19. What was the main logic which led to the failure of Rutherford's model of atom?

20. Explain what is meant by quantisation of energy.

21. Why is the energy of a shell mentioned as a negative number?

22. State Heisenberg's uncertainty principle and its consequences ✳ in relation to an electron.

23. What do you understand by an orbital? How is it different ✳ from an orbit?

24. How many and which quantum numbers are required to completely define :
  (i) an orbital and

  (ii) an electron in an atom?

25. Draw the shapes of $1s$, $2s$, $2p_x$, $2p_y$ and $2p_z$ orbitals.

✳26. Give a brief account of Hund's rule of maximum multiplicity.

27. What is Aufbau principle? How is it helpful in the filling up of electrons in various orbitals in an atom?

28. Arrange the subshells in the increasing order of their energies and depict this order diagrammatically.

29. Why is $4s$ shell filled before $3d$ shell? Explain in the light of $n + l$ rule.

✳ 30. Write the electronic configurations of following elements :
  Li, N, Ne, P, Cl, Ca, Sc, Cr, Fe, Cu, Zn, Ag

ESSAY (LONG ANSWER) TYPE QUESTIONS

1. What are cathode rays and how are they obtained? How did these rays help in the discovery of electrons ? Why is an electron regarded a subatomic particle?

2. How was neutron discovered? Describe the important properties of neutron.

3. What are anode rays? Describe the experimental set up used for the production of these rays. How are these rays produced in a discharge tube? Describe the properties of these rays.

4. What is a proton and how was it discovered? What led to believe that proton was an essential constituent of the all known atoms?

5. What is radio activity? Compare the properties of α, β and γ-rays. What is the contribution of radio activity in the development of atomic structure?

6. Describe Rutherford's α-particle scattering experiment. What were the evidences that led Rutherford to conclude that
  (i) most part of the atom was hollow,
  (ii) nucleus was very heavy and positively charged?

7. Why is Rutherford's model of atom called nuclear model of atom? What are the important features of this model? Discuss its shortcomings.

8. Explain why
  (i) isotopes possess similar chemical properties,
  (ii) isobars are placed at different places in periodic table,
  (iii) number of electrons present in an ion differ from its atomic number?

9. Discuss the Bohr's model for H atom. How does this model explain the presence of various lines in the spectrum of atomic hydrogen?

10. Describe in brief the principles which led to the failure of Bohr's model.

11. What is the significance of ψ and ψ^2 in the quantum mechanical model of atom? Define an orbital and show that it differs from an orbit.

12. What are quantum numbers and what information is provided by them? Specify the electrons with following sets of quantum numbers :

  (i) $n = 4, l = 1, m = +1, s = +\dfrac{1}{2}$

  (ii) $n = 3, l = 0, m = 0, s = -\dfrac{1}{2}$

13. Write short notes on
  ✳ (i) Pauli's exclusion principle
  ✳ (ii) Aufbau principle.

14. Explain the following terms in relation to orbitals :
  (i) Node   (ii) Nodal point
  (iii) Nodal plane   (iv) Spherically symmetric
  (v) Dumb bell shape   (vi) Completely and half filled shells.

15. Explain why
  (i) the three electrons present in $2p$ subshell of nitrogen remain unpaired,
  (ii) in potassium, the 19th electron enters into $4s$ subshell instead of $3d$ subshell,
  (iii) chromium has configuration $3d^5\, 4s^1$ instead of $3d^4\, 4s^2$,
  (iv) the electronic configuration of zinc can be represented as $[Ar]3d^{10}\, 4s^2$?
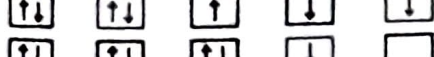
OBJECTIVE (MULTIPLE CHOICE) TYPE *QUESTIONS*

Choose the correct option in the following questions :

1. The discovery of neutron became very late because :
   (a) neutrons are present in nucleus
   (b) neutrons are chargeless
   (c) neutrons are fundamental particles
   (d) all of the above.

2. Which is the correct statement about proton?
   (a) Proton is nucleus of deuterium
   (b) Proton is α-particle
   (c) Proton is ionised hydrogen molecule
   (d) Proton is ionised hydrogen atom.

3. The number of neutrons in the radioactive isotope of hydrogen is;
   (a) 2
   (b) 0
   (c) 1
   (d) 3.

4. If the nucleus of an atom is enlarged to the size of a ball of 10 cm diameter, the atom would look like a sphere of diameter roughly equal to :
   (a) 10 m
   (b) 10 km
   (c) 100 km
   (d) 1000 km.

