Exercise 3 (Taking it together)

1.The radiation is emitted when a hydrogen atom goes from a higher energy state to a lower energy state. The wavelength of one line in visible region of atomic spectrum of hydrogen is 6.63×10^{-7}m. Energy difference between the two states is

(a) 3.0×10^{-19} J (b) 1.0×10^{-18} J

(c) 5.0×10^{-10} J (d) 6.5×10^{-7} J

2. The ratio of the energy of the electron in ground state of hydrogen to the electron in first excited state of Be^{3+} is

(a) 1:4 (b) 1:8

(c) 1:16 (d) 16:1

3. The number of d-electrons in Fe^{2+} (z=26) is not equal to that of

(a) p-electrons in Ne (z=10)

(b) s-electrons in Mg (z=12)

(c) d-electrons in Fe (z=26)

(d) p-electrons in Cl (z=17)

4. The orbital angular momentum of an electron in 2s orbital is

(a) $+\frac{1}{2}\ \frac{h}{2\pi}$ **(b) zero**

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

5. Which of the following has the maximum number of unpaired electrons?

(a) Mg^{2+} (b) Ti^{3+}

(c) V^{3+} **(d) Fe^{3+}**

6. Bohr model can explain the spectrum of

(a) the hydrogen atom only

(b) an atom or ion having one electron only

(c) the hydrogen molecule only

(d) the sodium atom only

7. Of the following radiation with maximum wavelength is

(a) UV **(b) Radiowave**

(c) X-ray (d) IR

8. Magnetic moment of Xn+ (z= 26) is $\sqrt{24}$ BM. Hence, number of unpaired electrons and value of n respectively are

(a) 4,2 (b) 2,4

(c) 3,1 (d) 0,2

9. Zeeman effect explains splitting of lines in

(a) magnetic field (b)electric field

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

10. In the presence of magnetic field d-sub-orbit is

(a) 5-fold degenerate (b) 3-fold degenerate

(c) 7-fold degenerate (d) non degenerate

11. $\frac{e}{m}$ ratio was determined by

(a) J.J Thomsan (b) Dalton

(c) Chadwick (d) Goldstein

12. Size of the nucleus is

(a) 10^{-13} cm (b) 10^{-10}m

(c) 10^{-1} nm (d) all are correct

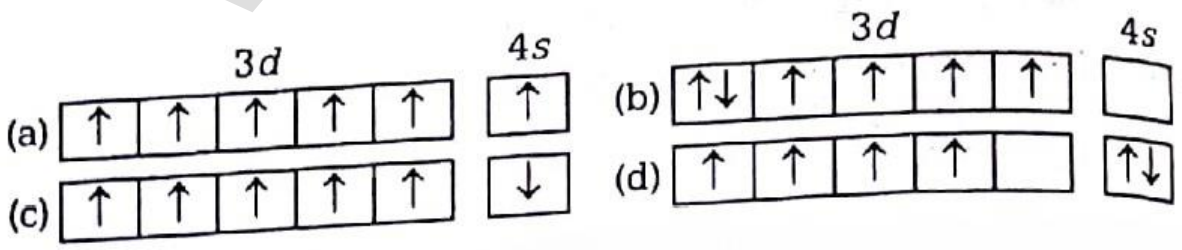
13. visible spectrum extends from 400 nm (violet) to red (750 nm). Hence, frequency ratio is

(a) 4/15 (b) 8/15

(c) 15/8 (d) None of these

14. Which of the following arrangements of electrons is mostly likely to be stable?

ANS:(A)



15. Which of the following orbitals has/ have zero probability of finding the electron in xy plane?

(a) P_z (b) d_{yz}

(c) d_{zx} (d) P_x

16. How fast is an electron moving if it has a wavelength equal to the distance it travels in one second?

(a) $\sqrt{\frac{h}{m}}$ (b) $\sqrt{\frac{m}{h}}$

(c) $\sqrt{\frac{h}{p}}$ (d) $\sqrt{\frac{h}{2(KE)}}$

17. Each orbital has a nodal plane. Which of the following statements about nodal planes is not true?

(a) A plane on which there is zero probabaility that the electron will be found

(b) A plane on which there is maximum probability that the electron will be found

(c) Both (a) and (b)

