Spectra, Hydrogen Spectrum, Bohr's Model

1. Bohr's model of an atom is in contradicted with

1) Pauli's exclusive principle 2) Planck's quantum theory

3) Heisenberg's uncertainty principle 4) All the Above

2. According to Bohr's theory when an electron moves from a lower to a higher orbit energy is

1) Absorbed 2) Emitted 3) No change 4) Either 1 or 2

3. In an hydrogen atom When electron is moved from the ground state to an excited state.

1) Both kinetic energy and potential energy decrease

2) Potential energy increases and kinetic energy decreases

3) Potential energy decreases and kinetic energy increases

4) Both kinetic energy and potential energy increase

4. The ratio of radius of 2nd and 3rd Bohr orbit is

1) 3: 2 2) 9: 4 3) 2: 3 4) 4: 9

5. The radius of the 10th orbit in hydrogen atom is

1) 52.9×10^{-8} cm 2) 5.29nm 3) $52.9A^0$ 4) All of these

6. When an electron move closer to nucleus of the atom, its energy

1) Increases to a grater +ve value 2) Decreases to a smaller +ve value

3) Increases to a grater -ve value 4) Decreases to a smaller -ve value

7. The difference in angular momentum associated with the electron in two successive orbits of hydrogen atom is

1) $h/2\pi$ 2) h/π 3) h/2 4) (n - 1) $h/2\pi$

8. To which of the following is Bohr's theory applicable

I) He^{+} II) Li^{+2} III) H-atom IV) Be^{+2}

The correct combination is

1) III, IV 2) I, II, III, IV 3) I, II 4) I, II, III

9. Line spectrum is characteristic of

1) Atoms 2) Molecules

3) Any substance in the solid state 4) Any substance in the liquid state

10. The band spectrum is caused by

1) Molecules 2) Atoms 3) Hot Metal 4) Both 1and 3

11. If the energy of the electron in Bohr's first orbit is E, then its energy in the Third orbit is

1) E/9 2) 9E 3) E/4 4) 4E

12. Energy of electron moving in the second orbit of H-atom is

1) -13.6ev 2) -3.4 ev 3) -1.51 ev 4) -0.84ev

13. If the ionization energy of the ground state of hydrogen atom is $-2.18X10^{-18}J$ **then energy of an electron in its second orbit would be**

1) $+5.45\times10^{-19}$ J 2) $+5.45\times10^{-18}$ J 3) -5.45×10^{-18} J 4) -5.45×10^{-19} J

14. When the electron in hydrogen spectrum jumps from 6th orbit into the first orbit, the number of spectral lines produced is

1) 5 2) 10 3) 15 4) 6

15. The electronic transition that emits maximum energy is [n = represents orbit]

1) $n_5 \rightarrow n_1$ 2) $n_4 \rightarrow n_1$ 3) $n_2 \rightarrow n_1$ 4) $n_3 \rightarrow n_1$

16. The wave number of limiting line in Balmer series of hydrogen atoms is

1) 4/109678 cm^{-1} 2) 109678 cm^{-1}

3) 109678/4 cm^{-1} 4) 4 x 109678 cm^{-1}

17. If the total energy of electron in a Bohr orbit is -4.9eV then the kinetic energy and potential energy of electron are respectively

1) $9.8\,eV, -4.9\,eV$ 2) $4.9\,eV, -9.8\,eV$ 3) $4.9\,eV, -4.9\,eV$ 4) $9.8eV, -9.8eV$

18. The ratio of energy of electron in the first three orbits of H- atom is

1)36: 9: 4 2)4: 9:36 3) 1: 4: 9 4) 9: 4: 1

19. If the energy of an electron in H atom is -19.6 K.cal the electron belongs to

1) K-shell 2) L-shell 3) M-shell 4) N-shell

20. A spectral line with λ = 6561A^0 belongs to which series of Hydrogen atom

1) Lyman 2) Balmer 3) Parchen 4) Pfund

21. Among the first lines of Lyman, Balmer, Paschen and Brackett series in hydrogen atomic spectra, which has longest wavelength?

1) Lyman 2) Balmer 3) Paschen 4) Bracket

22. The fourth line of the Balmer series corresponds to the electronic transition between two orbits of the H atom, Identify the orbits.

