Spectra, Hydrogen Spectrum, Bohr's Model

1. The energy of an electron present in Bohr's second orbit of hydrogen atom is (E - 2001)

1) -1312 J $atom^{-1}$ 2) -328 kJ mol^{-1}
3) -328 J mol^{-1} 4) -164 kJ mol^{-1}

2. Splitting of spectral lines under the influence of strong magnetic field is called (AFMC)

1) Stark effect 2) Zeeman effect
3) Photoelectric effect 4) None of these

3. The wave number of first line of Balmer series of H-atom is 15200 cm^{-1}. The wave number of first Balmer line of Li^{2+} ion is (IIT 92)

1) 15200 cm^{-1} 2) 60800 cm^{-1}
3) 76000 cm^{-1} 4) 136,800cm^{-1}

4. What are the values of n_1 and n_2 respectively for line in the Lyman series of hydrogen atomic spectrum? (E 2001)

1) 3 and 5 2) 2 and 3 3) 1 and 3 4)1 and 4

5. If the electron of a hydrogen atom is present in the first orbit, the total energy of the electron is (E-2003)

1) $\frac{-e^2}{r}$ 2) $\frac{-e^2}{r^2}$ 3) $\frac{-e^2}{2r}$ 4) $\frac{-e^2}{2r^2}$

6. The angular momentum of an electron present in the excited state of hydrogen is 1.5h/. The electron is present in (M- 2006)

1) Third orbit 2) Second orbit
3) Fourth orbit 4) Fifth orbit

7. The wavelength of a spectral line emitted by hydrogen atom in the Lyman series is 16/15R cm. What is the value of n_2? (R = Rydberg constant) (E – 2007)

1) 2 2) 3 3) 4 4) 1

8. What is the lowest energy of the spectral line emitted by the hydrogen atom in the Lyman series? (h = Planck constant, c = Velocity of light, R = Rydberg constant) (M- 2005)

1) $\frac{5hcR}{36}$ 2) $\frac{4hcR}{3}$ 3) $\frac{3hcR}{4}$ 4) $\frac{7hcR}{144}$

9. Bohr's radius for the Hydrogen atom (n=1) is 0.53A° .The radius for the first excited state is (CBSE1998)

1)0.13A° 2) 1.06A° 3)4.77A° 4) 2.12A°

10) The wavelength of visible light is (AIIMS 1998)

1)2000-3700A° 2)7800-8900A°
3)3800-7600A° 4)500-1200A°

11. The Velocity of the electron in the 2nd orbit of Hydrogen atom is (AIIMS2001)

1)10.96×10^6 m/sec 2) 18.88×10^6m/sec
3) 1.888×10^6 m/sec 4) 1.094×10^6m/sec

12. **In Hydrogen atom energy of the electron in first excited state is-3.4eV. Then kinetic energy in same orbit is (CBSE2002)**

1)+3.4eV 2)+6.8eV 3) -13.6eV 4)+13.6eV

13. **The ratio of Radiusof 4th and 2nd orbits of H- atom is (BHU2003)**

1)2 2)4 3) 3 4)6

14. **When the electron in hydrogen atom jumps from 4th orbit into the first orbit, the frequency of radiation will be (CBSE2004)**

1) 1.54×10^{15} 2) 1.03×10^{15} 3) 3.08×10^{15} 4) 2.0×10^{15}

15. **The radius of first orbit in H-atom is R ,then radius of first orbit in will be (PMT2009)**

1) R/9 2) R/3 3) 3R 4)9R

16. **In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter-orbit jumps of the electron for Bohr orbits is an atom of hydrogen. (2002 A.I.E.E.E)**

1) $5 \rightarrow 2$ 2) $4 \rightarrow 1$ 3) $2 \rightarrow 5$ 4) $3 \rightarrow 2$

17. **What are the values of n_1 and n_2 respectively for H_β line in the Lyman series of hydrogen atomic spectrum? (E-2000)**

1) 3 and 5 2) 2 and 3 3) 1 and 3 4) 2 and 4

18. **What is the wavelength of H_β line the Balmer series of hydrogen spectrum?**

(R = Rydberg constant) (M-2000)

1) 36/5R 2) 5R/36 3) 3R/16 4) 16/3R

KEY

1)2 2) 2 3)4 4)4 5)3 6)1 7)3 8)3

9) 4 10)3 11)4 12)1 13)2 14)3 15)2 16)1

17)3 18)1

Hints

1. $E_n = \frac{-1312}{n^2} = \frac{-1312}{2^2} KJ / mole$

3. for same spectral line, $\frac{\overline{\upsilon_H}}{\upsilon_{Li^{+2}}} = \frac{Z^2{}_H}{Z^2{}_{Li^{+2}}} = \frac{1^2}{3^2}$

6. $mvr = \frac{nh}{2\pi} = \frac{1.5h}{\pi}, n = 3$

7. $\frac{1}{\lambda} = R(\frac{1}{n_1^2} - \frac{1}{n_2^2}), R(\frac{1}{1^2} - \frac{1}{n^2}) = \frac{15R}{16}$ n=4

8. Lowest energy is for

$H_{\alpha,} \frac{1}{\lambda} = R(\frac{1}{n_1^2} - \frac{1}{n_2^2}) = R(\frac{1}{1^2} - \frac{1}{2^2}) = \frac{3R}{4}$

$\Delta E = \frac{hc}{\lambda} = hc(\frac{3R}{4}) = \frac{3hcR}{4}$

14. $\frac{1}{\lambda} = R(\frac{1}{n_1^2} - \frac{1}{n_2^2}).\upsilon = \frac{c}{\lambda}$