KD EDUCATION ACADEMY [9582701166]

Time : 6 Hour | STD 11 Science Chemistry | Total Marks : 230

kd 90+ Questions ch- 2 ch-2 structure of atom

*** Choose The Right Answer From The Given Options.[1 Marks Each]** **[48]**

1. The angular moment of electron in d-orbital is equal to:
   (Where $\not{h} = \frac{h}{2\pi}$)
   (A) $2\sqrt{3}\ \not{h}$ (B) $0\ \not{h}$ (C) $\sqrt{6}\ \not{h}$ (D) $\sqrt{2}\not{h}$

2. Number of electrons surroundings Kr in KrF_2 is:
   (A) 10 (B) 6 (C) 4 (D) 8

3. For the electrons of oxygen atom, which of the following statements is correct?
   (A) Zeff for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p orbital.
   (B) An electron in the 2s orbital has the same energy as an electron in the 2p orbital.
   (C) Zeff for an electron in 1s orbital is the same as Z_{eff} for an electron in a 2s orbital LED.
   (D) The two electrons present in the 2s orbital have spin quantum numbers m, but of opposite sign.

4. Isotopes have same____but different____.
   (A) Atomic number, mass number. (B) Mass number, atomic number.
   (C) Number of neutrons, atomic number. (D) None of these.

5. For an atom of a given element, the number of electrons equals to:
   (A) The number of protons + number of neutrons.
   (B) The atomic number of the element.
   (C) The number of proton – number of neutrons.
   (D) The mass number of the element.

6. The Bohr model of atoms:
   (A) Uses Einstein's photo electric equation.
   (B) Predicts continuous emission spectra for atoms.
   (C) Predicts the same emission spectra for all types of atoms.
   (D) Assumes that the angular momentum of electrons is quantized.

7. Which of the following statements is/ are correct regarding Rutherford scattering experiment?
   (A) Most of the A-particles passed through the gold foil remain undeflected.
   (B) A small fraction of the Q-particles was deflected by small angles.
   (C) A very few a-particles $(\sim 1 \text{ in } 20000)$ bounced back, i.e. were deflected by nearly 180°.
   (D) All of the above.

8. The band spectrum is caused by:
   (A) Molecules. (B) Atoms.
   (C) Any substance in solid state. (D) Any substance in liquid state.

9. The first use of quantum theory to explain the structure of atom was made by:
   (A) Heisenberg (B) Bohr (C) Planck (D) Einstein

10. The ionisation enthalpy of hydrogen atom is 1.312×10^6 J mol^{-1}. The energy required to excite the electron in the atoms from n = 1 to n_2 = 2 is:

(A) 6.56×10^5 J mol^{-1} (B) 9.84×10^5 J mol^{-1}

(C) 7.56×10^5 J mol^{-1} (D) 8.51×10^5 J mol^{-1}

11. The atomic number of an element is determined by:

(A) The number of electrons in one atom. (B) The number of neutrons in one atom.

(C) The valency of the element. (D) The number of protons in one atom.

12. For the electrons of oxygen atom, which of the following statements is correct?

(A) Z_{eff} for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p orbital.

(B) An electron in the 2s orbital has the same energy as an electron in the 2p orbital.

(C) Z_{eff} for an electron in 1s orbital is the same as Z_{eff} for an electron in a 2s orbital.

(D) The two electrons present in the 2s orbital have spin quantum numbers m_s but of opposite sign.

13. An atom of an element has two electrons in the M shell. Identify its atomic number.

(A) 10 (B) 12 (C) 14 (D) 15

14. Atomic mass unit is abbreviated as _____.

(A) atm (B) ama (C) a.m.u (D) aum

15. Who suggested the distribution of electrons into different orbits of an atom?

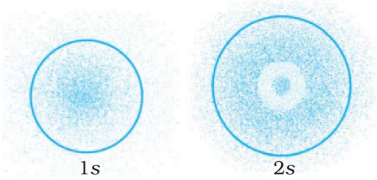
(A) E. Goldstein (B) Ernest Rutherford

(C) Bohr and Bury (D) Dalton

16. After completion of 'np' level, the electron enters into which level according to (n + p) rule?

(A) (n − 1)d (B) (n + 1)s (C) nd (D) (n + 1)p

17. The probability density plots of 1s and 2s orbitals are given in Fig.:



The density of dots in a region represents the probability density of finding electrons in the region.