5. No two electrons in an atom of an element have :
   (a) same principal quantum number
   (b) same azimuthal quantum number
   (c) identical sets of quantum numbers
   (d) same magnetic quantum number.

6. The number of unpaired electrons in chromium (atomic number 24) is :
   (a) 2
   (b) 3
   (c) 5
   (d) 6.

7. Atomic number of an element indicates :
   (a) the number of electrons in the nucleus
   (b) the number of neutrons in the nucleus
   (c) the number of protons in the nucleus
   (d) valency of an element.

8. If the mass number of an element is W and its atomic number is N, then :
   (a) number of $_{-1}^{0}e = W - N$
   (b) number of $_{1}^{1}H = W - N$
   (c) number of $_{0}^{1}n = W - N$
   (d) number of $_{0}^{1}n = N$.

9. Electronic configuration of H^- is :
   (a) $1s^0$
   (b) $1s^1$
   (c) $1s^2$
   (d) $1s^1 2s^1$.

10. Magnetic quantum number specifies:
   (a) size of orbitals
   (b) shape of orbitals
   (c) orientation of orbitals in space
   (d) nuclear stability.

11. When the value of $n = 2, m$ can have :
   (a) 1 value
   (b) 3 values
   (c) 4 values
   (d) 7 values.

12. The correct set of quantum numbers for the unpaired electron of chlorine atom is :

	n	l	m
(a)	2	1	0
(b)	2	1	1
(c)	3	1	1
(d)	3	0	0

13. From the given sets of quantum numbers, the one that is inconsistent with the theory is :
   (a) $n = 3, l = 2, m = -3, s = +\frac{1}{2}$
   (b) $n = 4, l = 3, m = 3, s = +\frac{1}{2}$
   (c) $n = 2, l = 1, m = 0, s = -\frac{1}{2}$
   (d) $n = 4, l = 3, m = 2, s = +\frac{1}{2}$.

14. Which of the following are isoelectronic with one another?
   (a) Na^+ and Ne
   (b) K^+ and O
   (c) Ne and O
   (d) Na^+ and K^+.

15. The total number of neutrons in dipositive zinc ions with mass number 70 is :
   (a) 34
   (b) 40
   (c) 36
   (d) 38.

16. A p-orbital can accommodate :
   (a) 4 electrons
   (b) 6 electrons
   (c) 2 electrons with parallel spins
   (d) 2 electrons with opposite spins.

17. Which of the following is not correct for electronic distribution in the ground state?
   (a) Co [Ar]
   (b) Ni [Ar]
   (c) Cu [Ar]
   (d) Zn [Ar]

18. Which of the following electron transitions will require the largest amount of energy in a hydrogen atom?
   (a) From $n = 1$ to $n = 2$
   (b) From $n = 2$ to $n = 3$
   (c) From $n = \infty$ to $n = 1$
   (d) From $n = 3$ to $n = 5$.

19. A 200 g cricket ball is thrown with a speed of 3×10^3 cm/sec. what will be its de-Broglie wavelength?
   (a) 1.1×10^{-32} cm
   (b) 2.2×10^{-32} cm
   (c) 0.55×10^{-32} cm
   (d) 11.0×10^{-32} cm.

20. For the energy levels in an atom which one of the following statements is correct?

(a) There are seven principal electron energy levels

(b) The second principal energy level can have four subenergy levels and contains a maximum of eight electrons

(c) The M energy level can have a maximum of 32 electrons

(d) The 4s subenergy level is at a higher energy than the 3d subenergy level.

21. Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon?

(a) 3s   (b) 2p

(c) 1s   (d) 3d.

22. Spectrum produced due to transition of an electron from M to L shell is :

(a) absorption   (b) emission

(c) X-rays   (d) continuous.

23. Energy of the third orbit of Bohr's atom is :

(a) –13.6 eV   (b) –3.4 eV

(c) –1.5 eV   (d) None of these.

24. If the speed of the electron in the Bohr's first orbit is x, then speed of the electron in the 3rd orbit would be :

(a) $x/9$ (b) $x/3$

(c) $3x$ (d) $9x$.

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

(a) Cu^+ (b) Th^{4+}

(c) Cs^+ (d) K^+.

