Chapter 20

ATOMIC SPECTRA

Each question has four possible answers, tick (■) the correct answer:

1. Rutherford concluded that central part of an atom is:

(a) Electrically neutral **(b)** Positively charged

(c) Negatively charged **(d)** None of above

2. The first theory about the structure of an atom was introduced by:

(a) Neil Bohr **(b)** Einstein

(c) Compton **(d)** Rutherford

3. Bohr's postulates explained by:

(a) de-Broglie **(b)** Einstein

(c) Newton **(d)** Rutherford

4. de-Broglie's wavelength is:

(a) $\lambda = hv$ **(b)** $\lambda = hp$

(c) $\lambda = \frac{h}{2\lambda}$ **(d)** $\lambda = \frac{h}{p}$

5. Study of hydrogen visible spectrum in:

(a) 1886 **(b)** 1887

(c) 1895 **(d)** 1885

6. Bohr was presented atomic model of hydrogen in:

(a) 1913 **(b)** 1919

(c) 1918 **(d)** 1905

7. According to Bohr theory only those orbit are allowed along which angular momentum of electron is:

(a) $\frac{2\pi}{nh}$ **(b)** $\frac{nh}{2\pi}$

(c) $\frac{n}{2\pi h}$ **(d)** $\frac{2\pi n}{h}$

8. The scientist who studies the spectrum of hydrogen in visible light, wavelength range was:

(a) Rydberg **(b)** Bohr

(c) Balmer **(d)** Paschen

9. The first series, which was identified in the spectrum of hydrogen is called:
(a) Balmer series **(b)** Lyman series
(c) Paschen series **(d)** Brakett series

10. Balmer series was identified in:
(a) 1685 **(b)** 1785
(c) 1985 **(d)** 1885

11. Balmer series lies in that region of electromagnetic wave spectrum, which is known as:
(a) Visible region **(b)** Invisible region
(c) Ultraviolet region **(d)** Infra-red region

12. The results of spectra obtained by Balmer were expressed in 1896 by:
(a) Newton **(b)** Bohr
(c) Rydberg **(d)** Planck

13. The process of formation of spectrum is known as:
(a) Diffraction **(b)** Interferences
(c) Refraction **(d)** Spectroscopy

14. The value of Rydberg constant is:
(a) $1.0974 \times 10^{7}\ m^{-1}$ **(b)** $1.0974 \times 10^{-7}\ m^{-1}$
(c) $1.0974 \times 10^{6}\ m^{-1}$ **(d)** $1.0974 \times 10^{-6}\ m^{-1}$

15. Spectrum shows the number of component colour present in certain light in terms of:
(a) Frequency **(b)** Energy
(c) Wavelength **(d)** All of the above

16. Tick the series lies in visible region:
(a) Paschen series **(b)** Lyman series
(c) Pfund series **(d)** Balmer series

17. Tick the series lies infrared region:
(a) Paschen series **(b)** Brakett series
(c) Pfund series **(d)** All of the above

18. In the general formula in which all the series of hydrogen spectrum is given by:
(a) $\lambda = R_H\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$ **(b)** $\frac{1}{\lambda} = R_H\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$
(c) $\lambda = \frac{1}{R_H}\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$ **(d)** $\lambda = R_H\left(\frac{1}{n^2} - \frac{1}{p^2}\right)$

19. During the transition of electron of hydrogen atom from higher orbit to a third orbit, a photon of:
(a) Paschen series is emitted **(b)** Balmer series is emitted
(c) Lyman series is emitted **(d)** Brakett series is emitted