On the basis of above diagram which of the following statements is incorrect?

(A) 1s and 2s orbitals are spherical in shape.

(B) The probability of finding the electron is maximum near the nucleus.

(C) The probability of finding the electron at a given distance is equal in all directions.

(D) The probability density of electrons for 2s orbital decreases uniformly as distance from the nucleus increases.

18. Total number of orbitals associated with third shell will be _____.

(A) 2 (B) 4 (C) 9 (D) 3

19. Identify the correct order of increase in the energy of the orbitals for hydrogen atom:

(A) 1s < 28 = 2p < 3s = 3p = 3d < 4s = 4 p = 4d = 4f

(B) 1s > 2s = 2p > 3s = 3p = 3d > 4s = 4p = 4d = 4f

(C) 1s = 2s = 3s = 4s > 2p = 3 p = 4p > 3d = 4d > 4f

(D) 1s = 2s = 3s = 4s < 2p = 3p = 4p < 3d = 4d < 4f

20. For an element, A = 34 and N = 19, What is the atomic number of the element?

(A) 34 (B) 19 (C) 53 (D) 15

21. Impossible orbital among the following is:

(A) 3f (B) 2p (C) 4d (D) 2s

22. Which of the following has the same number of protons?

(A) Isobars (B) Isoelectronic

(C) Isotopes (D) Isotones

23. Which of the following pairs of d-orbitals have electron density along the axis?

(A) $d_{z^2}\, d_{xz}$ (B) d_{xz}, d_{yz} (C) $d_{z^2}, d_{x^2y^2}$ (D) $d_{zy}, d_{x^2y^2}$

24. The de Broglie wavelengths associated with a ball of mass 1kg having kinetic energy 0.5J is:

(A) 6.626×10^{-34}m (B) 13.20×10^{-34}m (C) 10.38×10^{-21}m (D) 6.626×10^{-34}A

25. A neutral atom has 13 electrons and 14 neutrons. Its mass number is _____.

(A) 13 (B) 26 (C) 27 (D) 28

26. The atomic number of an element is 32 and mass number 55. Calculate the number of neutrons?

(A) 23 (B) 32 (C) 21 (D) 25

27. The electronic configuration of an element is $1s^2 2s^2 2p^3$. The number of unpaired electron in this atom are:

(A) 3 (B) 5 (C) 7 (D) 1

28. The maximum number of electrons that can be filled into all the orbitals corresponding to the azimuthal quantum number l = 3, is:

(A) 14 (B) 15 (C) 12 (D) 18

29. Aufbau principle does not give the correct arrangement of filling up of the atomic orbitals in:

(A) Cu and Zn (B) Co and Zn (C) Mn and Cr (D) Cu and Cr

30. Which of the following options does not represent ground state electronic configuration of an atom?

(A) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^8\ 4s^2$ (B) $1s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ 4s^2$

(C) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$ (D) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

31. Magnetic moment 2.83BM is given by which of the following ions? [Atomic number Ti = 22, Cr = 24, Mn = 25, Ni = 28].

(A) Ti^{3+} (B) Ni^{2+} (C) Cr^{2+} (D) Mn^{2+}

32. In the line spectrum of hydrogen, the lines described by the formula $\bar{v} = 109.677\left(\frac{1}{2^2} - \frac{1}{n^2}\right) cm^{-1}$ where, n = integer, $n \geq 3$.

Constitutes:

(A) Balmer series. (B) Lyman series.

(C) Pfund series. (D) Paschen series.

33. The number of radial nodes for 3p orbital is _____.

(A) 3. (B) 4. (C) 2. (D) 1.

34. Pauli exclusion principle states that:

(A) No two electrons in an atom can have the same set of four quantum numbers.

(B) Only two electrons may exist in the same orbital and these electrons must have opposite spin.

(C) Both (a) and (b).

(D) None of the above.

