University Center of Mila **Academic year :2023/2024**
Institute of Science and Technology **Module : Structure of matter**
First Year ST

Series Nº4

Exercise 1:

Single Color Light Radiation Frequency .υ = 5,1 .10^{14} Hz.

1- Calculate the wave length λ, wave number υ, period **T**, and photon energy carried by this light radiation.

2- This light radiation hits a metal plate of zinc Zn with E_0(Zn) = 3,4 ev. Does photoelectric action occur?

3- This light radiation hits a metal plate of cesium Cs with E_0(Cs) = 1,9 ev. Does photoelectric action occur? If so, calculate the kinetic energy of the liberated electron, then calculate the speed of the electrons freed from the cesium metal.

given : **h** = 6,62 .10^{-34}J.s, **C** = 3 .10^8 m/s, **me** = 9,1 .10^{-31} Kg

Exercise 2:

1- Calculate the wavelength approval of the first line and the boundary line of series: Lyman and Brackett.

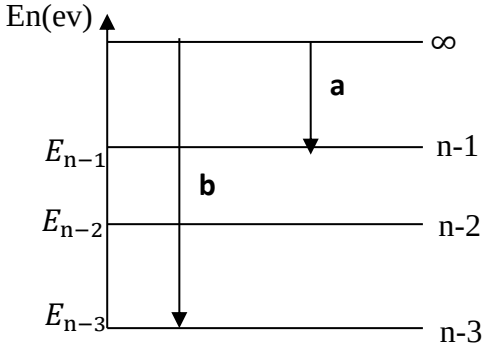
2- Calculate the ionizing energy of the hydrogen atom in the first excited state.

3- Calculate radius $\mathbf{r_n}$, speed **Vn** and energy **En** for n = 1, 2, 3 according to Bohr model.

4- Represent on the energy diagram the transitions of the first line of absorption spectrum in the Lyman series and the second line of emission spectrum in the Paschen series.

5- We have transitions a and b shown on the following diagram, if $\frac{\Delta E_b}{\Delta E_a} = \frac{25}{9}$, Find the number **n** indicate on the energy diagram, then name each spectral series

For each transition.



Exercise 3:

1- If the wavelength of one line of hydrogen atom spectrum is $\lambda = 4868\ A°$, at what energy level the electron transits

2- It is assumed that this transitions was made on Hydrogenoid of $_3$Li.

a- Write the reactions that lead to the corresponding hydrogen.

b- Calculate the wavelength corresponding to the same previous transition.

c- Calculate the energy for the previous transition in two ways.

Exercise 4:

Considering that the hydrogenoid $_zX^{+q}$ is in a state of second excitation with total energy

En=-24,17ev. find the number of charge Z and charge q for this hydrogenoid.

1- Calculate the wavelength $\lambda_{X^{+q}}$ for the assumed transition $(3 \rightarrow 4)$

2- Find the relation between $\lambda_{\ H}$ and $\lambda_{X^{+q}}$ then calculate $\lambda_{\ H}$ for transition$(3 \rightarrow 4)$

3- Calculate the ionization energy of H and $_zX^{+q}$ in the fundamental state, then in the second excitation.

4- find the quantum numbers n, l, m, s possible for the electron hydrogenoid $_zX^{+q}$ in second excitation. Then calculate the radius **a** and **b** according to Sommerfield.

Exercise 5:

1- Calculate the wavelength for the following cases

a- the weight of a human being is m = 65 kg and its speed is v = 5 km/h

b- Atom ^{63}Cu moves in vacuum by kinetic energy Ec = 7eV.

c- Electron of hydrogen atom in third excitation.

2- We consider electron to be its kinetic energy Ec = 10^2 eV and the absolute uncertainty of speed is 10^{-5}m/, calculate relative uncertainty on this speed and then absolute uncertainty on the position xΔ.

3- Find the quantum numbers n,l,m,s of the main electronic layers M, N.

4- Find quantum numbers n, l for electronic layers ψ_{4d}, ψ_{4f}, ψ_{3p}, ψ_{2s}.

5- Write wave functions according to secondary electronic layers ψ_{52}, $\psi_{6331/2}$, ψ_{600}, $\psi_{1111/2}$