EXERCISE-I

Discovery and Properties of anode, cathode rays neutron and Nuclear Structure

1. Penetration power of proton is
(A) More than electron
(B) Less than electron
(C) More than neutron
(D) None

2. An elementary particle is
(A) An element present in a compound
(B) An atom present in an element
(C) A sub-atomic particle
(D) A fragment of an atom

3. The nucleus of helium contains
(A) Four protons
(B) Four neutrons
(C) Two neutrons and two protons
(D) Four protons and two electrons

4. Which is correct statement about proton
(A) Proton is nucleus of deuterium
(B) Proton is ionized hydrogen molecule
(C) Proton is ionized hydrogen atom
(D) Proton is α-particle

5. Cathode rays are made up of
(A) Positively charged particles
(B) Negatively charged particles
(C) Neutral particles
(D) None of these

6. Anode rays were discovered by
(A) Goldstein (B) J. Stoney
(C) Rutherford (D) J.J. Thomson

7. The radius of an atom is of the order of
(A) 10^{-10} cm (B) 10^{-13} cm
(C) 10^{-15} cm (D) 10^{-8} cm

8. Neutron possesses
(A) Positive charge (B) Negative charge
(C) No charge (D) All are correct

9. Neutron is a fundamental particle carrying
(A) A charge of +1 unit and a mass of 1 unit
(B) No charge and a mass of 1 unit
(C) No charge and no mass
(D) A charg of –1 and a mass of 1 unit

10. Cathode rays have
(A) Mass only
(B) Charge only
(C) No mass and charge
(D) Mass and charge both

Atomic number, Mass number, Atomic species

11. Number of electrons in the outermost orbit of the element of atomic number 15 is
(A) 1 (B) 3
(C) 5 (D) 7

12. The atomic weight of an element is double its atomic number. If there are four electrons in 2p orbital, the element is
(A) C (B) N
(C) O (D) Ca

13. An atom has the electronic configuration of $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^2 4p^5$. Its atomic weight is 80. Its atomic number and the number of neutrons in its nucleus shall be
(A) 35 and 45 (B) 45 and 35
(C) 40 and 40 (D) 30 and 50

14. Which of the following particles has more electrons than neutrons
(A) C (B) F^-
(C) O^{-2} (D) Al^{+3}

15. Compared with an atom of atomic weight 12 and atomic number 6, the atom of atomic weight 13 and atomic number 6
(A) Contains more neutrons
(B) Contains more electrons
(C) Contains more protons
(D) Is a different element