(d) None of the above

18. The radial distribution curve of 2s sublevel consists of x nodes, x is

(a) 1 (b) 3

(c) 2 (d) 0

19. Angular momentum of the orbitals is given by

(a) $\sqrt{S(S+1)}\frac{h}{2\pi}$ **(b)** $\sqrt{1(1+1)}\frac{h}{2\pi}$

(c) $\sqrt{N(N+2)}\frac{h}{2\pi}$ (d) $\sqrt{(S+1)}\frac{h}{2\pi}$

20. Which relates uncertainty principle?

(a) $\Delta x\, \Delta p \geq \frac{h}{2\pi}$ (b) $\Delta x\, \Delta p \geq \frac{h}{\pi}$

(c) $\Delta x\, \Delta p \geq h$ (d) None of these

21. Ritz combination principle is

(a) $\bar{v} = \overline{R_H}\ [\frac{1}{n_1^2} - \frac{1}{n_2^2}]$ (b) $E_n = \frac{-2\pi^2 m Z^2 e^4}{h^2}$

(c) $E = \frac{hc}{\lambda}$ (d) None of these

22. Which has [Ar] $3d^5 4s^1$ configuration each having 24 e?

(a) Cr (b) Mn^+

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

23. Millikan's oil drop experiment and diffraction effect showed respectively

(a) Wave nature and particle nature

(b) particle and wave nature

(c) Mullikan showed both the nature

(d) diffraction showed both the nature

24. To whom was awarded Nobel prize in the field of quantum mechanics?

(a) Einstein **(b) Planck**

(c) Heisenberg (d) Schrodinger

25. Magnetic moments of V(z=23), Cr(z=24) and Mn (z=25) are x,y,z. Hence

(a) x=y=z (b)x<y<z

(c) x<z<y (d) z<y<x

26. Absolute value of charge on the electron was determined by

(a) J.J. Thomson (b) R.A. Millikan

(c) M. Faraday (d) E. Rutherford

27. Which is not coloured ion?

(a) Cu^+ (b) Na^+

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

28. Uncertainty in position and momentum are equal. Uncertainty in velocity is

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

(c) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ (d) None of these

29. If Aufbau rule is not used, 19^{th} electron in Sc (z= 21) will have

(a) n = 3, l = 0 (b) n = 3, l = 1

(c) n = 3, l = 2 (d) n = 4, l = 0

30. Number of electrons that F (z= 9) has in p-orbitals is equal to

(a) number of electrons in s-orbitals in Na($11e^-$)

(b) number of electrons in d-orbitals in Fe^{3+}($23e^-$)

(c) number of electrons in d-orbitals in Mn ($25e^-$)

(d) All of the above

31. f-suborbit in the presence of magnetic field is

(a) non-degenerate (b) five-fold degenerate

(c) seven-fold degenerate (d) None is true

32. The first use of quantum theory to explain the structure of atom was made by

(a) Heisenberg **(b) Bohr**

(c) Planck (d) Einstein

33. If each orbital can hold a maximum of 3 electrons, the number of elements in 4^{th} period of periodic Table (long form) is

(a) 48 (b) 54

(c) 27 (d) 36

34. If the radius of first Bohr orbit is x, then de-Brogile wavelength of electron in 3^{rd} orbit is nearly

(a) 2πx **(b) 6πx**

(c) 9x (d) $\frac{x}{3}$

35. If the shortest wavelength of H atom in Lyman series is x, then longest wavelength in Balmer series of He^+ is

(a) $\frac{9x}{5}$ (b) $\frac{36x}{5}$

(c) $\frac{x}{4}$ (d) $\frac{5x}{9}$

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

(a) the number of orbital undergoing the transition

(b) the nuclear charge of an atom

(c) the difference in energy levels involved in the transition

(d) the velocity of the electron undergoing the transition

37. Electromagnetic radiations of frequency 'v' consists of a stream of particles called photons. Which of the following statements is/are true about photons?

(a) As the frequency increases, the number of photons in the beam increases

(b) As the intensity of light increases, the number of photons in the beam increases

(c) The number of photons in the beam are independent of frequency

(d) The number of photons in the beam are independent of the intensity of light

38. The allowed energies of a hydrogenic atom are determined solely by the principal quantum number. 'n' , E= $\frac{-hcR}{n^2}$, n = 1, 2, ...,R Rydberg constant. Which of the following statements about R is/are true?