35. If E_A, E_B and E_C represent kinetic energies of an electron, alpha particle and proton respectively and each moving with same de-Broglie wavelength, then choose the correct increasing representation,

(A) $E_A = E_B = E_C$ (B) $E_A > E_B > E_C$ (C) $E_B > E_C > E_A$ (D) $E_A < E_C < E_B$

36. Identify the pairs which are **not** of isotopes?

(A) ${}^{13}_{6}X,\ {}^{13}_{6}Y.$ (B) ${}^{35}_{17}X,\ {}^{37}_{17}Y.$ (C) ${}^{14}_{6}X,\ {}^{14}_{7}Y.$ (D) ${}^{8}_{4}X,\ {}^{8}_{5}Y.$

37. The pair of ions having same electronic configuration is _____.

(A) Cr^{3+}, Fe^{3+} (B) Fe^{3+}, Mn^{2+} + (C) Fe^{3+}, CO^{3+} (D) Sc^{3+}, Cr^{3+}

38. A ray of white light is spread out into a series of coloured bands of visible light are called:

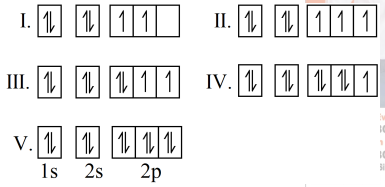
(A) Visible band. (B) Spectrum.

(C) Electronic spectrum. (D) None of these.

39. How will you find out the maximum number of electrons in the main energy level?

(A) n (B) n^2 (C) $2n^4$ (D) $2n^2$

40. Electronic configuration of five elements I, II, III, IV, V is mentioned below.



In the above configuration element I, II, III, IV and V represent as:

(A) C, N, O, F, Ne (B) Ne, F, O, N, C

(C) C, O, N, Ne, F (D) O, C, F, Ne, V

41. Atomic number of an atom is equal to the _____.

(A) Number of protons. (B) Number of electrons.

(C) Both a and b. (D) Sum of proton and electron.

42. What tool was Thomson using when he discovered the electron?

(A) Magnifying Glass (B) Hammer

(C) Cathode Ray (D) Microscope

43. Thomson showed that the stream of particles in cathode ray tube is made up of small particles which are a component of the atom and is:

(A) Neutral. (B) Negatively charged.

(C) Positively charged. (D) Both A and B.

44. Protons and neutrons are also called _____.

(A) Nucleons (B) Isotope (C) Isobars (D) Elements

45. Total number of orbitals associated with third shell will be _____.

(A) 2. (B) 4. (C) 9. (D) 3.

46. Who was the first scientist to propose a model for the structure of an atom?

(A) J.J. Thomson (B) Dalton

(C) Ernest Rutherford (D) E. Goldstein

47. Number of angular nodes for 4d orbital is _____.

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

48. The mass number of a nucleus is:

(A) Always less than its atomic number.

(B) Always more than its atomic number.

(C) Sometimes equal to its atomic number.

(D) Sometimes equal and sometimes more than its atomic number.

*** a statement of Assertion (A) is followed by a statement of Reason (R). [2]**

Choose the correct option.

49. **Note:** In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A): Black body is an ideal body that emits and absorbs radiations of all frequencies.

Reason (R): The frequency of radiation emitted by a body goes from a lower frequency to higher frequency with an increase in temperature.

a. Both A and R are true and R is the correct explanation of A.
b. Both A and R are true but R is not the explanation of A.
c. A is true and R is false.
d. Both A and R are false.

50. **Note:** In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A): It is impossible to determine the exact position and exact momentum of an electron simultaneously.

Reason (R): The path of an electron in an atom is clearly defined.

a. Both A and R are true and R is the correct explanation of A.
b. Both A and R are true and R is not the correct explanation of A.
c. A is true and R is false.
d. Both A and R are false.

*** Answer The Following Questions In One Sentence.[1 Marks Each] [10]**

51. Write the complete symbol for the atom with the given atomic number (Z) and atomic mass (A),

Z = 4 , A = 9.

52. Write the complete symbol for the atom with the given atomic number (Z) and atomic mass (A),

Z = 17 , A = 35.

53. Among the following pairs of orbitals which orbital will experience the larger effective nuclear charge?

3d and 3p.

54. Write electronic configuration of:

i. $Na^+(11)$,

ii. $Cl^-(17)$.

55. Write the values of the quantum number n, l, m and s for electron filling 21st place in the atom of element with atomic number 24.

56. Why is 4s-orbital filled before 3d-orbital?

57. Why is energy of 1s electron lower than 2s electron?

58. Why is following electronic configuration not correct for ground state of Cr atom?
(Atomic number = 24) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^4$.