16. Which of the following are isoelectronic species

$I = CH_3^+, II - NH_2, III - NH_4^+, IV - NH_3$

(A) I, II, III (B) II, III, IV

(C) I, II, IV (D) I and II

17. The charge on the atom containing 17 protons, 18 neutrons and 18 electrons is

(A) +1 (B) –2

(C) –1 (D) Zero

18. Number of unpaired electrons in inert gas is

(A) Zero (B) 8

(C) 4 (D) 18

19. In neutral atom, which particles are equivalent

(A) p^+, e^+ (B) e^-, e^+

(C) e^-, p^+ (D) p^+, n^o

20. Nuclei tend to have more neutrons than protons at high mass numbers because

(A) Neutrons are neutral particles

(B) Neutrons have more mass than protons

(C) More neutrons minimize the coulomb repulsion

(D) Neutrons decrease the binding energy

21. The nucleus of tritium contains

(A) 1 proton + 1 neutron

(B) 1proton + 3 neutron

(C) 1 proton + 0 neutron

(D) 1 proton + 2 neutron

22. Which one of the following groupings represents a collection of isoelectronic species

(A) Na^+, Ca^{2+}, Mg^{2+} (B) N^{3-}, F^-, Na^+

(C) Be, Al^{3+}, Cl^- (D) Ca^{2+}, Cs^+, Br

23. Which of the following are isoelectronic and isostructural $NO_3^-, CO_3^{2-}, ClO_3^-, SO_3$

(A) NO_3^-, CO_3^{2-} (B) SO_3, NO_3^-

(C) ClO_3^-, CO_3^{2-} (D) CO_3^{2-}, SO_3

24. The number of electrons in Cl^- ion is

(A) 19 (B) 20

(C) 18 (D) 35

25. The number of neutron in tritium is

(A) 1 (B) 2

(C) 3 (D) 0

Atomic models and Planck's quantum theory

26. The wavelength of a spectral line for an electronic transition is inversely related to

(A) The number of electrons undergoing the transition

(B) The nuclear charge of the atom

(C) The difference in the energy of the energy levels involved in the transition

(D) The velocity of the electron undergoing the transition

27. When an electron drops from a higher energy level to a low energy level, then

(A) Energy is emitted

(B) Energy is absorbed

(C) Atomic number increases

(D) Atomic number decreases

28. Davisson and Germer's experiment showed that

(A) β-particles are electrons

(B) Electrons come from nucleus

(C) Electrons show wave nature

(D) None of the above

29. When an electron jumps from lower to higher orbit, its energy

(A) Increases (B) Decreases

(C) Remains the same (D) None of these

30. Experimental evidence for the existence of the atomic nucleus comes from

(A) Millikan's oil drop experiment

(B) Atomic emission spectroscopy

(C) The magnetic bending of cathode rays

(D) Alpha scattering by a thin metal foil

31. Which of the following statements does not form part of Bohr's model of the hydrogen atom

(A) Energy of the electrons in the orbit is quantized

(B) The electron in the orbit nearest the nucleus has the lowest energy

(C) Electrons revolve in different orbits around the nucleus

(D) The position and velocity of the electrons in the orbit cannot be determined simultaneously

32. When β-particles are sent through a tin metal foil, most of them go straight through the foil as

(A) β-particles are much heavier than electrons

(B) β-particles are positively charged

(C) Most part of the atom is empty space

(D) β-particles move with high velocity

33. The energy of second Bohr orbit of the hydrogen atom is –328 $kJ\ mol^{-1}$, hence the energy of fourth Bohr orbit would be

(A) $-41\ kJ\ mol^{-1}$ (B) $-1312\ kJ\ mol^{-1}$

(C) $-164\ kJ\ mol^{-1}$ (D) $-82\ kJ\ mol^{-1}$

34. When an electron revolves in a stationary orbit then

(A) It absorbs energy

(B) It gains kinetic energy

(C) It emits radiation

(D) Its energy remains constant

35. A moving particle may have wave motion, if

(A) Its mass is very high

(B) Its velocity is negligible

(C) Its mass is negligible

(D) Its mass is very high and velocity is negligible

36. Energy of electron of hydrogen atom in second Bohr orbit is

(A) -5.44×10^{-19} J

(B) -5.44×10^{-19} kJ

(C) -5.44×10^{-19} cal

(D) -5.44×10^{-19} eV

37. If change in energy $(\Delta E) = 3\times10^{-8}$ J, $h = 6.64\times10^{-34}$ J-s and $c = 3\times10^{8}$ m/s, then wavelength of the light is

(A) $6.36\times10^{3}\ \mathring{A}$ (B) $6.36\times10^{5}\ \mathring{A}$

(C) $6.64\times10^{-8}\ \mathring{A}$ (D) $6.36\times10^{18}\ \mathring{A}$

38. The radius of first Bohr's orbit for hydrogen is 0.53 Å. The radius of third Bohr's orbit would be

(A) 0.79 Å (B) 1.59 Å

(C) 3.18 Å (D) 4.77 Å

39. Rutherford's α-particle scattering experiment proved that atom has

(A) Electrons (B) Neutron

(C) Nucleus (D) Orbitals

40. Wavelength of spectral line emitted is inversely proportional to

(A) Radius (B) Energy

(C) Velocity (D) Quantum number

41. The energy of a radiation of wavelength 8000 Å is E_1 and energy of a radiation of wavelength 16000 Å is E_2. What is the relation between these two