(a) Its numerical value is 1.09 x 10^5 cm^{-1}

(b) It depends on Planck's constant (h)

(c) It depends on permittivity of open space (ε_0)

(d) All of the above

39. Which orbital gives an electron a greater probability of being found close to the nucleus?

(a) 3p (b) 3d

(c) 3s (d) Equal

40. Hund's rule deals with distribution of electrons in

(a) a quantum shell (b) an orbit

(c) an orbital **(d) degenerate orbitals**

41. Which describes orbital?

(a) Ψ (b) Ψ^2

(c) $|\Psi^2|\Psi$ (d) None of these

42. s-orbital is spherically symmetrical hence

(a) it is directional independent

(b) angular dependent

(c) both (a) and (b)

(d) None of the above

43. In centro-symmetrical system, the orbital angular momentum, a measure of the momentum of a particle travelling around the nucleus, is quantised. Its magnitude is

(a) $\sqrt{\mathbf{1(1+1)}}\,\frac{\boldsymbol{h}}{\mathbf{2\pi}}$ (b) $\sqrt{1(1-1)}\,\frac{h}{2\pi}$

(c) $\sqrt{S(S+1)}\,\frac{h}{2\pi}$ (d) $\sqrt{S(S-1)}\,\frac{h}{2\pi}$

44. The correct set of four quantum numbers for the valence electron of rubidium (z=37) is

(a) n = 5, l = 0, m = 0, $m_s = +\frac{1}{2}$

(b) n = 5, l = 1, m = 0, $m_s = +\frac{1}{2}$

(c) n = 5, l = 1, m = 1, $m_s = +\frac{1}{2}$

(d) n = 6, l = 0, m = 0, $m_s = +\frac{1}{2}$

45. The number of orbitals in a sub-shell are

(a) 2 l (b) m

(c) 2l+1 (d) n^2

46. If n and I are respectively the principal and azimuthal quantum numbers, than the expression for calculating the total number of electrons in any energy level is

(a)$\sum_{l=1}^{l=n} 2(2l+1)$ (b) $\sum_{l=1}^{l=n-1} 2(2l+1)$

(c) $\sum_{l=1}^{l=n+1} 2(2l+1)$ **(d)** $\sum_{\boldsymbol{l=0}}^{\boldsymbol{l=n-1}} \mathbf{2(2l+1)}$

47. Which one of the following orbitals is nearest to the nucleus?

(a) 4f (b) 5d

(c) 6s (d) 7p

48. Energy equivalent of 10.00 cm^{-1} is

(a) 2.0 x 10^{-22} J per photon

(b) 28.6 x 10^{-3} kcal mol^{-1} photon

(c) 12.0 x 10^{-2} kJ mol^{-1} photon

(d) all of the above are correct

49. Which of the following relates to light as wave motion?

(a) Diffraction (b) Interference

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

50. When a certain metal was irradiated with light of frequency 3.2×10^{16} Hz, photoelectrons emitted had twice the kinetic energy as did photoelectrons emitted when the same metal was irradiated with light of frequency 2.0×10^{16} Hz. Hence threshold frequency is

(a) 0.8×10^{15} Hz **(b) 8.0×10^{15} Hz**

(c) 0.8×10^{14} Hz (d) 6.4×10^{16} Hz

51. An orbital for which the electron probability distribution is spherically symmetric about the nucleus is

(a) 2p **(b) 3s**

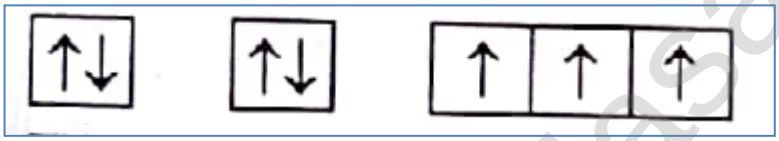
(c) 3p (d) 3d

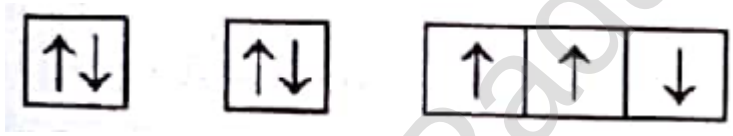
52. If travelling at equal speeds, the longest wavelength of the following matter waves is that for

(a). An electron (b). A proton

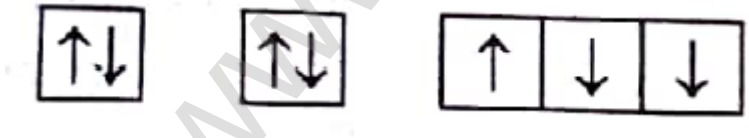
(c). A neutron (d). An alpha particle (He^{2+})

