2. Structure of Atom – Multiple Choice Questions

1. Discovery and Properties of Anode, Cathode Rays Neutron and Nuclear Structure

1. The ratio of charge and mass would be greatest

(a) Proton (b) Electron

(c) Neutron (d) Alpha

2. What is the ratio of mass of an electron to the mass of a proton

(a) 1 : 2 (b) 1 : 1

(c) 1 : 1837 (d) 1 : 3

3. As electron moves away from the nucleus, its potential energy

(a) Increases (b) Decreases

(c) Remains constant (d) None of these

4. Which of the following statement is not correct about the characteristics of cathode rays

(a) They start from the cathode and move towards the anode

(b) They travel in straight line in the absence of an external electrical or magnetic field

(c) Characteristics of the cathode rays do not depend upon the material of electrodes in cathode ray tube

(d) Characteristics of cathode rays depend upon the nature of gas present in the cathode ray tube

5. Which of the following statements about the electron is incorrect

(a) It is a negatively charged particle

(b) The mass of electron is equal to the mass of neutron

(c) It is a basic constituent of all atoms

(d) It is a constituent of cathode rays

6. The nature of anode rays depends upon

(a) Nature of electrode

(b) Nature of residual gas

(c) Nature of discharge tube

(d) All the above

7. The ratio of specific charge of a proton and an α -particle is

(a) 2 : 1 (b) 1 : 2

(c) 1 : 4 (d) 1 : 1

2. Atomic Number, Mass Number, Atomic Species

1. Atoms consist of protons, neutrons and electrons. If the mass of neutrons and electrons were made half and two times respectively to their actual masses, then the atomic mass of ${}_6C^{12}$

(a) Will remain approximately the same

(b) Will become approximately two times

(c) Will remain approximately half

(d) Will be reduced by 25%

2. Chlorine exists in two isotopic forms. $Cl-37$ and $Cl-35$ but its atomic mass is 35.5. This indicates the ratio of $Cl-37$ and $Cl-35$ is approximately

(a) 1 : 2 (b) 1 : 1

(c) 1 : 3 (d) 3 : 1

3. 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

4. Which of the following oxides of nitrogen is isoelectronic with CO_2

(a) NO_2 (b) N_2O

(c) NO (d) N_2O_2

5. An element has 8 electrons in the valence shell

(a) It will lose electron

(b) It will gain an electron

(c) It neither gains nor lose electron

(d) It will make bond with itself

6. 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

7. If the atomic weight of an element is 23 times that of the lightest element and it has 11 protons, then it contains

(a) 11 protons, 23 neutrons, 11 electrons

(b) 11 protons, 11 neutrons, 11 electrons

(c) 11 protons, 12 neutrons, 11 electrons

(d) 11 protons, 11 neutrons, 23 electrons

8. The total number of neutrons in dipositive zinc ions with mass number 70 is

(a) 34 (b) 40

(c) 36 (d) 38

9. The compound in which cation is isoelectronic with anion is

(a) $NaCl$ (b) CsF

(c) NaI (d) K_2S

10. Which among the following species have the same number of electrons in its outermost as well as penultimate shell

(a) Mg^{2+} (b) O^{2-}

(c) F^- (d) Ca^{2+}

3. Atomic Models and Planck's Quantum Theory

1. Rutherford's experiment on scattering of particles showed for the first time that the atom has

(a) Electrons (b) Protons

(c) Nucleus (d) Neutrons

2. Which of the following conclusions could not be derived from Rutherford's α – particle scattering experiment

(a) Most of the space in the atom is empty

(b) The radius of the atom is about $10^{-10}m$ while that of nucleus is $10^{-15}m$

(c) Electrons move in a circular path of fixed energy called orbits

(d) Electrons and the nucleus are held together by electrostatic forces of attraction