59. How are d_{xy} and $d_{x^2} - y^2$ orbitals related?

60. How many radial and angular nodes are present in 2p-orbital.

*** Given Section consists of questions of 2 marks each.** **[36]**

61. Which of the following orbitals are possible? 1p, 2s, 2p and 3f

62. An atom of an element contains 29 electrons and 35 neutrons. Deduce
    1. The number of protons
    2. The electronic configuration of the element.

63. Indicate the number of unpaired electrons in:
Fe.

64. What are the atomic numbers of elements whose outermost electrons are represented by
    a. $3s^1$
    b. $2p^3$
    c. $3p^5$?

65. An electron is in one of the 3d orbitals. Give the possible values of n, l and ml for this electron.

66. The energy associated with the first orbit in the hydrogen atom is -2.18×10^{-18}J $atom^{-1}$. What is the energy associated with the fifth orbit?

67. The velocity associated with a proton moving in a potential difference of 1000V is $4.37 \times 10^5 ms^{-1}$. If the hockey ball of mass 0.1kg is moving with this velocity, calcualte the wavelength associated with this velocity.

68. Indicate the number of unpaired electrons in:
Fe.

69. Which of the following orbitals are degenerate?
$3d_{xy}$, $4d_{xy}$, $3d_{z^2}$, $3d_{yz}$, $4d_{yz}$, $4d_{z^2}$

70. In photoelectric effect experiment, irradiation of a metal with light of frequency $5 \times 10^{20}\ s^{-1}$ yields electrons with maximum K.E. = 6.63×10^{-14}J. Calculate v_0(threshold frequency) for the metal.

71. In an atom, an electron is moving with a speed of $600 ms^{-1}$ with an accuracy of 0.005%. Find the certainty with which the position of the electron can be located. ($h = 6.6 \times 10^{-34}$kg/ $m^2 s^{-1}$, mass of electron me = 9.1×10^{-31}kg).

72. What will be the wavelength of a ball of mass 0.1kg moving with a velocity of $10 ms^{-1}$?

73. Which orbital in each of the following pairs is lower in energy in a many electron atom?
    i. 2s, 2p
    ii. 3p, 3d
    iii. 3s, 4s
    iv. 40, 5f

74. Nickel atom can lose two electrons to form Ni^{2+} ion. The atomic number of nickel is 28. From which orbital will nickel lose two electrons.

75. Calculate the velocity of a particle of mass 0.1mg which is associated with a wavelength of 3.3×10^{-29}m ($h = 6.6 \times 10^{-34}$kg/ m^2s^{-1}).

76. How many quantum numbers specify an:
    i. Electron,
    ii. Orbital? Name them.

77. A proton is moving with kinetic energy 5×10^{-27}J. What is the velocity of the proton?

78. Out of Cu^{2+}, Fe^{2+} and Cr^{3+}, which ion is most paramagnetic and why?

*** Given Section consists of questions of 3 marks each.** **[51]**

79. Yellow light emitted from a sodium lamp has a wavelength (λ) of 580 nm. Calculate the frequency (ν) and wavenumber $(\bar{\nu})$ of the yellow light.

80. Write the electronic configurations of the following ions:
    a. H^-
    b. Na^+
    c. O^{2-}
    d. F^-

81. Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range. If the radiation source has the duration of 2 ns and the number of photons emitted during the pulse source is 2.5×10^{15}, calculate the energy of the source.

82. An element with mass number 81 contains 31.7% more neutrons as compared to protons. Assign the atomic symbol.

83. How many neutrons and protons are there in the following nuclei?
    $^{13}_{06}C$, $^{16}_{08}O$, $^{24}_{12}Mg$, $^{56}_{26}Fe$, $^{88}_{38}Sr$

84. Correct the following electronic configuration of the elements in the ground state.
    i. $1s^2\ 2s^1, 2p_x^2, 2p_y^2, 2p_z^2, 3s62, 2p_x^1$
    ii. $1s^2\ 2s^1, 2p_x^1, 2p_y^1, 2p_z^1$
    iii. $1s^2\ 2s^1, 2p^6, 3s^2, 3p^6, 3d^5$
    iv. $1s^2\ 2s^2, 2p^6, 3p^6, 3d^4, 4s^2$

85. The first shell may contain up to 2 electrons, the second shell up to 8, the third shell up to 18, and the fourth shell up to 32. Explain this arrangement in terms of quantum numbers.