53. Ground state electronic configuration of nitrogen atom can be represented by

(a) 

(b) 

(c) 

(d) 

54. The electronic configuration of an element (M) is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$. This represents its

(a) excited state **(b) ground state**

(c) Cationic from M^{2+} (d) anionic form M^-

55. The ground state electronic configuration of Fe^{3+} is

(a) $[Ar]3d^3 4s^2$ (b) $[Ar]3d^6 4s^2$

(c) $[Ar]3d^5$ (d) $[Ar]3d^4 4s^1$

56. Which of the following ions is paramagnetic?

(a) Ag^{+} (b) Zn^{2+}

(c) Sc^{3+} **(d) Ni^{2+}**

57. An ion with five unpaired electrons in its ground state is

(a) Cr^{3+} **(b) Fe^{3+}**

(c) Mn^{3+} (d) Ni^{2+}

58. The atom with lowest atomic number that has a ground state electronic configuration of (n-1) d^6ns^2 is in the

(a) 2nd period (b) 3rd period

(c) 4th period (d) 5th period

59. If there were three possibilities of electron spin, K(19) would be placed in

(a) s-block **(b) p-block**

(c) d-block (d) f-block

60. If the quantum number l could have the value n also then Sc(21) would have electronic configuration as (other rules strictly followed)

(a) $1s^2\ 1p^6\ 2s^2\ 2p^6\ 2d^3\ 3s^2$

(b) $1s^2\ 1p^6\ 2s^2\ 2p^6\ 3s^2\ 3d^3$

(c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1\ 4s^2$

(d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$

61. If the quantum number l could have the value of n also then Fe(26) would have unpaired electrons

(a) 2 (b) 3

(c) 4 (d) 5

62. A particular electromagnetic radiation with wavelength 200 nm

(a) has a higher frequency than radiation with wavelength 400 nm

(b) is in the visible region of the electromagnetic spectrum

(c) has a greater speed in vacuum than does radiation of wavelength 400 nm

(d) has a greater energy content per photon than does radiation with wavelength 100 nm

63. Which of the following wave properties is proportional to energy for electromagnetic radiation?

(a) Velocity **(b) wave number**

(c) wavelength (d) Amplitude

64. Which of the following best describes the emission spectrum of atomic hydrogen?

(a) A discrete series of lines of equal intensity and equally spaced with respect to wavelength

(b) A series of only four lines

(c) A continuous emission of radiation of all frequencies

(d) Several discrete series of lines with both intensity and spacing between lines decreasing as the wavelength number increases within each series

65. Atomic emission spectra of an element cannot be used to

(a) identify the element

(b) determine the mass number of the nucleus of the atom

(c) measure the difference in energy between pairs of stationary states of the atom

(d) calculate the ionisation energy of the atom

66. The ionisation energy of gaseous Na atoms is 495.80 kJ mol^{-1}. The lowest possible frequency of light that can ionise a Na atom is

(a) 4.76 x 10^{14} s^{-1} (b) 7.50 x $10^{14}s^{-1}$

(c) 1.24 x $10^{15}s^{-1}$ (d) 3.15 x $10^{15}s^{-1}$

67. The cathode-ray experiments carried out J.J. Thomsan demonstrated that

(a) α- particles are the nuclei of He atoms

(b) the ratio of charge to mass for the particles of the cathode rays is constant if different gases are placed in the tube

(c) the mass of an atom is essentially all contained in its very small nucleus

(d) cathode rays are streams of negatively charged ions

68. If the electron in a hydrogen atom drops from the n= 6 to the n = 4 level, the radiation emitted is in which series of lines in the spectrum of atomic hydrogen?

(a) Lyman (b) Balmer

(c) Paschen **(d) Brackett**

69. A line with wave number 1.028 x 10^{-2} nm^{-1} is emitted in the spectrum of atomic hydrogen. In what region of the electromagnetic spectrum does this line occur?

(a) Far UV **(b) Near UV**

(c) Visible (d) Near IR

70. Which of the following statements about Millikan's oil drop experiment is true?

(a) When the electric field is turned on, all the oil-drops move towards the positively charged plate

(b) The charge on each oil-drops is the electronic charge

(c) In the absence of the electric field, the speed with which the drop falls depends only upon the acceleration of gravity

(d) Some oil-drops become positively charged and some become negatively charged after colliding with gaseous ions

71. Because of the observation that some α- particles directed at a gold foil are scattered backwards at angles larger than 90^{o}, Rutherford was able to conclude that

(a) all atoms are electrically neutral

(b) the positively charged parts of atoms move with extremely large velocities

(c) negatively charged electrons are a part of all matter

(d) the positively charged parts of atoms occupy only a very small functions of the volume of the atom

72. To move the electron in one H atom from the ground state to the second excited state, 12.084 eV are needed. How much energy is needed to cause 1 mole of H atoms to undergo this transition?

