photon ejects the red electron.

The work function of metal I is
(A) greater than (B) the same as (C) smaller than
the work function of metal II.



In each case the blue photon ejects the red electron.

The kinetic energy of the red electron in case I is
(A) greater than (B) the same as (C) smaller than
in case II.



0eV

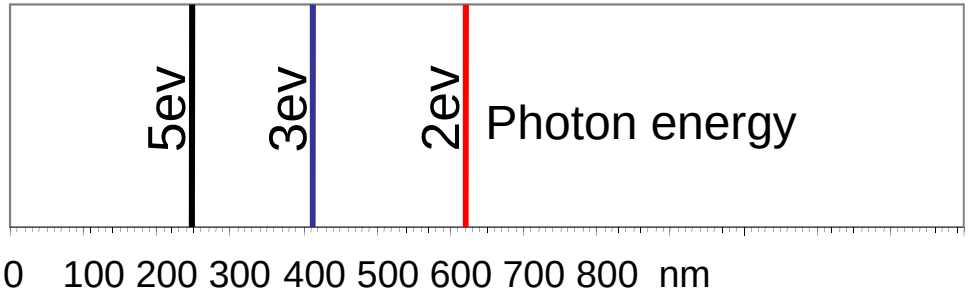
-2eV

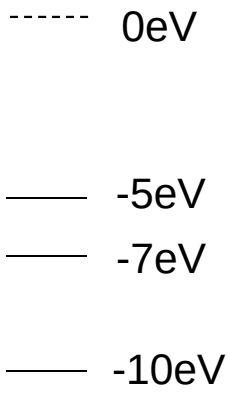
-5eV

Being asked to draw a energy level scheme (for electron in ground state) consistent with the spectrum above, a student has drawn the scheme on the left. Is the student correct?

(A) Yes (B) No

Ask yourself: Why not? Provide arguments

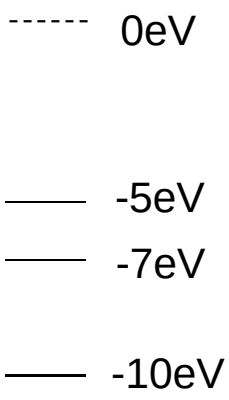




The scheme on the left is consistent with the spectrum above. Which of the lines corresponds to emission of the photon with *highest* frequency?

(A) 2 eV (B) 3 eV (C) 5 eV

Ask yourself: Isn't there a 10 eV line missing? Why not?
Minimum kinetic energy of free electron to observe this spectrum?
Or, which photon energy (energies) are needed to observe this spectrum?



Given the energy level scheme on the left: Which of the following photon energies can be absorbed, if the atom is in its ground state (-10 eV)?

(A)2 eV only

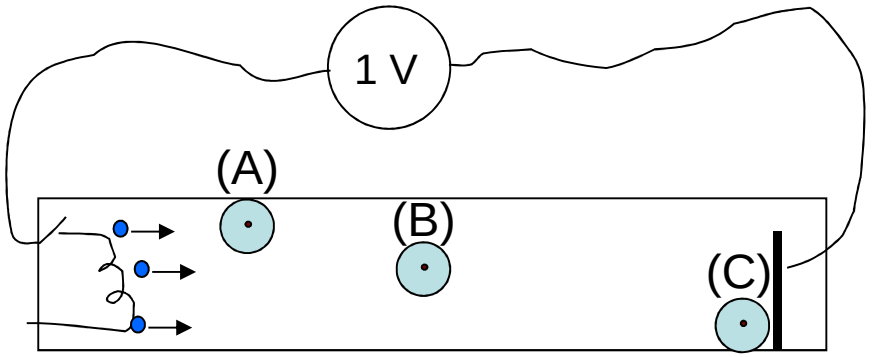
(B)3 eV only

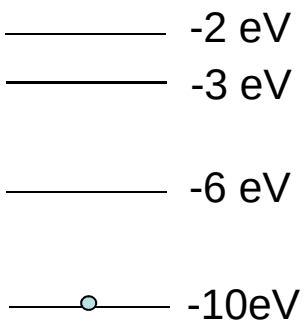
(C)5 eV only

(D) two of these

(E) all three of these

Ask yourself: Which ones? What about other photon energies not listed?



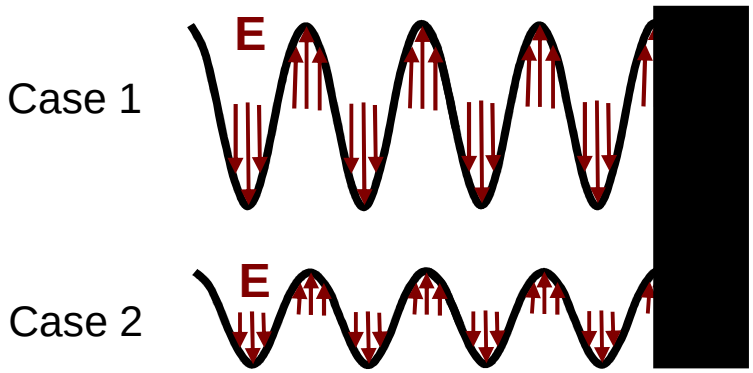


Given the position of the atoms in the discharge lamp which of the atoms emits most colors?

(D) All the same, at least one color

(E) All the same, namely no color

Ask yourself: What do you need to change such that there is light emitted from at least one of the atoms? If you change to, say 10 V, which of the atoms would emit the most colors?



The max E-field in case 1 is 2 times larger than in case 2. The number of photons in case 1 is

(A)4 times smaller (B) 2 times smaller

(C) exactly the same (D) 2 times larger

(E) 4 times larger than in case 2?

Ask yourself: Why 4 times larger? What does this has to do with power or intensity? Does it matter that the frequency is the same? Is the photon energy in case 1 the same / greater than / smaller than In case 2?