Atomic Structure

Here are some JEE and NEET questions based on Bohr's concept, energy of electron, radius of electron orbit, Rydberg's constant, and hydrogen spectrum from recent years:

JEE Questions

1. **Bohr's Radius Calculation:**
   Calculate the radius of the second orbit of the hydrogen atom using Bohr's model.

   $$r_n = n^2 \times 0.529\,\text{Å}$$

   For $n = 2$, $r_2 = 4 \times 0.529\,\text{Å} = 2.116\,\text{Å}$.
2. **Energy Levels:**
   What is the energy of an electron in the third orbit of the hydrogen atom?

   $$E_n = \frac{-13.6\,\text{eV}}{n^2}$$

   For $n = 3$, $E_3 = \frac{-13.6}{9}\,\text{eV} = -1.51\,\text{eV}$.
3. **Transition Energy:**
   Calculate the wavelength of the photon emitted when an electron transitions from $n = 3$ to $n = 2$ in the hydrogen atom.

   $$\Delta E = 13.6 \left(\frac{1}{2^2} - \frac{1}{3^2} \right)\,\text{eV} = 1.89\,\text{eV}$$

   Using $\lambda = \frac{hc}{\Delta E}$, calculate the wavelength.
4. **Rydberg Equation:**
   Use the Rydberg equation to find the wavelength of the first line in the Lyman series.

   $$\frac{1}{\lambda} = R_H \left(\frac{1}{1^2} - \frac{1}{2^2} \right)$$

   Calculate λ using $R_H = 1.097 \times 10^7\,\text{m}^{-1}$.

NEET Questions

1. **Bohr's Postulates:**
   Explain Bohr's postulates regarding quantized orbits and angular momentum.

   $$L = \frac{nh}{2\pi}$$

   Describe how these postulates explain the stability of electron orbits.
2. **Hydrogen Spectrum:**
   Describe the significance of the Balmer series in the hydrogen spectrum and calculate the

wavelength of the second line in the series.

$$\frac{1}{\lambda} = R_H \left(\frac{1}{2^2} - \frac{1}{4^2} \right)$$

3. **Energy Calculations:**
   Determine the kinetic and potential energy of an electron in the second orbit of a hydrogen atom.

$$E_k = \frac{1}{2}mv^2, \quad E_p = -\frac{Ze^2}{4\pi\epsilon_0 r_n}$$

4. **Application of Bohr's Model:**
   Given the energy of an electron in the nth orbit, $E_n = -\frac{13.6\,\text{eV}}{n^2}$, calculate the frequency of the emitted photon when an electron transitions from $n = 4$ to $n = 2$.

$$\Delta E = 13.6 \left(\frac{1}{2^2} - \frac{1}{4^2} \right) \text{ eV}$$

These problems cover fundamental concepts and calculations based on Bohr's atomic model, energy levels, and spectral lines, which are frequently tested in competitive exams like JEE and NEET.