20. In the general formula for spectral series, if we put P = 3, we get the formula for:

(a) Paschen series **(b)** Blamer series

(c) Lyman series **(d)** Brakett series

21. An electron of the hydrogen atom in the second orbit, is called its:

(a) Ground state **(b)** Ionized state

(c) Excited state **(d)** None of these

22. Which of the following is one of the spectral series of atomic hydrogen:

(a) Brockett series **(b)** Balmer series

(c) P fund series **(d)** All of above

23. An example of an absorption spectrum is the spectrum of:

(a) Sodium vapour **(b)** Molten iron

(c) Atomic hydrogen **(d)** Mercury vapour lamp

24. The radiations emitted from hydrogen filled discharge tube shows:

(a) Continuous spectrum **(b)** Line spectrum

(c) Band spectrum **(d)** None of these

25. The spectral series that contains transitions terminating on the ground level of hydrogen is called:

(a) Paschen series **(b)** P fund series

(c) Balmer series **(d)** Lyman series

26. In hydrogen spectrum, which one the following series lies in the ultraviolet region:

(a) Lyman series **(b)** Balmer series

(c) P fund series **(d)** Brackett series

27. In hydrogen atom, which one of the following series lies in the infrared region:

(a) Lyman series **(b)** Brackett series

(c) Paschen series **(d)** Balmer series

28. The longest wavelength of light which ionizes a hydrogen atom is:

(a) 912 A° **(b)** 0.74 A°

(c) 400 A° **(d)** 720 A°

29. Radiations with wavelengths longer than red light is called:

(a) Visible radiation **(b)** Infrared radiation

(c) Ultraviolet radiation **(d)** X-rays

30. Radiation, with wavelength shorter than violet is called:

(a) Ultraviolet radiation **(b)** Infrared radiation

(c) Visible radiation **(d)** None of these

31. Electromagnetic rays which lies above the x-rays region are called:

(a) γ-rays **(b)** Infrared radiations

(c) Ultraviolet radiation **(d)** None of these

32. Rutherford's nuclear model predicted:

(a) Discrete spectra of atoms **(b)** Continuous spectra of atoms

(c) Both (a) and (b) **(d)** None of these

33. For the stability of nuclear model, Rutherford proposed:

(a) Static equilibrium **(b)** Dynamic equilibrium

(c) Neutral equilibrium **(d)** None of these

34. According to Rutherford nuclear model, the major constituents of the nucleus are:

(a) Neutrons and electrons **(b)** Protons and positrons

(c) Neutron and protons **(d)** Protons and electrons

35. Net force on an electron in an orbit around the nucleus is:

(a) Positive **(b)** Zero

(c) Negative **(d)** None of these

36. In Bohr atomic model, the electron does not fall into the nucleus because:

(a) The electron is not a particle

(b) The quantum rules does not allow it

(c) The electrostatic attraction is balanced by mechanical force

(d) None of these

37. Brackett series is obtained when electronic transitions terminate on the:

(a) 1^{st} orbit **(b)** 2^{nd} orbit

(c) 3^{rd} orbit **(d)** 4^{th} orbit

38. In Bohr's atomic model, the lowest orbit corresponds to:

(a) Zero energy **(b)** The minimum energy

(c) The maximum energy **(d)** None of these

39. Only those orbits are allowed for the electron of hydrogen atom for which orbital angular momentum is equal to an integral multiple of:

(a) $\frac{2\pi}{h}$ **(b)** $\frac{h}{2\pi}$

(c) $\frac{2\pi}{h}$ **(d)** $\frac{h}{2\pi}$

40. mvr is the expression for:

(a) Linear momentum **(b)** Angular momentum

(c) Torque **(d)** None of these

41. de-Broglie suggest for a length of Bohr's orbit that:

(a) $l = 2\pi r$ **(b)** $l = 2\pi\lambda$

(c) $l = \pi r^2$ **(d)** $\lambda l = 2\pi$

42. The radii of different orbits around the nucleus of an atom is given by:

(a) $r^2_n = nr_1$ **(b)** $r_n = n r^2_1$

(c) $r_n = n^2 r_1$ **(d)** $r_n = nr_1$

43. Balmer series is obtained when all the transitions of electron terminate on:

(a) 4^{th} orbit **(b)** 2^{nd} orbit

(c) 5^{th} orbit **(d)** 3^{rd} orbit

44. The orbital speed of an electron in the nth orbit is:

(a) $v_n = \dfrac{nh}{2\pi r_n m}$ **(b)** $v_n = \dfrac{nh}{\pi m r_n}$

(c) $v_n = \dfrac{2\pi m r_n}{nh}$ **(d)** None of these

45. The numerical value of ground state energy of an electron in an orbit is the measure of:

(a) Excitation energy **(b)** Excitation potential

(c) Ionization energy **(d)** None of these

46. The electric P.E of an electron in an orbit around the nucleus is:

(a) $\dfrac{-ke^2}{r_n}$ **(b)** $\dfrac{ke}{r^2 n}$

(c) $\dfrac{ke^3}{r^2 n}$ **(d)** $\dfrac{-ke^2}{r^2 n}$

47. If the ionization energy of hydrogen atom is 13.6 eV, its ionization potential will be:

(a) 136.0 volt **(b)** 3.0 volt

(c) 13.6 volt **(d)** None of these

48. The SI unit of Rydberg constant is:

(a) ms^{-1} **(b)** m

(c) sm^{-1} **(d)** m^{-1}

49. The experimental value of Rydberg's constant is:

(a) $1.0974 \times 10^7\ m^{-1}$ **(b)** $1.0974 \times 10^{-7}\ m^{-1}$

(c) $10.97 \times 10^{-7}\ m^{-1}$ **(d)** $109.1 \times 10^{-9}\ m^{-1}$

50. The radius of the nth orbit for hydrogen atom is:

(a) $\dfrac{4\pi^2 mke^2}{n^2 h^2}$ **(b)** $\dfrac{nh}{4\pi^2 mke^2}$

(c) $\dfrac{nh}{4\pi^2 kme^4}$ **(d)** $\dfrac{n^2 h^2}{4\pi^2 kme^2}$

51. The diameter of an atom is of the order of:

(a) 10^{-16} m **(b)** 10^{-8} m

(c) 10^{-10} m **(d)** 10^{10} m

52. The electrostatic force between the electron and the nucleus of hydrogen atom is given by:

(a) $F_e = \frac{ke}{r_n^2}$ **(b)** $F_e = \frac{ke^2}{r_n^2}$

(c) $Fe = \frac{ke^2}{r^2 n}$ **(d)** None of these

53. The centripetal force when an electron revolving around the nucleus is given by:

(a) $F_c = \frac{mv_n^2}{r_n}$ **(b)** $F_c = \frac{mv_n}{r_n^2}$

(c) $F_c = \frac{mv_n^2}{r_n^2}$ **(d)** None of these

54. The value of Planck's constant is:

(a) $9 \times 10^9 \, Nm^2C^{-2}$ **(b)** 6.63×10^{-34} J.S

(c) 9.1×10^{-31} kg **(d)** 1.67×10^{-27} kg

55. The radius of 1st Bohr's orbit for hydrogen is:

(a) 0.053 nm **(b)** 0.53 nm

(c) 0.53 m **(d)** None of these

56. The total energy of an electron in the nth orbit of the hydrogen atom is given by:

(a) $E_n = \frac{-2\pi \, Kme^4}{n^2 \, h^2}$ **(b)** $E_n = \frac{-2\pi^2 \, K^2me^4}{n^2 \, h^2}$

(c) $E_n = \frac{-2\pi \, K^2me^2}{n^2 \, h^2}$ **(d)** $E_n = \frac{-\pi \, K^2m^2e^2}{n^2 \, h^2}$

57. An expression for ground state energy of an electron is given by:

(a) $E_o = \frac{4\pi^2k^2me^4}{h^2}$ **(b)** $E_o = \frac{4\pi \, Kme^4}{h^2}$

(c) $E_o = \frac{2\pi^2 \, k^2me^4}{h^2}$ **(d)** $E_o = \frac{2\pi \, K^2 \, me^4}{h^2}$

58. The 1st Bohr atom in the hydrogen atom has radius:

(a) 3.56×10^{-10} m **(b)** 0.053×10^{-11} m

(c) 0.53×10^{-11} m **(d)** 5.30×10^{-11} m

59. Mathematically, P fund series is written as:

(a) $\frac{1}{\lambda} = R_H \left(\frac{1}{1^2} - \frac{1}{n^2}\right)$ **(b)** $\frac{1}{\lambda} = R_H \left(\frac{1}{5^2} - \frac{1}{n^2}\right)$