3. Which of the following properties of atom could be explained correctly by Thomson model of atom

(a) Overall neutrality of atom

(b) Spectra of hydrogen atom

(c) Position of electrons, protons and neutrons in atom

(d) Stability of atom

4. Bohr's model can explain

(a) The spectrum of hydrogen atom only

(b) Spectrum of atom or ion containing one electron only

(c) The spectrum of hydrogen molecule

(d) The solar spectrum

5. 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

6. 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 $kJ\ mol^{-1}$

7. The expression for Bohr's radius of an atom is

(a) $r = \dfrac{n^2h^2}{4\pi^2me^4z^2}$ (b) $r = \dfrac{n^2h^2}{4\pi^2me^2zk}$

(c) $r = \dfrac{n^2h^2}{4\pi^2me^2z^2}$ (d) $r = \dfrac{n^2h^2}{4\pi^2m^2e^2z^2}$

8. The electronic energy levels of the hydrogen atom in the Bohr's theory are called

(a) Rydberg levels (b) Orbits

(c) Ground states (d) Orbitals

9. Bohr model of atom is contradicted by

(a) Pauli's exclusion principle

(b) Planck quantum theory

(c) Heisenberg uncertainty principle

(d) All of these

10. The ratio between kinetic energy and the total energy of the electrons of hydrogen atom according to Bohr's model is

(a) 2 : 1 (b) 1 : 1

(c) 1 : – 1 (d) 1 : 2

11. According to Bohr atomic model, the ratio of area covered by second orbit to the first orbit is

(a) 1 : 2 (b) 1 : 16

(c) 8 : 1 (d) 16 : 1

12. According to Bohr's principle, the relation between principle quantum number (n) and radius of orbit is

(a) $r \propto n$ (b) $r \propto n^2$

(c) $r \propto \dfrac{1}{n}$ (d) $r \propto \dfrac{1}{n^2}$

13. The radius of the first Bohr orbit of the H atom is r. Then the radius of the first orbit of Li^{2+} will be

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

(c) $3r$ (d) $9r$

14. Which one of the following is considered as the main postulate of Bohr's model of atom

(a) Protons are present in the nucleus

(b) Electrons are revolving around the nucleus

(c) Centrifugal force produced due to the revolving electrons balances the force of attraction between the electron and the protons

(d) Angular momentum of electron is an integral multiple of $\dfrac{h}{2\pi}$

15. Time taken for an electron to complete one revolution in the Bohr orbit of hydrogen atom is

(a) $\dfrac{4\pi^2mr^2}{nh}$ (b) $\dfrac{nh}{4\pi^2mr}$

(c) $\dfrac{nh}{4\pi^2mr^2}$ (d) $\dfrac{h}{2\pi mr}$

16. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon

(a) $n = 6$ to $n = 5$ (b) $n = 5$ to $n = 3$

(c) $n = 6$ to $n = 1$ (d) $n = 5$ to $n = 4$

17. Splitting of spectral lines under the influence of magnetic field is called

(a) Zeeman effect (b) Stark effect

(c) Photoelectric effect (d) None of these

18. In hydrogen spectrum the different lines of Lyman series are present is

(a) *UV* field (b) *IR* field

(c) Visible field (d) Far *IR* field

19. The emission spectrum of hydrogen is found to satisfy the expression for the energy change. ΔE (in joules) such that $\Delta E = 2.18 \times 10^{-18}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) J$ where $n_1 = 1, 2, 3.....$ and $n_2 = 2, 3, 4.....$ The spectral lines correspond to Paschen series to

(a) $n_1 = 1$ and $n_2 = 2, 3, 4$

(b) $n_1 = 3$ and $n_2 = 4, 5, 6$

(c) $n_1 = 1$ and $n_2 = 3, 4, 5$

(d) $n_1 = 2$ and $n_2 = 3, 4, 5$

(e) $n_1 = 1$ and $n_2 =$ infinity

20. Which of the following statement(s) is true

(a) The Kinetic energy of an electron is inversely proportional to square of its momentum

(b) de-Broglie wavelength associated with a particle is directly proportional to its mass

(c) de-Broglie wavelength associated with a particle is directly proportional to square of its velocity

(d) The wavelength associated with an electron is directly proportional to square root of accelerating potential

(e) The kinetic energy of an electron is directly proportional to accelerating potential