26. Which of the following statement(s) is not correct?

(a) The electronic configuration of Cr is $[Ar] 3d^5 4s^1$ (At. No. of Cr = 24).

(b) The magnetic quantum number may have a negative value.

(c) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type. (At. no. of Ag = 47).

(d) The oxidation state of nitrogen in N_3H is –3.

27. The electrons identified by quantum numbers n and l, (i) $n = 4$, $l = 1$, (ii) $n = 4$, $l = 0$, (iii) $n = 3$, $l = 2$, (iv) $n = 3$, $l = 1$ can be placed in the order of increasing energy, from the lowest to highest, as :

(a) (iv) < (ii) < (iii) < (i)

(b) (ii) < (iv) < (i) < (iii)

(c) (i) < (iii) < (ii) < (iv)

(d) (iii) < (i) < (iv) < (ii).   [I.I.T., 1999]

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

29. The number of nodal planes in a p_x orbital is :

(a) one   (b) two

(c) three   (d) zero.   [I.I.T. Screening, 2000]

30. 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.
     [I.I.T. Screening, 2000]

31. Which of the following statements regarding the electron spin $+\frac{1}{2}$ and $-\frac{1}{2}$ is correct? These two numbers .

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

(b) represent the rotation of electron in anticlockwise and clockwise directions respectively

(c) represent the upward and downward directions of magnetic moment

(d) represent two quantum mechanical states which have no classical mechanical analogues. [I.I.T. Screening, 2001]

32. The speed of a 200 g golf ball is 5.0 metre per hour. The wavelength of this ball will be of the order of

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

(c) 10^{-30} m   (d) 10^{-4} m [I.I.T. Screening, 2001]

33. Energy of H-atom in the ground state is – 13.6 eV, hence energy in the second excited state is

(a) – 6.8 eV   (b) – 3.4 eV

(c) –1.51 eV   (d) – 4.53 eV. [A.I.E.E.E., 2002]

34. Uncertainty in position of a particle of 25 g in space is 10^{-5} m. Hence, uncertainty in velocity (m s^{-1}) is (Planck's constant $h = 6.6 \times 10^{-34}$ J s) :

(a) 2.1×10^{-28} (b) 2.1×10^{-34}

(c) 0.5×10^{-34} (d) 5.0×10^{-24}.
     [A.I.E.E.E., 2002]

35. In Balmer series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inner-orbit jumps of the electron for Bohr orbits in an atom of hydrogen?

(a) $3 \rightarrow 2$ (b) $5 \rightarrow 2$

(c) $4 \rightarrow 1$ (d) $2 \rightarrow 5$ [A.I.E.E.E., 2003]

36. The de-Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 m/s is approximately (Planck's constant, $h = 6.63 \times 10^{-34}$ J s)

(a) 10^{-33} m   (b) 10^{-31} m

(c) 10^{-16} m   (d) 10^{-25} m.   [A.I.E.E.E., 2003]

37. The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{l(l+1)} \frac{h}{2\pi}$. The momentum for an s-electron will be given by :

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

(c) $\frac{h}{2\pi}$ (d) $\sqrt{2} \cdot \frac{h}{2\pi}$ [A.I.E.E.E., 2003]

38. Which of the following sets of quantum numbers is correct for an electron in 4f orbital?

(a) $n = 4, l = 3, m = +4, s = +\frac{1}{2}$

(b) $n = 4, l = 4, m = -4, s = -\frac{1}{2}$

(c) $n = 4, l = 3, m = +1, s = +\frac{1}{2}$

(d) $n = 3, l = 2, m = -2, s = +\frac{1}{2}$.   [A.I.E.E.E., 2004]

39. Consider the ground state of Cr atom ($Z = 24$). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are respectively :
   (a) 12 and 4
   (b) 12 and 5
   (c) 16 and 4
   (d) 16 and 5. [A.I.E.E.E., 2004]

40. The wavelength of the radiation emitted, when in a hydrogen atom electron falls from infinity to stationary state 1, would be (Rydberg constant $= 1.097 \times 10^7$ m^{-1}) :
   (a) 91 nm
   (b) 192 nm
   (c) 406 nm
   (d) 9.1×10^{-8} nm.
   [A.I.E.E.E., 2004]

41. In a multi-electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric fields ?
   (A) $n = 1, l = 0, m = 0$
   (B) $n = 2, l = 0, m = 0$
   (C) $n = 2, l = 1, m = 1$
   (D) $n = 3, l = 2, m = 1$
   (E) $n = 3, l = 2, m = 0$
   (a) (D) and (E)
   (b) (C) and (D)
   (c) (B) and (C)
   (d) (A) and (B). [A.I.E.E.E., 2005]