(A) $E_1 = 6E_2$ (B) $E_1 = 2E_2$

(C) $E_1 = 4E_2$ (D) $E_1 = 1/2E_2$

42. The formation of energy bonds in solids are in accordance with

(A) Heisenberg's uncertainty principle

(B) Bohr's theory

(C) Ohm's law

(D) Rutherford's atomic model

43. The frequency of yellow light having wavelength 600 *nm* is

(A) 5.0×10^{14} Hz (B) 2.5×10^{7} Hz

(C) 5.0×10^{7} Hz (D) 2.5×10^{14} Hz

44. The value of the energy for the first excited state of hydrogen atom will be

(A) -13.6 eV (B) -3.40 eV

(C) -1.51 eV (D) -0.85 eV

45. Bohr model of atom is contradicted by

(A) Pauli's exclusion principle

(B) Planck quantum theory

(C) Heisenberg uncertainty principle

(D) All of these

Dual nature of electron

46. An electron has kinetic energy 2.8×10^{-23} J. de-Broglie wavelength will be nearly $(m_e = 9.1\times10^{-31}\,kg)$

(A) 9.28×10^{-4} m (B) 9.28×10^{-7} m

(C) 9.28×10^{-8} m (D) 9.28×10^{-10} m

47. What will be de-Broglie wavelength of an electron moving with a velocity of $1.2\times10^{5}\ ms^{-1}$

(A) 6.068×10^{-9} (B) 3.133×10^{-37}

(C) 6.626×10^{-9} (D) 6.018×10^{-7}

48. The de-Broglie wavelength associated with a particle of mass 10^{-6} kg moving with a velocity of 10 ms^{-1}, is

(A) 6.63×10^{-22} m (B) 6.63×10^{-29} m

(C) 6.63×10^{-31} m (D) 6.63×10^{-34} m

49. What is the de-Broglie wavelength associated with the hydrogen electron in its third orbit

(A) 9.96×10^{-10} cm (B) 9.96×10^{-8} cm

(C) 9.96×10^{4} cm (D) 9.96×10^{8} cm

50. If the velocity of hydrogen molecule is $5\times10^{4}\,cm\,sec^{-1}$, then its de-Broglie wavelength is

(A) 2 Å (B) 4 Å

(C) 8 Å (D) 100 Å

51. A 200*g* golf ball is moving with a speed of 5 *m* per hour. The associated wave length is $(h = 6.625\times10^{-34}\ J\text{-sec})$

(A) 10^{-10} m (B) 10^{-20} m

(C) 10^{-30} m (D) 10^{-40} m

52. A cricket ball of 0.5 kg is moving with a velocity of 100 m / sec. The wavelength associated with its motion is

(A) 1 / 100cm (B) 6.6×10^{-34} m

(C) 1.32×10^{-35} m (D) 6.6×10^{-28} m

53. Dual nature of particles was proposed by

(A) Heisenberg (B) Lowry

(C) de-Broglie (D) Schrodinger

54. Calculate de-Broglie wavelength of an electron travelling at 1% of the speed of light

(A) 2.73×10^{-24} (B) 2.42×10^{-10}

(C) 242.2×10^{10} (D) None of these

55. Which is the correct relationship between wavelength and momentum of particles

(A) $\lambda = \frac{h}{P}$ (B) $\pi = \frac{h}{P}$

(C) $P = \frac{h}{\lambda}$ (D) $h = \frac{P}{\lambda}$

Uncertainty principle and Schrodinger wave equation

56. The maximum probability of finding an electron in the d_{xy} orbital is

(A) Along the *x*-axis

(B) Along the *y*-axis

(C) At an angle of 45^{o} from the *x* and *y*-axes

(D) At an angle of 90^{o} from the *x* and *y*-axes

57. Simultaneous determination of exact position and momentum of an electron is

(A) Possible

(B) Impossible

(C) Sometimes possible sometimes impossible

(D) None of the above

58. If uncertainty in the position of an electron is zero, the uncertainty in its momentum would be

(A) Zero (B) $< \frac{h}{2\lambda}$

(C) $> \frac{h}{2\lambda}$ (D) Infinite

59. The possibility of finding an electron in an orbital was conceived by
(A) Rutherford (B) Bohr
(C) Heisenberg (D) Schrodinger

60. Uncertainty principle gave the concept of
(A) Probability
(B) An orbital
(C) Physical meaning of Ψ the Ψ^2
(D) All the above