21. Electron occupies the available orbital singly before pairing in any one orbital occurs, it is

(a) Pauli's exclusion principle

(b) Hund's Rule

(c) Heisenberg's principle

(d) Prout's hypothesis

22. If the 1st ionization energy of *H* atom is $13.6\,eV$, then the 2nd ionization energy of *He* atom is

(a) $27.2\,eV$ (b) $40.8\,eV$

(c) $54.4\,eV$ (d) $108.8\,eV$

23. The *H*-spectrum show

(a) Heisenberg's uncertainty principle

(b) Diffraction

(c) Polarisation

(d) Presence of quantised energy level

24. A metal surface is exposed to solar radiations

(a) The emitted electrons have energy less than a maximum value of energy depending upon frequency of incident radiations

(b) The emitted electrons have energy less than maximum value of energy depending upon intensity of incident radiation

(c) The emitted electrons have zero energy

(d) The emitted electrons have energy equal to energy of photos of incident light

25. The energy of the electron in the first orbit of He^+ is $-871.6 \times 10^{-20} J$. The energy of the electron in the first orbit of hydrogen would be

(a) $-871.6 \times 10^{-20} J$ (b) $-435.8 \times 10^{-20} J$

(c) $-217.9 \times 10^{-20} J$ (d) $-108.9 \times 10^{-20} J$

26. The series limit for Balmer series of *H*-spectra is

(a) 3800 (b) 4200

(c) 3646 (d) 4000

27. Which of the following electron transition in a hydrogen atom will require the largest amount of energy

(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 $n = 5$

28. The energy required to break one mole of hydrogen-hydrogen bonds in H_2 is 436 *kJ*. What is the longest wavelength of light required to break a single hydrogen-hydrogen bond

(a) 68.5 *nm* (b) 137 *nm*

(c) 274 *nm* (d) 548 *nm*

29. Calculate the energy in joule corresponding to light of wavelength 45 *nm* : (Planck's constant $h = 6.63 \times 10^{-34}\,Js$; speed of light $c = 3 \times 10^8\,ms^{-1}$)

(a) $4.42 \times 10^{-15}\,J$ (b) $4.42 \times 10^{-18}\,J$

(c) $6.67 \times 10^{15}\,J$ (d) $6.67 \times 10^{11}\,J$

30. The radii of the first Bohr orbit of $H(r_H), He^+(r_{He^+})$ and $Li^{2+}(r_{Li^{2+}})$ are in the order

(a) $r_{He^+} > r_H > r_{Li^{2+}}$ (b) $r_H < r_{He^+} < r_{Li^{2+}}$

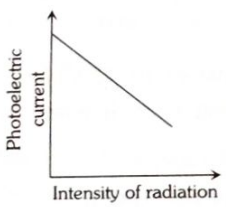
(c) $r_H > r_{He^+} > r_{Li^{2+}}$ (d) $r_{He^+} < r_H < r_{Li^{2+}}$

31. If the radius of the hydrogen atom is $53pm$, the radius of the He^+ ion is closest to

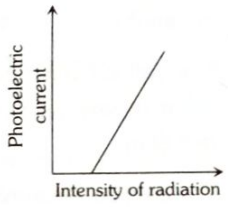
(a) $108pm$ (b) $81pm$

(c) $27pm$ (d) $13pm$

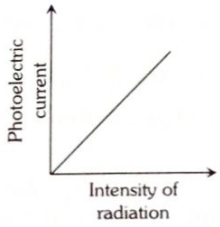
32. The graph that depicts Einstein photoelectric effect for a monochromatic source of frequency above the threshold frequency is



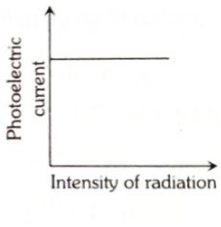
(a)



(b)



(c)



(d)

4. Dual Nature of Electron

1. If travelling at same speeds, which of the following matter waves have the shortest wavelength

(a) Electron (b) Alpha particle (He^{2+})