42. Uncertainty in the position of an electron (mass $= 9.1 \times 10^{-31}$ kg) moving with a velocity 300 m s^{-1}, accurate upto 0.001% will be :
   (a) 19.2×10^{-2} m
   (b) 5.76×10^{-2} m
   (c) 1.92×10^{-2} m
   (d) 3.84×10^{-2} m.
   ($h = 6.63 \times 10^{-34}$ J s) [A.I.E.E.E., 2006]

43. Which of the following sets of quantum numbers represents the highest energy of an atom?
   (a) $n = 3, l = 1, m = 1, s = +\dfrac{1}{2}$
   (b) $n = 3, l = 2, m = 1, s = +\dfrac{1}{2}$
   (c) $n = 4, l = 0, m = 0, s = +\dfrac{1}{2}$
   (d) $n = 3, l = 0, m = 0, s = +\dfrac{1}{2}$ [A.I.E.E.E., 2007]

44. 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) $CN^-, N_2, O_2^{2-}, C_2^{2-}$
   (d) N_2, O_2^-, NO^+, CO. [A.I.E.E.E., 2008]

45. The ionisation enthalpy of hydrogen atom is 1.312×10^6 J mol^{-1}. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is :
   (a) 8.51×10^5 J mol^{-1}
   (b) 6.56×10^5 J mol^{-1}
   (c) 7.56×10^5 J mol^{-1}
   (d) 9.84×10^5 J mol^{-1}. [A.I.E.E.E., 2008]

46. The total number of atomic orbitals in fourth energy level an atom is :
   (a) 16
   (b) 32
   (c) 4
   (d) 8 (A.I.P.M.T., 2011)

47. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths, i.e. λ_1 and λ_2 will be :
   (a) $\lambda_1 = 2\lambda_2$
   (b) $\lambda_1 = 4\lambda_2$
   (c) $\lambda_1 = \dfrac{1}{2}\lambda_2$
   (d) $\lambda_1 = \lambda_2$ (A.I.P.M.T., 2011)

48. If $n = 6$, the correct sequence for filling of electrons will be
   (a) $ns \longrightarrow (n-1)d \longrightarrow (n-2)f \longrightarrow np$
   (b) $ns \longrightarrow (n-2)f \longrightarrow np \longrightarrow (n-1)d$
   (c) $ns \longrightarrow np \longrightarrow (n-1)d \longrightarrow (n-2)f$
   (d) $ns \longrightarrow (n-2)f \longrightarrow (n-1)d \longrightarrow np$
   (A.I.P.M.T., 2011)

49. The correct set of four quantum numbers for the valency electron of rubidium atom ($Z = 37$) is :
   (a) $5, 1, 1, +\dfrac{1}{2}$
   (b) $6, 0, 0, +\dfrac{1}{2}$
   (c) $5, 0, 0, +\dfrac{1}{2}$
   (d) $5, 1, 0, +\dfrac{1}{2}$ (A.I.P.M.T., 2012)

50. What is the maximum number of orbitals that can be identified with the following quantum numbers?
   $n = 3, l = 1, m = 0$
   (a) 1
   (b) 2
   (c) 3
   (d) 4 (A.I.P.M.T., 2014)

51. Calculate the energy in joule corresponding to light of wavelength 45 nm : (Planck's constant $h = 6.63 \times 10^{-34}$; speed of light $c = 3 \times 10^8$ ms^{-1})
   (a) 6.67×10^{15}
   (b) 6.67×10^{11}
   (c) 4.42×10^{-15}
   (d) 4.42×10^{-18} (A.I.P.M.T. 2014)

52. Energy of an electron is given by $E = -2.178 \times 10^{-18}$ J $\left(\dfrac{Z^2}{n^2}\right)$
   Wavelength of light required to excite an electron in a hydrogen atom from level $n = 1$ to $n = 2$ will be : ($h = 6.62 \times 10^{-34}$ J s and $c = 3.0 \times 10^8$ ms^{-1})
   (a) 1.214×10^{-7} m
   (b) 2.816×10^{-7} m
   (c) 6.500×10^{-7} m
   (d) 8.500×10^{-7} m
   (J.E.E. Main, 2013)