86. i. Define Aufbau's principle.
    ii. Draw the shape of d_{z^2} orbital.
    iii. Which quantum number specify number of orbitals in a given subshell?

87. According to de Broglie, matter should exhibit dual behaviour, that is both particle and wave like properties. However, a cricket ball of mass 100g does not move like a wave when it is thrown by a bowler at a speed of 100km/h. Calculate the wavelength of the ball and explain why it does not show wave nature.

88. Hydrogen atom has only one electron, so mutual repulsion between electrons is absent. However, in multielectron atoms mutual repulsion between the electrons is significant. How does this affect the energy of an electron in the orbitals of the same principal quantum number in multielectron atoms?

89. i. The mass of an electron is 9.1×10^{-28}g. If its K.E. is 3.0×10^{-25}J, calculate its wave-length in Angstrom. [h = 6.6×10^{-34}Js]
    ii. What is photoelectric effect?

90. i. The frequency of the strong yellow line in the spectrum of sodium is 5.09×10^{14} s^{-1}. Calculate the wavelength of the light in nanometer.
    ii. Using s, p, d notations, describes the orbital with the following quantum numbers:
        - n = 3, l = 1, m = 0, (b) n = 1, l = 0

    iii. Which quantum number distinguishes the electron in the same orbital? Name the principle involved.

91. Find energy of each of the photons which,

    Have wavelength of 0.50 Å.

92. The mass of an electron is 9.1×10^{-31}kg. If its K.E. is 3.0×10^{-25}J, calculate its wavelength.

93. Give the number of electrons in the species H_2^+, H_2 and O_2^+

94. Find
    a. The total number and.
    b. The total mass of protons in 34mg of NH_3 at STP.

    Will the answer change if the temperature and pressure are changed?

95. The unpaired electrons in Al and Si are present in 3p orbital. Which electrons will experience more effective nuclear charge from the nucleus?

* Case study based questions [8]

96. Read the passage given below and answer the following questions from (i) to (vi).

The atomic theory of matter was first proposed on afirm scientific basis by JohnDalton, a British schoolteacher in 1808. His theory, called Dalton's atomictheory, regarded the atom as the ultimate particle ofmatter Dalton's atomic theory was able to explainthe law of conservation of mass, law of constantcomposition and law of multiple proportion verysuccessfully. However, it failed to explain the results ofmany experiments.In mid 1850s many scientists mainlyFaraday began to study electrical dischargein partially evacuated tubes, known ascathode ray discharge tubes.Electrical discharge carried out in the modifiedcathode ray tube led to the discovery of canalrays carrying positively charged particles. Thecharacteristics of these positively chargedparticles are listed below.

1. Unlike cathode rays, mass of positivelycharged particles depends upon thenature of gas present in the cathode raytube. These are simply the positivelycharged gaseous ions.

2. The charge to mass ratio of the particlesdepends on the gas from which theseoriginate.
3. Some of the positively charged particlescarry a multiple of the fundamental unitof electrical charge.
4. The behaviour of these particles in themagnetic or electrical field is opposite tothat observed for electron or cathoderays.

The smallest and lightest positive ion wasobtained from hydrogen and was called proton. This positively charged particle wascharacterised in 1919. Later, a need was feltfor the presence of electrically neutral particleas one of the constituent of atom. Theseparticles were discovered by Chadwick (1932)by bombarding a thin sheet of beryllium byα-particles. When electrically neutral particleshaving a mass slightly greater than that ofprotons were emitted. He named theseparticles as neutrons.J. J. Thomson, in 1898, proposed that an atom possesses a spherical shape (radiusapproximately 10–10 m) in which the positivecharge is uniformly distributed. The electronsare embedded into it in such a manner as togive the most stable electrostatic arrangementMany different names are given tothis model, for example, plum pudding, raisinpudding or watermelon. This model can be visualised as a pudding or watermelon ofpositive charge with plums or seeds (electrons)embedded into it. An important feature of thismodel is that the mass of the atom is assumed to be uniformly distributed over theatom.Rutherford and his students (Hans Geiger andErnest Marsden) bombarded very thin gold foilwith α–particles. Rutherford's famous α–particle scattering experiment.The observations of Scattering experiment are as follows-:

I. most of the α–particles passed throughthe gold foil undeflected.
II. a small fraction of the α–particles wasdeflected by small angles.
III. a very few α–particles (~1 in 20,000)bounced back, that is, were deflected bynearly 180°.