(c) Neutron (d) Proton

2. C_{60} emerging from a source at a speed (v) has a de–Broglie wavelength of $11.0A^{\circ}$. The value of v (in ms^{-1}) is closest to [Planck's constant $h = 6.626 \times 10^{-34} Js$]

(a) 0.5 (b) 2.5

(c) 5.0 (d) 30

3. The wave nature of an electron was first given by

(a) de-Broglie (b) Heisenberg

(c) Mosley (d) Sommerfield

4. Minimum de-Broglie wavelength is associated with

(a) Electron (b) Proton

(c) CO_2 molecule (d) SO_2 molecule

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

(a) $2.73 \times 10^{-24}\ m$ (b) $2.42 \times 10^{-10}\ m$

(c) $242.2 \times 10^{10}\ m$ (d) None of these

6. Wave nature of electron was shown experimentally by

(a) Bohr

(b) De-Broglie

(c) Davisson and Germer

(d) Schrodinger

7. The electrons possess properties of both the waves as well as the particles. The expression for showing this dual character of the electrons is

(a) $n\lambda = 2d \sin\theta$ (b) $E = h\upsilon$

(c) $\lambda = h/p$ (d) $\Delta x.\Delta p \approx h/2\pi$

8. 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) $6.6 \times 10^{-34}\,m$

(c) $1.32 \times 10^{-35}\,m$ (d) $6.6 \times 10^{-28}\,m$

5. Uncertainty Principle and Schrodinger Wave Equation

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

(a) $1.05 \times 10^{-28}\,m$ (b) $1.05 \times 10^{-26}\,m$

(c) $5.27 \times 10^{-30}\,m$ (d) $5.25 \times 10^{-28}\,m$

2. If uncertainty in position and momentum are equal, then uncertainty in velocity is

(a) $\frac{1}{m}\sqrt{\frac{h}{\pi}}$ (b) $\sqrt{\frac{h}{\pi}}$

(c) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ (d) $\sqrt{\frac{h}{2\pi}}$

3. Orbital is

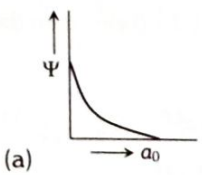
(a) Circular path around the nucleus in which the electron revolves

(b) Space around the nucleus where the probability of finding the electron is maximum

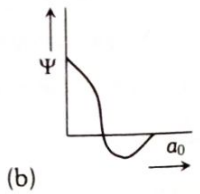
(c) Amplitude of electrons wave

(d) None of these

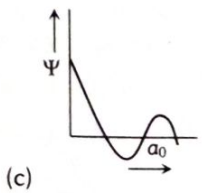
4. Which of the following graph correspond to one node



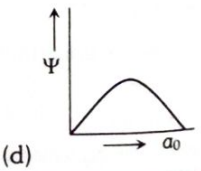
(a)



(b)



(c)



(d)

5. Which of the following does not represent the mathematical expression for the Heisenberg uncertainty principle

(a) $\Delta x.\Delta p \geq h/(4\pi)$ (b) $\Delta x.\Delta v \geq h/(4\pi m)$

(c) $\Delta E.\Delta t \geq h/(4\pi)$ (d) $\Delta E.\Delta x \geq h/(4\pi)$

6. Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons

(a) Pauli's exclusion principle

(b) Heisenberg's uncertainty principle

(c) Hund's rule of maximum multiplicity

(d) Aufbau principle

7. Which quantum number is not related with Schrodinger equation

(a) Principal (b) Azimuthal

(c) Magnetic (d) Spin

8. The schrodinger wave equation for hydrogen atom is

$$\Psi_{2s} = \frac{1}{4\sqrt{2\pi}}\left(\frac{1}{a_0}\right)^{3/2}\left[2 - \frac{r_0}{a_0}\right]e^{-r/a_0}$$

where a_0 is Bohr radius. If the radial node in $2s$ be at r_0, then find r_0 in terms of a_0