1) 3 and 1 2) 5 and 1 3) 5 and 2 4) 6 and 2

23. The wave length of line of Balmer series of a hydrogen atom is nearly

(R = 1.08 × 10^{7}m^{-1})

1) 4090A° 2) 5400A 3) 6800A° 4) 7200A°

24. The first emission line of hydrogen atomic spectrum in the Lyman series appears at a wavelength of (R=Rydberg constant)

1) $\frac{3R}{4} cm^{-1}$ 2) $\frac{4}{3R} cm$ 3) $\frac{7R}{144} cm^{-1}$ 4) $\frac{400}{9R} cm$

25. If in Hydrogen atom, an electron jumps from n_2=2 to n_1= 1 in Bohr's orbit, then the value of wave number of the emitted photon will be (R=109700 cm^{-1})

1) 54850cm^{-1} 2) 8227 cm^{-1}

3) 62875cm^{-1} 4) 10970 cm^{-1}

26. According to Bohr's theory, the angular momentum of electron in 5th orbit is

1) $2.5\frac{h}{\pi}$ 2) $25\frac{h}{\pi}$ 3) $1.5\frac{h}{\pi}$ 4) $10\frac{h}{\pi}$

27. Energy of an electron in n^{th} Bohr orbit is given as

1) $-\frac{n^2h^2}{4\pi^2mZe^2}$ 2) $-\frac{2\pi^2Z^2me^4}{n^2h^2}$ 3) $-\frac{2\pi Ze^2}{nh}$ 4) $-\frac{n^2h^2}{2\pi^2Z^2me^4}$

28. According to Bohr's theory, when ever the electron drops from a higher energy level to a lower energy level, the frequency of radiation emitted is related to the energy change as

1) $\lambda = \frac{h}{mv}$ 2) $mvr = \frac{nh}{2\pi}$ 3) $\upsilon = \frac{\Delta E}{h}$ 4) $\upsilon = \frac{h}{\Delta E}$

29. Velocity of the electron in the 2nd Bohr orbit of H-atom is

1) 1.09×10^8 cm/sec 2) 2.18×10^8cm/sec

3)4.36×10^8cm/sec 4) 3.27×10^8 cm/sec

30. The wavelengths of two radiations are 2000 & 3000nm respectively. Then identify the correct statement

LIST - A	LIST - B
I) Ratio of their energies	**a) 1: 1**
II) Ratio of their frequency	**b) 2: 3**
III) Ratio of their velocity	**c) 3: 2**
IV) Ratio of their wave number	**d) 2: 9**

1) I – b, II – c, III – a, IV – a 2) I – c, II – c, III – a, IV – c

3) I – b, II – b, III – a, IV – c 4) I – b, II – b, III – b, IV – b

KEY

1)3	**2) 1**	**3)2**	**4)4**	**5)4**	**6)3**	**7)1**	**8)4**	**9) 1**	**10)4**
11)1	**12)2**	**13)4**	**14)3**	**15)1**	**16)3**	**17)2**	**18)1**	**19)4**	**20)2**
21)4	**22)4**	**23)1**	**24)2**	**25)1**	**26)1**	**27)4**	**28)3**	**29)1**	**30)2**

Hints and Solutions

4. $r\alpha n^2, r_2 : r_3 = 2^2 : 3^2 = 4:9$

5. $r_{10} = 0.529X10^2 A^0 = 52.9A^0$

11. $E_n \infty \frac{1}{n^2}, \frac{E_1}{E_3} = \frac{3^2}{1^2} = 9, E_3 = \frac{E_1}{9}$

12. $E_2 = \frac{-13.6}{2^2} = -3.4eV$

13. $E_1 = -IE = -2.18X10^{-18} J, E_2 = \frac{E_1}{2^2} = -5.45X10^{-19} J$

14. No of Spectral lines=n(n-1)/2=6(6-1)/2=15

15. For limiting line $\bar{\upsilon} = \frac{R_H}{n_1^2} = \frac{109678}{2^2} cm^{-1}$

17. KE=-Total energy, PE= 2X Total energy

18. $E_n \infty \frac{1}{n^2}, E_1 : E_2 : E_3 = \frac{1}{1^2} : \frac{1}{2^2} : \frac{1}{3^2}$

19. $E_n = \frac{-313.6}{n^2} = -19.6, n^2 = \frac{-313.6}{-19.6} = 16, n = 4$

23. $\frac{1}{\lambda} = R(\frac{1}{n_1^2} - \frac{1}{n_2^2}) = R(\frac{1}{2^2} - \frac{1}{6^2})$

24. $\frac{1}{\lambda} = R(\frac{1}{n_1^2} - \frac{1}{n_2^2}) = R(\frac{1}{1^2} - \frac{1}{2^2}) = \frac{3R}{4}$ cm $\lambda = \frac{4}{3R} cm$

25. $\bar{\upsilon} = R(\frac{1}{n_1^2} - \frac{1}{n_2^2}) = R(\frac{1}{1^2} - \frac{1}{2^2}) cm^{-1}$

26. $mvr = \frac{nh}{2\pi} = \frac{5h}{2\pi}$

29. $V = \frac{.2.18X10^8}{n} cm/\sec = \frac{2.18X10^8}{2} cm/\sec$