(a) 728 kJ (b) 984 kJ

(c) 1036 kJ **(d) 1164 kJ**

73. One of the lines in the spectrum of atomic hydrogen has wave number 533.16 cm^{-1}. What is the frequency of this line?

(a) 5.623 x $10^{5}s^{-1}$ (b) 1.876 x 10^{11} s^{-1}

(c) 1.598 x 10^{13} s^{-1} (d) 1.598 x $10^{14}s^{-1}$

74. The amount of energy required to remove the electron from a Li^{2+} ion its ground state is how many times greater than the amount of energy needed to remove the electron from an H atom in its ground state?

(a) 2 **(b) 9**

(c) 4 (d) 6

75. A typical golf ball weighs 40.0g. If it is moving with a velocity of 20.0 ms^{-1}, its de-Broglie wavelength is

(a) 1.66 x 10^{-34} nm (b) 8.28 x 10^{-32} nm

(c) 8.28 x 10^{-25} nm (d) 1.66 x 10^{-24} nm

76. What is the energy, in joules, of a photon of IR light with wavelength 4.0 x 10^{3} nm?

(a) 5.0 x 10^{-20} (b) 7.5 x 10^{-20}

(c) 4.0 x 10^{-16} (d) 2.5 x 10^{-14}

77. The most intense line in the Brackett series of the spectrum of atomic hydrogen is the transition

(a) $n_2 = \infty \rightarrow n_1 = 1$ (b) $n_2 = 8 \rightarrow n_1 = 4$

(c) $n_2 = \infty \rightarrow n_1 = 4$ (d) $n_2 = 4 \rightarrow n_1 = 3$

78. Atomic unit of length is called ..... and denoted by...

(a) Bohr,Å **(b) Bohr, a_0**

(c) Bohr, I (d) Einstein, a_0

79. Hamiltonia operator $\hat{H}$ is the sum of two energy operators. These are

(a) mechanical and potential

(b) kinetic and mechanical

(c) kinetic and potential

(d) thermal and potential

80. Select the correct statement.

(a) Radial part is dependent on r and angular part is dependent on θ and ϕ

(b) Angular wave function 'θ ϕ' depends only on l and m_1 independent on n for a given type of orbital

(c) Both (a) and (b) are correct

(d) None of the above is correct

81. Energy for 7.25 x 10^{15} photons of 5.37 x 10^{14} s^{-1} frequency in Einstein unit is

(a) 1.20 x 10^{-8} (b) 2.58 x 10^{-3}

(c) 3.56 x 10^{-19} (d) 8.33 x 10^{7}

82. A black body is an object which is capable of

(a) emitting all frequencies of radiation uniformly

(b) absorbing all frequencies of radiation uniformly

(c) emitting and absorbing all frequencies of radiation uniformly

(d) emitting and absorbing all frequencies of radiation at random

83. Number of photons emitted by a 100 W (Js^{-1}) yellow lamp in 1.0s is (λ of yellow light is 560 nm)

(a) 2.8×10^{20} (b) 2.8×10^{18}

(c) 1.1×10^{20} (d) 2.2×10^{20}

84. Time taken to produce 1 mole of the photons in above case is

(a) 40 min **(b) 36 min**

(c) 12 min (d) 340 min

85. The wavelength of a neuron with a translator kinetic energy equal to kT at 300 K is

(a) 178 pm (b) 200 pm

(c) 17.8 pm (d) 20.0 pm

86. Speed of an electron of wavelength 3.0 cm is

(a) 2.43 ms^{-1} **(b) 0.0243 ms^{-1}**

(c) 24.3 ms^{-1} (d) 0.243 ms^{-1}

87. A laser used to read CDs emits red light of wavelength 700 nm. How many photons does it emit each second if its power is 1.0 W?

(a) $1.76 \times 10^{18}\ s^{-1}$ (b) $7.04 \times 10^{18}\ s^{-1}$

(c) $6.0 \times 10^{23}\ s^{-1}$ **(d) $3.52 \times 10^{18}\ s^{-1}$**

88. Consider the following statements.

I: $|\Psi|^2$ is a measure of electron density at a point in an atom.