(a) $r_0 = 2a_0$ (b) $2r_0 = a_0$

(c) $3/2r_0 = a_0$ (d) $r_0 = a_0$

6. Quantum Number, Electronic Configuration and Shape of Orbitals

1. The number of possible spatial orientations of an electron in an atom is given by its

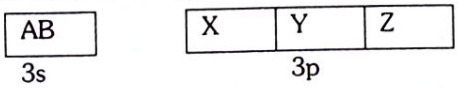
(a) Spin quantum number

(b) Spin angular momentum

(c) Magnetic quantum number

(d) Orbital angular momentum

2. Five valence electrons of $_{15}P$ are labelled as



If the spin quantum of B and Z is $+\frac{1}{2}$, the group of electrons with three of the quantum number same are

(a) AB, XYZ, BY (b) AB

(c) XYZ, AZ (d) AB, XYZ

3. If $n = 6$, the correct sequence of filling of electrons will be

(a) $ns \rightarrow np \rightarrow (n-1)d \rightarrow (n-2)f$

(b) $ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$

(c) $ns \rightarrow (n-1)d \rightarrow (n-2)f \rightarrow np$

(d) $ns \rightarrow (n-2)f \rightarrow np \rightarrow (n-1)d$

4. An element forms diatomic molecule with a triple bond. The configuration of the element may be

(a) $1s^2 2s^2 2p^5$ (b) $1s^2 2s^2 2p^6$

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

5. 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) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$

(c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$

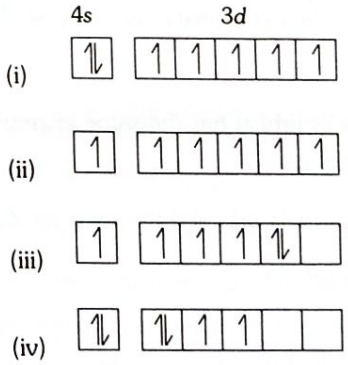
(d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

6. 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+}

7. Out of the following electronic arrangements for outer electronic configurations



The most stable arrangement is

(a) (i) (b) (ii)

(c) (iii) (d) (iv)

8. A completely filled d-orbital (d^{10}) is

(a) Spherically symmetrical

(b) Has octahedral symmetry

(c) Has tetrahedral symmetry

(d) Depends on the atom

9. Orbital angular momentum for a *d*-electron is

(a) $\frac{6h}{2\pi}$ (b) $\frac{\sqrt{6}\,h}{2\pi}$

(c) $\frac{12h}{2\pi}$ (d) $\frac{\sqrt{12}\,h}{2\pi}$

10. The most stable orbitals are

(a) p^2 and d^3 (b) p^4 and d^4

(c) p^3 and d^5 (d) d^5 and d^7

11. Which of the following orbitals will have zero probability of finding the electron in the yz plane

(a) p_x (b) p_y

(c) p_z (d) d_{yz}

12. The orbital angular momentum of a *p*-electron is given as

(a) $\frac{h}{\sqrt{2}\pi}$ (b) $\sqrt{3}\frac{h}{2\pi}$

(c) $\sqrt{\frac{3}{2}}\frac{h}{\pi}$ (d) $\sqrt{6}.\frac{h}{2\pi}$

13. Which of the following pair of orbitals possess two nodal planes

(a) p_{xy}, $d_{x^2-y^2}$ (b) d_{xy}, d_{zx}

(c) p_{xy}, d_{zx} (d) $d_{z^2}, d_{x^2-y^2}$

14. Orbital angular momentum depends on .....

(a) l (b) n and l

(c) n and m (d) m and s

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

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

(b) An electron in the 2*s* orbital has the same energy as an electron in the 2*p* orbital

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

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

16. The five *d*-orbitals are designated as $d_{xy}, d_{yz}, d_{xz}, d_{x^2-y^2}$ and d_{z^2}. Choose the correct statement

(a) The shapes of the first three orbitals are similar but that of the fourth and fifth orbitals are different

(b) The shapes of all five *d*-orbitals are similar

(c) The shapes of the first four orbitals are similar but that of the fifth orbital is different

