University of Menofia
Faculty of Science
Physics Department   January - 2 - 2019

Atomic Physics (1) P133
Physics Students
Time allowed: 2 hours

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$m=9.1 \times 10^{-31}$ kg — $e=1.6 \times 10^{-19}$ C - $h=6.6 \times 10^{-34}$ Js — $k=1.38 \times 10^{-23}$ J/K — $\varepsilon_0=8.85 \times 10^{-12}$ C^2/Nm^2 — $c=3 \times 10^8$ m/s

I- A) Complete these sentences with suitable words.   (25 M)
a) .... is a hydrogen – like ion.
b) N(θ) in Rutherford atom model is directly proportional to ...., ...
c) The reduced mass of electron and proton approximately equal to ....
d) Wien's law states that λ_{max} decreases with ....

B) Put ($\sqrt{}$) or (x), and correct the error statements.   (25 M)
i) In Bohr model when n increases v_n increases.   ( )
ii) In Bohr model the minimum angular momentum is zero.   ( )
iii) In Bohr model when n increases E_n decreases.   ( )
iv) The energy levels of the hydrogen atom are well separated at large n. ( )
v) $h\upsilon < \varphi$ is the necessary condition for the photoelectric effect to occur. ( )

2- a) Show that Planck's radiation law covers both shorter and longer
        Wavelengths, of BB radiation.   (20 M)
   b) Calculate the wavelength of an electron accelerated between a potential
      difference of 200V.   (20M)

3- a) Derive an expression for the electron energy E according to Rutherford
        classical planet model of the atom.   (30 M)
   b) Derive an expression for Bohr energy E_n in hydrogen atom.

4- a) Some of the energy levels (eV) of an atom are listed below with n.

n	1	2	3	4	∞
E(eV)	-16	-4	-1.8	-1	0

   i-   Draw the energy level diagram of the atom.
   ii-   Find the ionization energy of that atom.
   iii-   Calculate the excitation energy of the level n = 2.
   b) Calculate the wavelength of the first line in Lyman series. What is the
       wavelength of the series limit.   (60 M)

With my best regards

Prof. Dr. A Habib