Quantum number, Electronic configuration and Shape of orbitals

61. 2*p* orbitals have
(A) $n = 1, l = 2$ (B) $n = 1, l = 0$
(C) $n = 2, l = 1$ (D) $n = 2, l = 0$

62. Electronic configuration of H^- is
(A) $1s^0$ (B) $1s^1$
(C) $1s^2$ (D) $1s^1\,2s^1$

63. The quantum numbers for the outermost electron of an element are given below as $n = 2, l = 0, m = 0, s = +\frac{1}{2}$. The atoms is
(A) Lithium (B) Beryllium
(C) Hydrogen (D) Boron

64. Principal quantum number of an atom represents
(A) Size of the orbital
(B) Spin angular momentum
(C) Orbital angular momentum
(D) Space orientation of the orbital

65. An element has the electronic configuration $1s^2, 2s^2\,2p^6, 3s^2\,3p^2$. Its valency electrons are
(A) 6 (B) 2
(C) 3 (D) 4

66. The magnetic quantum number specifies
(A) Size of orbitals
(B) Shape of orbitals
(C) Orientation of orbitals
(D) Nuclear stability

67. Which of the following sets of quantum numbers represent an impossible arrangement

	n	*l*	*m*	m_s
(A)	3	2	– 2	$(+)\frac{1}{2}$
(B)	4	0	0	$(-)\frac{1}{2}$
(C)	3	2	–3	$(+)\frac{1}{2}$
(D)	5	3	0	$(-)\frac{1}{2}$

68. If $n = 3$, then the value of 'l' which is incorrect
(A) 0 (B) 1
(C) 2 (D) 3

69. Which orbital is dumb-bell shaped
(A) s -orbital (B) p -orbital
(C) d -orbital (D) f -orbital

70. The total number of unpaired electrons in d - orbitals of atoms of element of atomic number 29 is
(A) 10 (B) 1
(C) 0 (D) 5

71. Which set of quantum numbers are not possible from the following
(A) $n = 3, l = 2, m = 0, s = -\frac{1}{2}$
(B) $n = 3, l = 2, m = -2, s = -\frac{1}{2}$
(C) $n = 3, l = 3, m = -3, s = -\frac{1}{2}$
(D) $n = 3, l = 0, m = 0, s = -\frac{1}{2}$

72. The four quantum number for the valence shell electron or last electron of sodium (Z = 11) is
(A) $n = 2, l = 1, m = -1, s = -\frac{1}{2}$
(B) $n = 3, l = 0, m = 0, s = +\frac{1}{2}$
(C) $n = 3, l = 2, m = -2, s = -\frac{1}{2}$
(D) $n = 3, l = 2, m = 2, s = +\frac{1}{2}$

73. The explanation for the presence of three unpaired electrons in the nitrogen atom can be given by
(A) Pauli's exclusion principle
(B) Hund's rule
(C) Aufbau's principle
(D) Uncertainty principle

74. The maximum energy is present in any electron at
(A) Nucleus
(B) Ground state
(C) First excited state
(D) Infinite distance from the nucleus

75. The electron density between $1s$ and $2s$ orbital is
(A) High (B) Low
(C) Zero (D) None of these

76. For ns orbital, the magnetic quantum number has value
(A) 2 (B) 4
(C) – 1 (D) 0

77. The maximum number of electrons that can be accommodated in the M^{th} shell is
(A) 2 (B) 8
(C) 18 (D) 32

78. For a given value of quantum number l, the number of allowed values of m is given by
(A) $l+2$ (B) $2l+2$
(C) $2l+1$ (D) $l+1$

79. The number of radial nodes of $3s$ and $2p$ orbitals are respectively.
(A) 2, 0 (B) 0, 2
(C) 1, 2 (D) 2, 1

80. Which of the sub-shell is circular
(A) 4s (B) 4f
(C) 4p (D) 4d

81. For $n = 3$ energy level, the number of possible orbitals (all kinds) are
(A) 1 (B) 3
(C) 4 (D) 9

82. Which of the following ions is not having the configuration of neon
(A) F^- (B) Mg^{+2}
(C) Na^+ (D) Cl^-

83. Elements upto atomic number 103 have been synthesized and studied. If a newly discovered element is found to have an atomic number 106, its electronic configuration will be
(A) $[Rn]5f^{14}, 6d^4, 7s^2$
(B) $[Rn]5f^{14}, 6d^1, 7s^2 7p^3$
(C) $[Rn]5f^{14}, 6d^6, 7s^0$
(D) $[Rn]5f^{14}, 6d^5, 7s^1$