(d) The shapes of all five *d*-orbitals are different

17. The number of d-electrons in Fe^{2+} $(Z = 26)$ is not equal to the number of electrons in which one of the following

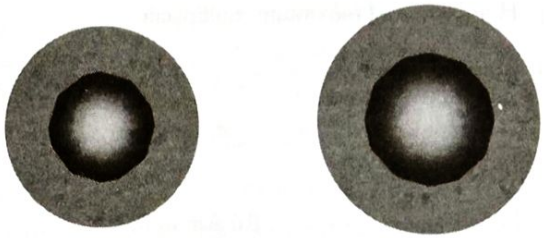
(a) *p*-electrons in $Cl\,(Z = 17)$

(b) *d*-electrons in $Fe\,(Z = 26)$

(c) *p*-electrons in $Ne\,(Z = 10)$

(d) *s*-electrons in $Mg\,(Z = 12)$

18. The probability density plots of 1*s* and 2*s* orbitals are given in figure



1*s* 2*s*

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) 1*s* and 2*s* 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 2*s* orbital decreases uniformly as distance from the nucleus increases

19. The set of principal (n), azimuthal (l) and magnetic (m_l) quantum numbers that is not allowed for the electron in H – atom is

(a) $n = 3, l = 1, m_l = -1$ (b) $n = 3, l = 0, m_l = 0$

(c) $n = 2, l = 1, m_l = 0$ (d) $n = 2, l = 2, m_l = -1$

20. Maximum number of electrons that can be accommodated in the subshell with azimuthal quantum number $l = 4$, is

(a) 10 (b) 8

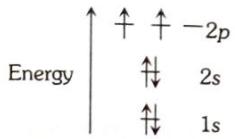
(c) 16 (d) 18

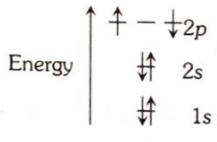
21. The element which readily forms an ionic bond has the electronic configuration

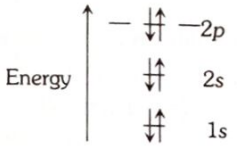
(a) $1s^2 2s^2 2p^3$ (b) $1s^2 2s^2 2p^1$

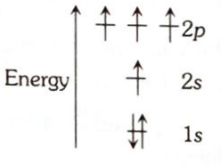
(c) $1s^2 2s^2 2p^2$ (d) $1s^2 2s^2 2p^6 3s^1$

22. The electronic configuration which obeys Hund's rule for the ground state of carbon atom is

(a) 

(b) 

(c) 

(d) 

23. For a $4p$ orbital, the number of radial and angular nodes, respectively are

(a) 3, 2 (b) 1, 2

(c) 2, 4 (d) 2, 1

7. IIT-JEE/ AIEEE

1. The radius of an atom is of the order of **[1985]**

(a) $10^{-10}\,cm$ (b) $10^{-13}\,cm$

(c) $10^{-15}\,cm$ (d) $10^{-8}\,cm$

2. CO has same electrons as **Or** the ion that is isoelectronic with CO is **[1982]**

(a) N_2^+ (b) CN^-

(c) O_2^+ (d) O_2^-

3. Which of the following are isoelectronic and isostructural $NO_3^-, CO_3^{2-}, ClO_3^-, SO_3$ **[2003]**

(a) NO_3^-, CO_3^{2-} (b) SO_3, NO_3^-

(c) ClO_3^-, CO_3^{2-} (d) CO_3^{2-}, SO_3

4. The group having isoelectronic species is **[2017]**

(a) O^-, F^-, Na, Mg^+ (b) O^{2-}, F^-, Na, Mg^{2+}

(c) O^-, F^-, Na^+, Mg^{2+} (d) $O^{2-}, F^-, Na^+, Mg^{2+}$

5. Rutherford's alpha particle scattering experiment eventually led to the conclusion that **[1986]**

(a) Mass and energy are related

(b) Electrons occupy space around the nucleus

(c) Neutrons are buried deep in the nucleus

(d) The point of impact with matter can be precisely determined

6. The first use of quantum theory to explain the structure of atom was made by **[1997]**

(a) Heisenberg (b) Bohr

(c) Planck (d) Einstein

7. The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom **[2004]**

(a) $He^+(n=2)$ (b) $Li^{2+}(n=2)$

(c) $Li^{2+}(n=3)$ (d) $Be^{3+}(n=2)$

8. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [a_0 is Bohr radius] **[2012]**