53. The electrons identified by quantum numbers n and l
   1. $n = 4, l = 1$
   2. $n = 4, l = 0$
   3. $n = 3, l = 2$
   4. $n = 3, l = 1$
   can be placed in the order of increasing energy as
   (a) $(3) < (4) < (2) < (1)$
   (b) $(4) < (2) < (3) < (1)$
   (c) $(2) < (4) < (1) < (3)$
   (d) $(1) < (3) < (2) < (4)$
   (A.I.E.E.E. Main, 2012)

54. A gas absorbs 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 (A.I.E.E.E. 2011)

55. 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 $n = 3$

(A.I.E.E.E., 2011)

56. The energy required to break one mole of Cl—Cl bonds in Cl_2 is 242 kJ mol^{-1}. The longest wavelength of light capable of breaking a single Cl—Cl bond is :

(a) 594 nm   (b) 640 nm

(c) 700 nm   (d) 494 nm   (A.I.E.E.E., 2010)

Answers

1. (b)	2. (d)	3. (a)	4. (b)	5. (c)	6. (d)	7. (c)	8. (c)	9. (c)	10. (c)
11. (c)	12. (c)	13. (a)	14. (a)	15. (b)	16. (d)	17. (c)	18. (a)	19. (a)	20. (b)
21. (c)	22. (b)	23. (c)	24. (b)	25. (a)	26. (d)	27. (a)	28. (a)	29. (b)	30. (b)
31. (a)	32. (d)	33. (c)	34. (a)	35. (b)	36. (a)	37. (b)	38. (c)	39. (b)	40. (a)
41. (a)	42. (c)	43. (b)	44. (b)	45. (d)	46. (a)	47. (a)	48. (d)	49. (c)	50. (a)
51. (d)	52. (a)	53. (b)	54. (c)	55. (b)	56. (d)				

NUMERICAL PROBLEMS

1. Find (i) the total number of neutrons and (ii) the total mass of neutrons in 7 mg of ^{14}C. (Assume that mass of a neutron = 1.675×10^{-27} kg). [Ans. (i) 24.096×10^{20}, (ii) 4.036×10^{-7} kg]

2. The density of mercury is 13.6 g cm^{-3}. Calculate approximately the diameter of an atom of mercury assuming that each atom is occupying a cube of edge length equal to the diameter of the mercury atom (Atomic mass of Hg = 200 amu). [Ans. 2.90×10^{-8} cm]

3. Calculate the wavelength of radio waves associated with frequency of 1×10^5 M Hz. [Ans. 3×10^{-3} m]

4. A photon of wavelength 4×10^{-7} m strikes on metal surface, the work function of the metal being 2.13 eV. Calculate the kinetic energy and the velocity of photo electron. [Ans. 0.974 eV, 5.85×10^5 m s^{-1}].

5. In a hydrogen atom, an electron jumps from the third orbit to the first orbit. Find out the frequency and wavelength of the spectral line. [Ans. 2.92472×10^{15} s^{-1}, 1025.73 Å]

6. Calculate the wavelength and energy of radiation emitted for the electronic transition from infinity (∞) to stationary state one of the hydrogen atom ($R = 1.09678 \times 10^7$ m^{-1}). [Ans. 9.11759×10^{-8} m, 2.18×10^{-18} J]

7. The electron energy in hydrogen atom is given by $E = (-21.7 \times 10^{-12})/n^2$ ergs. Calculate the energy required to remove an electron completely from the $n = 2$ orbit. What is the longest wavelength in cm of light that can be used to cause this transition? [Ans. 5.425×10^{-12} ergs, 3664 Å]

8. The mass of an electron is 9.1×10^{-31} kg. If its K.E. is 3.0×10^{-25} J, calculate its wavelength. [Ans. 8967 Å]

9. Calculate the uncertainty in position of an electron whose velocity is 3.0×10^4 cm s^{-1} accurate up to 0.001%. Mass of an electron = 9.1×10^{-28} g. [Ans. 1.9 cm]

10. The uncertainty in the position and velocity of a particle are 10^{-10} m and 5.27×10^{-24} m s^{-1} respectively. Calculate the mass of the particle ($h = 6.625 \times 10^{-34}$ J s). [Ans. 0.1 kg]

11. What is the energy in joules of a single photon of wavelength 250×10^{-9} m. [Ans. 7.951×10^{-19} J]

12. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition $n = 4$ to $n = 2$ of He^+ spectrum. [Ans. $n = 2$ to $n = 1$]