84. Ions which have the same electronic configuration are those of
(A) Lithium and sodium
(B) Sodium and potassium
(C) Potassium and calcium
(D) Oxygen and chlorine

85. When the azimuthal quantum number has a value of $l = 0$, the shape of the orbital is
(A) Rectangular (B) Spherical
(C) Dumbbell (D) Unsymmetrical

86. The magnetic quantum number for valency electrons of sodium is
(A) 3 (B) 2
(C) 1 (D) 0

87. The electronic configuration of an element with atomic number 7 *i.e.* nitrogen atom is
(A) $1s^2, 2s^1, 2p_x^3$ (B) $1s^2, 2s^2 2p_x^2 2p_y^1$
(C) $1s^2, 2s^2 2p_x^1 2p_y^1 2p_z^1$ (D) $1s^2, 2s^2 2p_x^1 2p_y^2$

88. In a multi-electron atom, which of the following orbitals described by the three quantum members will have the same energy in the absence of magnetic and electric fields

(1) $n = 1, l = 0, m = 0$

(2) $n = 2, l = 0, m = 0$

(3) $n = 2, l = 1, m = 1$

(4) $n = 3, l = 2, m = 0$

(5) $n = 3, l = 2, m = 0$

(A) (1) and (2) (B) (2) and (3)
(C) (3) and (4) (D) (4) and (5)

89. Which of the following represents the electronic configuration of an element with atomic number 17

(A) $1s^2, 2s^2 2p^6, 3s^1 3p^6$

(B) $1s^2, 2s^2 2p^6, 3s^2 3p^4, 4s^1$

(C) $1s^2, 2s^2 2p^6, 3s^2 3p^5$

(D) $1s^2, 2s^2 2p^6, 3s^1 3p^4, 4s^2$

90. The shape of s-orbital is

(A) Pyramidal
(B) Spherical
(C) Tetrahedral
(D) Dumb-bell shaped

91. The shape of p-orbital is

(A) Elliptical (B) Spherical
(C) Dumb-bell (D) Complex geometrical

92. The electronic configuration (outermost) of Mn^{+2} ion (atomic number of Mn = 25) in its ground state is

(A) $3d^5, 4s^0$ (B) $3d^4, 4s^1$

(C) $3d^3, 4s^2$ (D) $3d^2, 4s^2 4p^2$

93. The principal quantum number

(A) Shape of an orbital
(B) Distance of electron from nucleus
(C) Number of electrons in an orbit
(D) Number of orbitals in an orbit

94. When the azimuthal quantum number has a value of $l = 1$, the shape of the orbital is

(A) Unsymmetrical
(B) Spherically symmetrical
(C) Dumb-bell
(D) Complicated

95. How many electrons can be accommodated in a sub-shell for which

(A) 8 (B) 6
(C) 18 (D) 32

96. For azimuthal quantum number $l = 3$, the maximum number of electrons will be

(A) 2 (B) 6
(C) 0 (D) 14

97. An ion has 18 electrons in the outermost shell, it is

(A) Cu^+ (B) Th^{4+}
(C) Cs^+ (D) K^+

98. The order of filling of electrons in the orbitals of an atom will be

(A) 3d, 4s, 4p, 4d, 5s (B) 4s, 3d, 4p, 5s, 4d
(C) 5s, 4p, 3d, 4d, 5s (D) 3d, 4p, 4s, 4d, 5s