(a) $\frac{h^2}{4\pi^2 m a_0^2}$ (b) $\frac{h^2}{16\pi^2 m a_0^2}$

(c) $\frac{h^2}{32\pi^2 m a_0^2}$ (d) $\frac{h^2}{64\pi^2 m a_0^2}$

9. The value of the energy for the first excited state of hydrogen atom will be **[2015]**

(a) $-13.6\,eV$ (b) $-3.40\,eV$

(c) $-1.51\,eV$ (d) $-0.85\,eV$

10. The ratio of the energy of a photon of 2000Å wavelength radiation to that of 4000Å radiation is **[1986]**

(a) 1/4 (b) 4

(c) 1/2 (d) 2

11. The energy of an electron in the first Bohr orbit of H atom is $-13.6eV$. The possible energy value(s) of the excited state(s) for electrons in Bohr orbits to hydrogen is(are) **[1998]**

(a) $-3.4eV$ (b) $-4.2eV$

(c) $-6.8eV$ (d) $+6.8eV$

12. The wavelength of a spectral line for an electronic transition is inversely related to **[1988]**

(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

13. Energy of an electron is given by $E = -2.178 \times 10^{-18} J\left(\frac{Z^2}{n^2}\right)$. Wavelength of light required to excite an electron in an hydrogen atom from level $n=1$ to $n=2$ will be **[2013]**

($h = 6.62 \times 10^{-34}\,Js$ and $c = 3.0 \times 10^8\,ms^{-1}$)

(a) $1.214 \times 10^{-7}\,m$ (b) $2.816 \times 10^{-7}\,m$

(c) $6.500 \times 10^{-7}\,m$ (d) $8.500 \times 10^{-7}\,m$

14. The radius of the second Bohr orbit for hydrogen atom is : (Planck's Const. $h = 6.6262 \times 10^{-34} Js$; mass of electron $= 9.1091 \times 10^{-31} kg$; charge of electron $e = 1.60210 \times 10^{-19} C$; permittivity of vacuum $\epsilon_0 = 8.854185 \times 10^{-12} kg^{-1} m^{-3} A^2$) **[2017]**

(a) 4.76 Å (b) 0.529 Å

(c) 2.12 Å (d) 1.65 Å

15. Which one of the following explains light both as a stream of particles and as wave motion **[1992]**

(a) Diffraction (b) $\lambda = h/p$

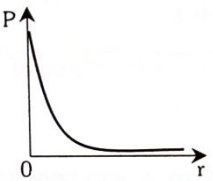
(c) Interference (d) Photoelectric effect

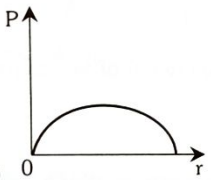
16. A stream of electrons from a heated filament was passed between two charged plates kept at a potential difference V esu. If e and m are charge and mass of an electron respectively, then the value of h/λ (where λ is wavelength associated with electron wave) is given by **[2016]**

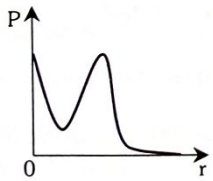
(a) $2meV$ (b) $\sqrt{meV}$

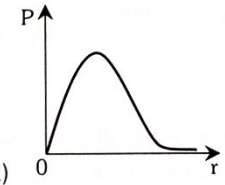
(c) $\sqrt{2meV}$ (d) meV

17. P is the probability of finding the 1s electron of hydrogen atom in a spherical shell of infinitesimal thickness, dr, at a distance r from the nucleus. The volume of this shell is $4\pi r^2 dr$. The qualitative sketch of the dependence of P on r is **[2016]**

(a) 

(b) 

(c) 

(d) 