II: Radial probability function ($= 4\pi r^2R^2$) gives the probability of finding the electron at a distance r (atomic radius) from the nucleus regardless of direction.

III: The shape of an orbital is defined as a surface of constant probability density that encloses some large fraction of the probability of finding the electron.

Select the correct statement(s).

(a) I.II (b) II,III (c) I,III **(d) I,II,III**

89. For which of the following sets of four quantum numbers, an electron will have the highest energy?

	n	l	m	s
(a)	3	2	1	$+\frac{1}{2}$
(b)	**4**	**2**	**-1**	$\mathbf{+\frac{1}{2}}$
(c)	4	1	0	$-\frac{1}{2}$
(d)	5	0	0	$-\frac{1}{2}$

90. The radius of hydrogen atom in the ground state is 0.53 Å. The radius of Li^{2+} ion (atomic number = 3) in a similar state is

(a) 0.17 Å (b) 0.265 Å

(c) 0.53 Å (d) 1.06 Å

91. Uncertainty in position of an electron (mass = 9.1×10^{-28} g) moving with a velocity of 3×10^4 cm/s accurate up to 0.001% will be

(a) 1.93 cm (b) 3.84 cm

(c) 5.76 cm (d) 7.68 cm

92. In a Bohr's model of atom when an electron in H- atom jumps from n = 1 to n =3, how much energy will be emitted or absorbed?

(a) 2.15×10^{-11} erg/atom **(b) 0.1936×10^{-10} erg/atom**

(c) 2.389×10^{-12} erg/atom (d) 0.239×10^{-10} erg/atom

93. What will be the longest wavelength line in Balmer's series of spectrum?

(a) 566 nm (b) 556 nm

(c) 546 nm **(d) 656 nm**

94. Bohr radius for the hydrogen atom (n=1) is approximately 0.530Å. The radius for the first excited state (n =2) orbit is (in Å)

(a) 0.13 (b) 1.06

(c) 4.77 **(d) 2.12**

95. The position of both an electron and a helium atom is known within 1.0 mm. Further the momentum of the electron is known within 5.0×10^{-26} kg m s^{-1}. The minimum uncertainty in the measurement of the momentum of the helium atom is

(a) 50 kg m s^{-1} (b) 80 kg m s^{-1}

(c) 80 x 10^{-26} kg m s^{-1} **(d) 5.0 x 10^{-26} kg m s^{-1}**

96. Which one is paramagnetic among the following?

[Atomic number : Be = 4, Ne= 10, As= 33, Cl= 17]

(a) Cl^- (b) Be

(c) Ne **(d) As^+**

97. which one is paramagnetic among the following?

(a) $1s^2, 2s^22p^6, 3s^23p^63d^5$

(b) $1s^2, 2s^22p^6, 3s^23p^6, 4s^23d^5$

(c) $1s^2, 2s^22p^6, 3s^23p^6, 4s^23d^7$

(d) $1s^2, 2s^22p^6, 3s^23p^6, 4s^23d^6$

98. Which of the following has maximum unpaired d-electrons?

(a) Zn^+ **(b) Fe^{2+}**

(c) Ni^{3+} (d) Cu^+

99. The uncertainty in momentum of an electron is 1 x 10^{-5} m/s. The uncertainty in its position will be (h= 6.62 x 10^{-34} kg m^2/s)

(a) 1.05 x 10^{-28} m (b) 1.05 x 10^{-26} m

(c) 5.27 x 10^{-30} m (d) 5.25 x 10^{-28} m

100. Who modified Bohr's theory by introducing elliptical orbits for electron path?

(a) Hund (b) Thomson

(c) Rutherford **(d) Sommerfeld**

101. Which one of the following forms a colourless solution in aqueous medium?

(Atomic number : sc= 21, Ti = 22, V = 23, Cr = 24)

(a) V^{3+} **(b) Cr^{3+}**

(c) Ti $^{3+}$ (d) Sc^{3+}

102. The diamagnetic ion is

(a) Fe^{3+} (b) Sc^{2+}

(c) Fe^{2+} **(d)Zn^{2+}**

103. The configuration $1s^2,2s^22p^5,3s^1$ shows

(a) excited state of O_2^-

(b) excited state of neon atom

(c) excited state of fluorine atom

(d) ground state of fluorine atom

104. The energy of electron in first energy level is -21.79×10^{-12} erg per atom. The energy of electron in second energy level is