(c) $\frac{1}{\lambda} = R_H \left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ **(d)** $\frac{1}{\lambda} = R_H \left(\frac{1}{4^2} - \frac{1}{n^2}\right)$

60. Mathematically, Balmer series is written:

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

(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ **(d)** None of these

61. Mathematically, Brackett series is written as:

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

(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ **(d)** $\frac{1}{\lambda} = R_H\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$

62. When an electron exist in its lowest state it is called:

(a) Ground state **(b)** Excited state

(c) Both (a) and (b) **(d)** None of these

63. The photons emitted in inner shell transition are called:

(a) β-particle **(b)** Characteristic x-rays

(c) γ-particle **(d)** None of these

64. X-rays were discovered by:

(a) Curie **(b)** Henry Becquerel

(c) Rontgen **(d)** None of these

65. X-rays are similar in nature to:

(a) γ-rays **(b)** Positive rays

(c) α-particle **(d)** None of these

66. X-rays are:

(a) Electromagnetic waves **(b)** Mechanical waves

(c) Transverse waves **(d)** Longitudinal waves

67. The transition's of electrons in the hydrogen atom result in the emission of spectral lines in the:

(a) Visible region **(b)** Infra red region

(c) Ultra violet region **(d)** Any of these

68. X-ray tube used for production of X-rays contains:

(a) Air at pressure of 760 mm of Hg **(b)** Air at pressure of 76 cm of Hg

(c) No air at all **(d)** None of these

69. K_β x-ray is emitted when an electron from:

(a) M shell fills the vacancy of K shell **(b)** K shell fills the vacancy of M shell

(c) L shell fills the vacancy of K shell **(d)** Both (a) and (b)

70. The characteristic x-rays appear as:

(a) Discrete spectrum **(b)** Continuous spectrum
(c) Band spectrum **(d)** Discrete lines on continuous spectrum

71. Braking radiation causes:

(a) Discrete spectrum **(b)** Continuous spectrum
(c) Band spectrum **(d)** Line spectrum

72. By CAT scans, we can detect the density difference of the order of:

(a) 1% **(b)** 15%
(c) 10% **(d)** 50%

73. X-rays are diffracted by crystal but not by a diffraction grating because:

(a) The ions in a crystal are well arranged
(b) The lines in a diffraction grating cannot reflect x-rays
(c) The penetrating power of x-rays is in high in diffraction grating
(d) The wavelength of x-rays are the same order of magnitude as the separation between the atom in the crystal

74. The maximum frequency in the spectrum from x-rays tube is directly proportional to the:

(a) Number of incident electron
(b) The kinetic energy of the incident electron
(c) The soft target, which can easily emit electrons
(d) None of these

75. The characteristic x-rays spectrum is due to:

(a) The illumination of target metal by ultraviolet radiation
(b) The bombardment of the target by protons
(c) The bombardment of the target by electrons
(d) None of these

76. The minimum wavelength of x-rays can further be reduced by:

(a) Reducing the press use or cooling the target
(b) Increasing the temperature of the filament
(c) Using the target element of higher atomic number
(d) Increasing the potential difference