On the basis of observations andconclusions from this experiment, Rutherford proposed the nuclearmodel of atom. According to this model:

1. The positive charge and most of the massof the atom was densely concentrated inextremely small region. This very smallportion of the atom was called nucleusby Rutherford.
2. The nucleus is surrounded by electronsthat move around the nucleus with a veryhigh speed in circular paths called orbits.Thus, Rutherford's model of atomresembles the solar system in which thenucleus plays the role of sun and theelectrons that of revolving planets.
3. Electrons and the nucleus are held together by electrostatic forces of attraction.

i. The atomic theory of matter was first proposed on afirm scientific basis by:
   a. John Dalton
   b. Ernest Rutherford
   c. J.Thomson
   d. Henry Moseley

ii. The cathode rays start from … and move towards the….
   a. Anode, Cathode
   b. Centre, Anode
   c. Cathod, Anode
   d. Cathod, Centre

iii. Negativelycharged particles in atoms, called…
   a. Protons
   b. Electrons
   c. Neutron
   d. Positron

iv. The smallest and lightest positive ion wasobtained from …. and was called proton.
   a. Oxygen
   b. Nitrogen
   c. Carbon
   d. Hydrogen

v. Electrically neutral particles having a mass slightly greater than that of protons, these particles termed as:
   a. Protons
   b. Electrons
   c. Neutron
   d. Positron

vi. J.J. Thomson's atomic model is also named as:
   a. Plum pudding
   b. Raisin pudding
   c. Watermelon
   d. All the above

97. Read the passage given below and answer the following questions from (i) to (v).

The presence of positive charge on thenucleus is due to the protons in the nucleus.As established earlier, the charge on the proton is equal but opposite to that of electron.Atomic number (Z) = number of protons inthe nucleus of an atom = number of electrons in a nuetral atom. protons and neutrons present in thenucleus are collectively known as nucleons.The total number of nucleons is termed asmass number (A) of the atom.

mass number (A) = number of protons (Z) + number of neutrons (n).

Isobars are the atoms with same massnumber but different atomic number forexample, ${}_6{}^4C$ and ${}_7{}^{14}N$. On the other hand, atomswith identical atomic number but differentatomic mass number are known as Isotopes.For example,considering of hydrogen atom again, 99.985% of hydrogen atoms contain only one proton.This isotope is called protium (${}_1{}^1H$). Rest of thepercentage of hydrogen atom contains two otherisotopes, the one containing 1 proton and 1neutron is called deuterium (${}^2{}_1D$, 0.015%)and the other one possessing 1 proton and 2neutrons is called tritium (${}_1{}^3T$)..the studiesof interactions of radiations with matter haveprovided immense information regarding thestructure of atoms and molecules. Neils Bohrutilised these results to improve upon themodel proposed by Rutherford. Twodevelopments played a major role in theformulation of Bohr's model of atom. Thesewere:

1. Dual character of the electromagneticradiation which means that radiations possess both wave like and particle likeproperties, and
2. Experimental results regarding atomicspectra.

James Maxwell (1870) was the first to givea comprehensive explanation about theinteraction between the charged bodies andthe behaviour of electrical and magnetic fieldson macroscopic level. He suggested that whenelectrically charged particle moves underaccelaration, alternating electrical and magnetic fields are produced and transmitted.These fields are transmitted in the forms ofwaves called electromagnetic waves orelectromagnetic radiation.radiations are characterised by theproperties, namely, frequency (ν) and wavelength (λ).The SI unit for frequency (ν) is hertz(Hz, s^{-1}), after Heinrich Hertz. It is defined asthe number of waves that pass a given pointin one second.Wavelength should have the units of lengthand as you know that the SI units of length ismeter (m). Since electromagnetic radiationconsists of different kinds of waves of muchsmaller wavelengths, smaller units are used.In vaccum all types of

electromagneticradiations, regardless of wavelength, travel atthe same speed, i.e., 3.0 × 10^8m s^{-1} (2.997925× 10^8 ms^{-1}, to be precise). This is called speedof light and is given the symbol 'c'. Thefrequency (ν), wavelength (λ) and velocity of light(c) are related by the following equation .