(a) -54.47×10^{-12} erg $atom^{-1}$

(b) -5.447×10^{-12} erg $atom^{-1}$

(c) -0.5447×10^{-12} erg $atom^{-1}$

(d) -0.05447×10^{-12} erg $atom^{-1}$

105. The de-Broglie wavelength of the electron in the ground state of hydrogen atom is

[KE = 13.6 eV]; 1 eV = 1.6×10^{-19} J

(a) 33.29 nm (b) 3.329 nm

(c) 0.3329 nm (d) 0.0332 nm

106. The atomic number of an element is 17. The number of orbitals containing electron pairs in its valence shell are

(a) 2 **(b) 3**

(c) 4 (d) 5

107. Total number of electrons in all the p-orbitals of bromine are

(a) 17 (b) 24

(c) 27 (d) 33

108. If the nitrogen atom had electronic configuration $1s^7$, it would have energy lower than that of the normal ground state configuration $1s^22s^22p^3$, because the electrons would be closer to the nucleus, yet $1s^7$ is not observed because it violates

(a) Heisenberg uncertainty principle

(b) Hund's rule

(c) Pauli's exclusion principle

(d) Bohr's postulate of stationary orbits

109. Rutherford's experiment, which established the nuclear model of the atom used a beam of

(a) β-particles, which impinged on a metal foil and got absorbed

(b) γ-rays, which impinged on a metal foil and got electrons

(c) helium atoms, which impinged on a metal foil and got scattered

(d) helium nuclei, which impinged on a metal foil and got scattered

110. The number of radial nodes of 3s and 2porbitals are respectively

(a) 2, 0 (b) 0, 2

(c) 1, 2 (d) 2, 1

111. Bohr frequency condition is given by

(a) $\frac{h}{mv}$ (b) Δ E = hv

(c) Δ E = $\frac{h}{mv}$ (d) λ = $\frac{h}{p}$

112. The shortest wavelength transition in the Paschen series in hydrogen occurs at 821 nm; at what wavelength does it occur in Li^{2+} (isoelectronic of hydrogen)?

(a) 91.2 nm (b) 273.6 nm

(c) 821.0 nm (d) 7389.0 nm

113. Sum of spin of three α- electrons and two β-electrons is

(a) $\frac{5}{2}$ **(b)** $\mathbf{\frac{1}{2}}$

(c)- $\frac{1}{2}$ (d)- $\frac{5}{2}$

114. Select the correct statements(s).

(a) s-orbitals are spherically symmetrical and have non-zero amplitude at the nucleus

(b) Spin with $m_s = +\frac{1}{2}$ is called α and spin with $m_s = -\frac{1}{2}$ is called β

(c) A radial distribution function, P(r) is the probability density for finding an electron between r and (r+dr) and for s-orbitals p= $4\pi r^2\Psi^2$

(d) All of the above are correct statements

115. Select the correct matching for 3d orbital.

	n	l	Angular nodes	Radial nodes
(a)	3	2	2	1
(b)	**3**	**2**	**2**	**0**

(c)	3	2	1	1
(d)	3	2	1	0

116. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$. This represents its

(a) excited state **(b) ground state**

(c) cationic form (d) anionic form

117. The number of nodal planes in a P_x orbital is

(a) one (b) two

(c)three (d) zero

118. The wavelength associated witha golf hall weighing 200g and moving at a speed of 5 m/h is of the order

(a) 10^{-10} m (b) 10^{-20} m

(c) 10^{-30} m (d) 10^{-40} m

119. The quantum number $+\frac{1}{2}$ and $-\frac{1}{2}$ for the electron spin represent

(a) rotation of the electron in clockwise and anticlockwise direction respectively

(b) rotation of the electron in anti-clockwise and clockwise direction respectively

(c) magnetic moment of the electron pointing up and down respectively

(d) two quantum mechanical spin states which have no classical analogue

120. If the nitrogen atom had electronic configuration $1s^7$, it would have energy lower than that of the normal ground state configuration $1s^2 2s^2 2p^3$, because the electrons would be closer to the nucleus, yet $1s^7$, is not observed because it violates