77. The penetrating power of x-rays is comparable with that of:

(a) β-rays **(b)** γ-rays
(c) x-rays **(d)** None of these

78. The penetrating power of x-rays depends upon their:

(a) Frequency **(b)** Applied voltage
(c) Wavelength **(d)** None of these

79. When x-rays are passed through aluminium sheets, what happens to their thickness:

(a) Decreases **(b)** Increases

(c) Remain the same **(d)** None of these

80. X-rays are:

(a) Of unknown nature **(b)** High energy photons

(c) High energy electrons **(d)** High energy positrons

81. The x-rays diffraction with crystal was first studied by:

(a) W.H Bragg **(b)** W.L. Bragg

(c) Michelson **(d)** None of these

82. X-ray photons cannot produce pair production because:

(a) Electromagnetic waves **(b)** Rest mass and charge is zero

(c) Energy is less than rest mass energy **(d)** None of these

83. K-series of characteristic x-rays spectrum results when all the transitions of inner-shell electrons terminate an:

(a) K-shell **(b)** M-shell

(c) L-shell **(d)** None of these

84. The first spectra line of K-series of characteristics x-rays spectrum results when:

(a) M-shell electron fall into K-shell **(b)** L-shell electron into K-shell

(c) N-shell electron fall into M-shell **(d)** None of these

85. Most efficient tube for production of x-rays was designed by:

(a) Maxwell in 1913 **(b)** Einstein in 1913

(c) Dr. Coolidge 1913 **(d)** Dr. Rontgen in 1913

86. For the production of x-rays, the target metal should be bombarded by:

(a) Electrons **(b)** Neutrons

(c) Protons **(d)** Positrons

87. Quality of x-rays depends upon:

(a) Accelerating voltage **(b)** Filament current

(c) Material of the target **(d)** Both (a) and (c)

88. The velocity of x-rays is equal to that of:

(a) α-rays **(b)** β-rays

(c) γ-rays **(d)** Speed of light

89. X-rays can be used to:

(a) Detect Bone Fracture **(b)** Detect Flows in welding

(c) Control of Cancer **(d)** All of above

90. X-rays exhibit the phenomenon of:

(a) Diffraction **(b)** Interference

(c) Polarization **(d)** All of the above

91. The rest mass of x-ray photon is:

(a) Zero **(b)** 1.67×10^{-27} kg

(c) 9.1×10^{-31} kg **(d)** None of these

92. The reverse process of photo-electric effect is called:

(a) Annihilation of matter **(b)** Compton effect

(c) Pair production **(d)** X-rays

93. The transitions of inner shell electrons in heavy atoms give rise to the emission of:

(a) High energy photon or x-rays **(b)** High energy γ-rays

(c) Low energy photons or x-rays **(d)** High energy β-rays

94. Laser is device which can produce:

(a) Coherent beam of light **(b)** Monochromatic beam of light

(c) An intense beam of light **(d)** All of above

95. The idea of laser was introduced by:

(a) C.H. Townes and Arthur L Schaw Law **(b)** Dr. Grattling

(c) Frank whittle **(d)** Dr. C-gilbert young

96. The duration of a laser pulse is 10^{-8} see. The uncertainty in its energy will be:

(a) $\Delta E = \dfrac{h}{\Delta t}$ **(b)** $\Delta E = h\,\Delta t$

(c) $\Delta E = \dfrac{\Delta t}{h}$ **(d)** None of these

97. The duration of a laser pulse is 10^{-8} see. The uncertainty in its energy will be:

(a) 10.500×10^{-26} J **(b)** 6.625×10^{-28} J

(c) 6.625×10^{-26} J **(d)** 1.050×10^{-28} J

98. Different types of lasers are:

(a) Two **(b)** Three

(c) Five **(d)** None of these

99. Characteristic x-rays are produced from:

(a) Heavy element **(b)** Light element

(c) Inner shell **(d)** Both (a) and (b)

100. An atom can reside in excited state for:

(a) 10^{-8} second **(b)** One second

(c) 10^{-10} second **(d)** More than one second

101. The process by which lesser beam can be used to generate 3- dimensional images of objects is called:

(a) Holography **(b)** Geo graphy
(c) Tomography **(d)** Radio graphy

102. In the production of laser beam for each incident photon, we will have two photons going:

(a) In the same direction **(b)** In opposite direction
(c) At right angle to each other **(d)** In arbitrary direction

103. The velocity of laser light is:

(a) Less than ordinary light **(b)** More than ordinary light
(c) Equal to ordinary light **(d)** None of these

104. Reflecting mirrors in laser is used to:

(a) Further stimulation **(b)** For producing more energetic lasers
(c) Both (a) and (b) **(d)** None of these

105. In He-Ne laser, the laser action is produced by:

(a) Ne only **(b)** He-Ne both
(c) Electrons of He **(d)** Electrons of Ne

106. Most commonly used type of gas laser is:

(a) Helium-Neon **(b)** Carbon dioxide
(c) Argon ion **(d)** All of above

107. The excited atoms returns to their ground state in:

(a) 10^{-10} sec **(b)** 10^{-8} sec
(c) 10^{-6} sec **(d)** 10^{-11} sec

108. Life time of metastable states is:

(a) 10^{-6} sec or more **(b)** 10^{-3} sec or more
(c) 10^{-5} sec or more **(d)** None of these