$c = v\lambda$

The other commonly used quantityspecially in spectroscopy, is the wavenumber.It is defined as the number of wavelengthsper unit length. Its units are reciprocal ofwavelength unit, i.e., m^{-1}. However commonlyused unit is cm^{-1}

i. The presence of positive charge on the nucleus is due to the …. in the nucleus.
   a. Protons
   b. Neutrons
   c. Electron
   d. Nucleons

ii. Atomic Number is denoted by:
   a. A
   b. Z
   c. N
   d. M

iii. Atomic Mass number is denoted by:
   a. M
   b. Z
   c. N
   d. A

iv. … are the atoms with same mass number but different atomic number.
   a. Isotopes
   b. Allotropes
   c. Isobars
   d. None of above

v. Atoms with identical atomic number but different atomic mass number are known as ..
   a. Isotopes
   b. Allotropes
   c. Isobars
   d. None of above

*** Given Section consists of questions of 5 marks each.** **[75]**

98. a. Calculate the wavelength and frequency of limiting line of Lyman series (Rydberg constant = 109677cm^{-1})
   b. Give quantum numbers for electrons with highest energy in sodium atom (Z = 11)
   c. Which of the following sets of quantum numbers are not possible? Give reasons:
      i. $n = 1, 1 = 0, m_1 = 0, m_s = -\frac{1}{2}$
      ii. $n = 0, 1 = 0, m_1 = 0, m_s = -\frac{1}{2}$

99. When an electric discharge is passed through hydrogen gas, the hydrogen molecules dissociate to produce excited hydrogen atoms. These excited atoms emit electromagnetic radiation of discrete frequencies which can be given by the general formula.

$\bar{v} = 109677 \frac{1}{n_i^2} - \frac{1}{n_f^2}$

What points of Bohr's model of an atom can be used to arrive at this formula? Based on these points derive the above formula giving description of each step and each term.

100. Following results are observed when sodium metal is irradiated with different wavelengths. Calculate

a. Threshold wavelength.
b. Planck's constant.

$\lambda(\text{nm})$	500	450	400
$v \times 10^{-5}(\text{cm s}^{-1})$	2.55	4.35	5.35

101. The work function for caesium atom is 1.9eV. Calculate,

a. The threshold wavelength.
b. The threshold frequency of the radiation.

If the caesium element is irradiated with a wavelength 500nm, calculate the kinetic energy and the velocity of the ejected photoelectron.

102. Nitrogen laser produces a radiation at a wavelength of 337.1nm. If the number of photons emitted is 5.6×10^{24}, calculate the power of this laser.

103. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2?

104. Yellow light emitted from a sodium lamp has a wavelength (λ) of 580 nm. Calculate the frequency (ν) and wavenumber $(\bar{v})$ of the yellow light.

105. Write the electronic configurations of the following ions:

a. H^-
b. Na^+
c. O^{2-}
d. F^-

106. The electron energy in hydrogen atom is given by $E_n = \frac{(-2.18 \times 10-18)}{n^2} J$. Calculate the energy required to remove an electron completely from the n = 2 orbit. What is the longest wavelength of light in cm that can be used to cause this transition?

107. If the velocity of the electron in Bohr's first orbit is $2.19 \times 106 ms^{-1}$, calculate the de Broglie wavelength associated with it.

108. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition n = 4 to n = 2 of He^+ spectrum?

109. Which of the following are isoelectronic species i.e., those having the same number of electrons?

$Na^+, K^+, Mg^{2+}, Ca^{2+}, S^{2-}, Ar.$

110. How much energy is required to ionise a H atom if the electron occupies n = 5 orbit? Compare your answer with the ionization enthalpy of H atom (energy required to remove the electron from n = 1 orbit).

111. How many neutrons and protons are there in the following nuclei?

$^{13}_{06}C,\ ^{16}_{08}O,\ ^{24}_{12}Mg,\ ^{56}_{26}Fe,\ ^{88}_{38}Sr$

112. Show that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit.

----- “सफ़र में मुश्किलें आए ,तो हिम्मत और बढ़ती है.. अगर कोई रास्ता रोके, तो जुर्रत और बढ़ती है.. अगर बिकने पर आ जाओ, तो घट जाता है दम अक्सर.. ना बिकने का इरादा हो तो, कीमत और बढ़ती है।” -----