13. Calculate the ionisation potential of H atom. [Ans. 13.59 eV]

14. The ionisation energy of He^+ is 19.6×10^{-12} J/atom. Calculate the energy of the first stationary state of Li^{2+}. [Ans. -4.41×10^{-11} J/atom]

15. Estimate the difference in energy between 1st and 2nd Bohr orbits for hydrogen atom. At what minimum atomic number, a transition from $n = 2$ to $n = 1$ energy level would result in the emission of X-rays with $\lambda = 3 \times 10^{-8}$ m? Which hydrogen atom like species does this atomic number correspond to? [Ans. 1.63×10^{-11} ergs, Z = 2, He^+]

'TRUE OR FALSE' TYPE QUESTIONS

GPLUS EDUCATION

State whether the following statements are True (T) or False (F) :

1. The gas taken in a discharge tube glows when a high voltage is passed into it at 10^{-1} atm.
2. Cathode rays produce fluorescence when they strike the glass wall in the discharge tube.
3. The e/m value for cathode rays depends upon the nature of the gas taken in the discharge tube.
✷4. Canal rays travel in a straight line.
5. During the phenomenon of radio activity, the planetary electrons emit in the form of β-rays.
✷6. The ionising power of α-rays is maximum.
7. In an α-particle scattering experiment, most of the particles return back after colliding with gold foil.
8. Atomic number of an ion is the same as the number of electrons present in it.
9. The symbol ^3_1H indicates that the given hydrogen atom has a mass number equal to 3 and atomic number equal to 1.
✷10. Isobars possess similar chemical properties.
11. All types of waves are electromagnetic in nature.
12. The frequency of a radiation is given by $v = c\lambda$.
13. The radiant energy is emitted or absorbed continuously in the form of photons.
14. Atomic spectra contain well defined discrete lines.
15. In an atom, angular momentum of electrons is quantised.
16. Bohr's model is unable to explain the stability of an atom.
17. The transitions corresponding to Lyman series involve very long wavelengths.
✷18. Electron is neither a particle nor a wave.
19. The position and velocity of earth can be determined simultaneously with a fair degree of accuracy.
20. An orbital may contain one or more regions having zero probability of finding the electron.

Answers

1. F	2. T	3. F	4. T	5. F	6. T	7. F	8. F	9. T	10. F
11. F	12. F	13. F	14. T	15. T	16. F	17. F	18. F	19. T	20. T

'FILL IN THE BLANKS' TYPE QUESTIONS

1. During electrolysis, the amount of substance produced on a particular electrode is proportional to the .... passed in the solution.
✷2. Cathode rays produce .... when they strike .... metals.
3. The charge on an electron was first determined by .... in .... by his famous .... experiment.
4. The actual mass of a proton is .... g.
5. The entire mass and positive charge of an atom is concentrated into its ....
6. The light radiations with discrete quantities of energies are called ....
7. In the electromagnetic spectrum, in going from γ-rays to radio waves, the frequency ....
8. The $2p_x$ and $2p_y$, $2p_z$ orbitals of an atom have identical shapes but differ in their ....
9. An orbital consists a maximum of .... electrons.
✷10. In Bohr's model, an electron should follow a .... path due to loss of energy.
11. The uncertainty principle and the concept of wave nature of matter were proposed by .... and .... respectively.
12. The energy absorbed or emitted by an electron during a transition is always ....
✷13. The splitting of spectral lines under the influence of magnetic field is called .... and can be explained with the help of .... quantum number.
14. Wave functions of electrons in atoms and molecules are called ....
15. An acceptable value of wave function should be ...., ..., ..., and should be .... at infinite distance.
✷16. The principal quantum number tells the .... to which electron belongs.
✷17. The values of l are governed by the value of ....
18. An electron with $n = 3$ and $l = 2$ belongs to .... subshell.
19. An f subshell contains .... orbitals.
20. The energy of 6s subshell is .... than that of 4f subshell.

Answers

1. total charge
2. X-rays, heavy
3. Milliken, 1909, oil drop
4. 1.672×10^{-24}
5. nucleus
6. photons
7. decreases
8. orientation
9. two
10. spiral
11. Heisenberg, de-Broglie
12. quantised
13. Zeeman's effect, magnetic
14. orbitals
15. finite, single valued, continuous, zero
16. principal shell
17. n
18. 3d
19. seven
20. lower

WWW.GPLUSEDUCATION.ORG   8583042324