(a) Heisenberg uncertainty principle

(b) Hund's rule

(c) Pauli's exclusion principle

(d) Bohr's postulate of stationary orbits

121. Rutherford's experiment, which established the nuclear model of the atom, used a beam of

(a) β-particles, which impinged on a metal foil and got absorbed

(b) γ-rays, which impinged on a metal foil and ejected electrons

(c) helium atoms, which impinged on a metal foil and got scattered

(d) helium nuclei, which impinged on a metal foil and got scattered

122. Which hydrogen like species will have same radius as that of Bohr orbit of hydrogen atom?

(a) n = 2, Li^{2+} **(b) n = 2, Be^{3+}**

(c) n = 2, He^{+} (d) n = 3, Li^{2+}

123.The number of radial nodes of 3s and 2p orbitals are respectively

(a) 2, 0 (b) 0, 2

(c)1, 2 (d) 2, 1

124. A positron is emitted from $^{23}_{11}Na$. The ratio of the atomic mass and atomic number of the resulting nuclide is

(a) 22/10 (b) 22/11

(c) 23/10 (d) 23/12

125. In an atom, an electron is moving with a speed of 600 m/s with an accuracy of 0.005%. Certainty with which the position of the electron can be located is (h= 6.6 x 10^{-34} kg m^2s^{-1}, mass of electron e_m = 9.1 x 10^{-31} kg)

(a) 1.52 x 10^{-4} m (b)5.10 x 10^{-3} m

(c) 1.92 x 10^{-3} m (d) 3.84 x 10^{-3} m

126. Calculate the wavelength (in nanometer) associated with a proton moving at 1.0 x 10^3 m s^{-1} (mass of proton = 1.67 x 10^{-27} kg and h= 6.63 x 10^{-34} Js)

(a) 0.032 nm **(b) 0.40 nm**

(c) 2.5 nm (d) 14.0 nm

127. Which one of the following constitutes a group of the isoelectronic species?

(a) C_2^{2-}, O_2^-, CO ,NO

(b) NO^+, C_2^{2-}, CN^- , N_2

(c) CN^-, N_2 , O_2^{2-}, CO_2^{2-}

(d) N_2, O_2^-,NO^+, CO

128. The ionisation enthalpy of hydrogen atom is 1.312 x 10^6 J mol^{-1}. The energy required to excite the electron in the atom from n= 1 to n =2 is

(a) 8.51 x 10^5 J mol^{-1} (b) 6.56 x 10^5 J mol^{-1}

(c) 7.56 x 10^5 J mol^{-1} **(d) 9.84 x 10^5 J mol^{-1}**

129. Which of the following sets of quantum numbers represents the highest energy of an atom?

(a) n = 3, l = 1, m = 1, s = +1/2

(b) n = 3, l = 2, m = 1, s = +1/2

(c) n = 4, l = 0, m = 0, s = +1/2

(d) n = 3, l = 0, m = 0, s = +1/2

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

(a) 25 $\frac{h}{\pi}$ (b) 1.0 $\frac{h}{\pi}$

(c) 10$\frac{h}{\pi}$ **(d) 2.5$\frac{h}{\pi}$**

131. Uncertainty in the position of an electron (mass = 9.1 x 10^{-31} kg) moving with a velocity 300ms^{-1}, accurate upon 0.001 % will be (h= 6.63 x 10^{-34}JS)

(a) 19.2 x 10^{-2} m (b) 5.76 x 10^{-2} m

(c) 1.92 x 10^{-2} m (d) 3.84 x 10^{-2} m

132.The frequency of light emitted for the transition n = 4 to n =2 of He^+ is equal to the transition in H atom corresponding to which of the following?

(a) n = 3 to n = 1 **(b) n = 2 to n = 1**

(c) n = 3 to n = 2 (d) n = 4 to n = 3

133. A gas absorbed photon of 355 nm and emits at two wavelengths. If one of the emission is at 680 nm, the other is at

(a) 1035 nm (b) 325 nm

(c) 743 nm (d) 518 nm

134. Ionisation energy of He^+ is 19.6 x 10^{-18} J atom^{-1}. The energy of the first stationary state (n=1) of Li^{2+} is

(a) 4.41 x 10^{-16} J atom^{-1} **(b) -4.41 x 10^{-17} J atom^{-1}**

(c) -2.2 x 10^{-15} J atom^{-1} (d) 8.82 x 10^{-17} J atom^{-1}

135. The energy of hydrogen atom in its ground state is -13.6 eV. The energy of the level corresponding to the quantum number n =5 is

(a) -5.4 eV **(b) -0.54 eV**

(c) -2.72 eV (d) -0.85 eV