109. Operation of a laser depends upon:

(a) The existence of atoms in metastable state **(b)** The existence of atoms in ground state
(c) The existence of atoms in excited state **(d)** None of these

110. Laser beam can be used to generate three dimensional images of object in a process called:

(a) Holography **(b)** Tomography
(c) None of these

111. Helium-Neon laser discharge tube contains neon:

(a) 82% **(b)** 15%
(c) 25% **(d)** 85%

112. The idea of laser device was first introduced by C.H. Townes and Authers Schowlan is:

(a) 1972 **(b)** 1965
(c) 1958 **(d)** 1913

113. Laser can be made by creating:

(a) Population inversion **(b)** Metastable state
(c) Assembly **(d)** All of the above

114. For production of X-rays, the target must be of:

(a) High melting point **(b)** Low melting point
(c) Very hard **(d)** None of these

115. What is speed of electron in the first Bohr orbit?

(a) 2.19×10^{6} m/s **(b)** 1.6×10^{6} m/s
(c) 2.2×10^{-6} m/s **(d)** 3×10^{8} m/s

116. The branch of Physics in which laser is studied:

(a) Optics **(b)** Photonics
(c) Plasma **(d)** None

117. For shortest wavelength radiation in the Balmer series, the value of n is:

(a) 2 **(b)** 3
(c) Infinity **(d)** 5

ANSWERS

1.	(b)	**2.**	(d)	**3.**	(a)	**4.**	(d)	**5.**	(d)
6.	(a)	**7.**	(b)	**8.**	(c)	**9.**	(a)	**10.**	(d)
11.	(a)	**12.**	(c)	**13.**	(d)	**14.**	(a)	**15.**	(d)
16.	(d)	**17.**	(d)	**18.**	(b)	**19.**	(a)	**20.**	(a)
21.	(c)	**22.**	(d)	**23.**	(c)	**24.**	(b)	**25.**	(d)
26.	(a)	**27.**	(c)	**28.**	(a)	**29.**	(b)	**30.**	(a)
31.	(a)	**32.**	(b)	**33.**	(b)	**34.**	(c)	**35.**	(b)
36.	(c)	**37.**	(d)	**38.**	(b)	**39.**	(b)	**40.**	(b)
41.	(a)	**42.**	(c)	**43.**	(b)	**44.**	(a)	**45.**	(c)
46.	(a)	**47.**	(c)	**48.**	(d)	**49.**	(a)	**50.**	(d)
51.	(c)	**52.**	(c)	**53.**	(a)	**54.**	(b)	**55.**	(a)
56.	(b)	**57.**	(c)	**58.**	(d)	**59.**	(b)	**60.**	(a)
61.	(a)	**62.**	(a)	**63.**	(b)	**64.**	(c)	**65.**	(a)
66.	(a)	**67.**	(d)	**68.**	(c)	**69.**	(a)	**70.**	(d)
71.	(b)	**72.**	(a)	**73.**	(d)	**74.**	(b)	**75.**	(c)
76.	(d)	**77.**	(b)	**78.**	(a)	**79.**	(c)	**80.**	(b)
81.	(a)	**82.**	(c)	**83.**	(a)	**84.**	(b)	**85.**	(c)
86.	(a)	**87.**	(d)	**88.**	(d)	**89.**	(d)	**90.**	(d)
91.	(a)	**92.**	(d)	**93.**	(a)	**94.**	(d)	**95.**	(a)
96.	(a)	**97.**	(c)	**98.**	(b)	**99.**	(d)	**100.**	(a)
101.	(a)	**102.**	(b)	**103.**	(c)	**104.**	(a)	**105.**	(a)
106.	(d)	**107.**	(b)	**108.**	(b)	**109.**	(a)	**110.**	(a)
111.	(b)	**112.**	(c)	**113.**	(d)	**114.**	(a)	**115.**	(a)
116.	(b)	**117.**	(c)						