99. The quantum number which may be designated by s, p, d and f instead of number is

(A) n (B) l
(C) m_l (D) m_s

100. Which of the following represents the correct sets of the four quantum numbers of a 4d electron

(A) $4, 3, 2, \frac{1}{2}$ (B) 4, 2, 1, 0

(C) $4, 3, -2, +\frac{1}{2}$ (D) $4, 2, 1, -\frac{1}{2}$

101. The quantum numbers $n = 2, l = 1$

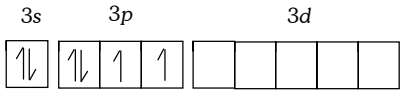
(A) 1*s* orbital (B) 2*s* orbital
(C) 2*p* orbital (D) 3*d* orbital

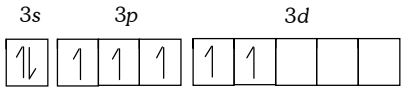
102. The magnetic quantum number of valence electron of sodium (*Na*) is
(A) 3 (B) 2
(C) 1 (D) 0

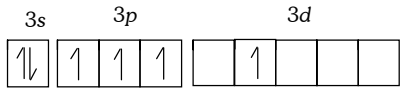
103. Azimuthal quantum number defines
(A) *e*/*m* ratio of electron
(B) Spin of electron
(C) Angular momentum of electron
(D) Magnetic momentum of electron

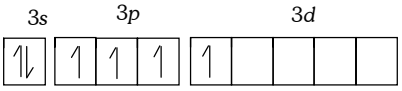
104. Quantum numbers of an atom can be defined on the basis of
(A) Hund's rule
(B) Aufbau's principle
(C) Pauli's exclusion principle
(D) Heisenberg's uncertainty principle

105. Which of the following has maximum energy

(A) 

(B) 

(C) 

(D) 

106. The total magnetic quantum numbers for *d*-orbital is given by
(A) 2 (B) $0, \pm 1, \pm 2$
(C) 0, 1, 2 (D) 5

107. The outer electronic structure $3s^2 3p^5$ is possessed by
(A) *Cl* (B) *O*
(C) *Ar* (D) *Br*

108. Which of the following set of quantum number is not possible

	n	l	m_1	m_2
(A)	3	2	1	+ 1/2
(B)	3	2	1	– 1/2
(C)	3	2	1	0
(D)	5	2	– 1	+ 1/2

109. The configuration $1s^2, 2s^2 2p^5, 3s^1$ shows
(A) Excited state of O_2^-
(B) Excited state of neon
(C) Excited state of fluorine
(D) Ground state of fluorine atom

110. The quantum number '*m*' of a free gaseous atom is associated with
(A) The effective volume of the orbital
(B) The shape of the orbital
(C) The spatial orientation of the orbital
(D) The energy of the orbital in the absence of a magnetic field

111. Which of the following metal ions will have maximum number of unpaired electrons
(A) Fe^{+2} (B) CO^{+2}
(C) Ni^{+2} (D) Mn^{+2}

112. Which of the metal ion will have highest number of unpaired electrons
(A) Cu^+ (B) Fe^{2+}
(C) Fe^{3+} (D) Co^{2+}

113. The maximum number of unpaired electron can be present in d orbitals are
(A) 1 (B) 3
(C) 5 (D) 7

114. The molecule having one unpaired electron is
(A) NO (B) CO
(C) CN^- (D) O_2

115. A filled or half-filled set of *p* or *d*-orbitals is spherically symmetric. Point out the species which has spherical symmetry
(A) Na (B) C
(C) Cl^- (D) Fe

116. The atom of the element having atomic number 14 should have
(A) One unpaired electron
(B) Two unpaired electrons
(C) Three unpaired electrons
(D) Four unpaired electrons

117. An atom has 2 electrons in K shell, 8 electrons in L shell and 6 electrons in M shell. The number of s-electrons present in that element is

(A) 6 (B) 5

(C) 7 (D) 10

118. The number of unpaired electrons in carbon atom in excited state is

(A) One (B) Two

(C) Three (D) Four

119. Maximum number of electrons present in 'N' shell is

(A) 18 (B) 32

(C) 2 (D) 8

120. The number of *d* electrons in Fe^{+2} (atomic number of Fe = 26) is not equal to that of the

(A) p-electrons in Ne (At. No.= 10)

(B) s-electrons in Mg (At. No.= 12)

(C) d-electrons in Fe

(D) p-electrons in Cl^- (At. No. of Cl = 17)