KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF PHYSICS
Term 032

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Physics 212 – Quiz #3
Chapter 3

Name: Key Id#:

(a) What are the energy and radius of the first two orbits in the triply ionized beryllium?
$Ry = 1.097 \times 10^{7}\ m^{-1}$, $a_0 = 0.0529$ nm, and $hc = 1240$ eV.nm

$$E_n = -\frac{13.6\, Z^2}{n^2}\ (eV) \quad \text{and} \quad r_n = \frac{a_0\, n^2}{Z}$$

$E_1 = -13.6 \times (4)^2 = \boxed{-217.6\ eV}$

$E_2 = -\frac{13.6}{(2)^2}(4)^2 = \boxed{-54.4\ eV}$ 3

$r_1 = \frac{0.0529}{4} = \boxed{0.01323\ nm}$

$r_2 = \frac{0.0529}{4}(2)^2 = \boxed{0.0529\ nm}$ 3

(b) What is the shortest wavelength of the Lyman series of the triply ionized beryllium?

Shortest wavelength correspond to the highest ΔE
Since this is Lyman transition $\Rightarrow n_f = 1$ and $n_i = \infty$

$$\frac{1}{\lambda} = R_H Z^2 \left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) = (1.097 \times 10^{7})(4)^2 \left(\frac{1}{1} - 0\right) = 1.755 \times 10^{8}\ m^{-1}$$

$\boxed{\lambda = 5.7\ nm}$ 3

(c) Is this wavelength in the visible spectrum? Explain

The wavelength indicate that the light emitted is in the UV (ultra violet) region.
UV region $\lambda < 400$ nm, IR region $\lambda > 700$ nm 2