18. Correct set of four quantum numbers for valence electron of rubidium ($Z = 37$) is **[1984]**

(a) $5, 0, 0, +\frac{1}{2}$ (b) $5, 1, 0, +\frac{1}{2}$

(c) $5, 1, 1, +\frac{1}{2}$ (d) $6, 0, 0, +\frac{1}{2}$

19. Which of the following sets of quantum numbers represent an impossible arrangement **[1986]**

	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	$(-)\frac{1}{2}$

20. The correct set of quantum numbers for the unpaired electron of chlorine atom is **[1989]**

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

21. 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 order of increasing energy from the lowest to highest, as **[1999]**

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

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

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

(d) (iii) < (i) < (iv) < (ii)

22. The quantum numbers + 1/2 and – 1/2 for the electron spin represent **[2001]**

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

(b) Rotation of the electron in anticlockwise 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

23. The orbital diagram in which the Aufbau's principle is violated is **[1988]**

	2s	$2p_x$	$2p_y$	$2p_z$
(a)	↑↓	↑↓	↑	↑
(b)	↑	↑↓	↑	↑
(c)	↑↓	↑	↑	↑
(d)	↑↓	↑↓	↑↓	↑

24. The correct ground state electronic configuration of chromium atom is **[1989,94]**

(a) $[Ar]3d^5 4s^1$ (b) $[Ar]3d^4 4s^2$

(c) $[Ar]3d^6 4s^0$ (d) $[Ar]4d^5 4s^1$

25. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$. This represents its **[2000]**

(a) Excited state (b) Ground state

(c) Cationic form (d) Anionic form

26. How many unpaired electrons are present in Ni^{2+} cation (atomic number = 28) **[1981]**

(a) 0 (b) 2

(c) 4 (d) 6

27. The number of electrons in the valence shell of calcium is **[1975]**

(a) 6 (b) 8

(c) 2 (d) 4

28. The number of radial nodes of 3*s* and 2*p* orbitals are respectively **[2005]**

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

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

29. A 3*p* orbital has **[1995]**

(a) Two spherical nodes

(b) Two non-spherical nodes

(c) One spherical and one non-spherical node

(d) One spherical and two non-spherical nodes

30. p_x orbital can accommodate **[1983]**

(a) 4 electrons

(b) 6 electrons

(c) 2 electrons with parallel spins

(d) 2 electrons with opposite spins

31. The number of nodal planes in a p_x is **[2000]**

(a) One (b) Two

(c) Three (d) Zero

32. Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon **[1984]**

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

(c) 2*s* (d) 1*s*

33. The orbital angular momentum of an electron in *s* orbital is **[1996]**

(a) $+\frac{1}{2}.\frac{h}{2\pi}$ (b) Zero

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

34. Which one of the following constitutes a group of the isoelectronic species **[2008]**

(a) $NO^+, C_2^{2-}, CN^-, N_2$ (b) $CN^-, N_2, O_2^{2-}, C_2^{2-}$

(c) N_2, O_2^-, NO^+, CO (d) C_2^{2-}, O_2^-, CO, NO

35. Which one of the following groupings represents a collection of isoelectronic species **[2003]**

(a) Na^+, Ca^{2+}, Mg^{2+} (b) N^{3-}, F^-, Na^+

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

36. According to Bohr's theory, the angular momentum of an electron in 5th orbit is **[2006]**

(a) $25h/\pi$ (b) $1.0\ h/\pi$

(c) $10h/\pi$ (d) $2.5h/\pi$

37. The wavelength of the radiation emitted, when in a hydrogen atom electron falls from infinity to stationary state 1, would be (Rydberg constant $=1.097\times10^7 m^{-1}$) **[2004]**

(a) 406 *nm* (b) 192 *nm*

(c) 91 *nm* (d) 9.1×10^{-8} *nm*

38. The ionization 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 **[2008]**

(a) $6.56\times10^5\ J\ mol^{-1}$ (b) $7.56\times10^5\ J\ mol^{-1}$

(c) $9.84\times10^5\ J\ mol^{-1}$ (d) $8.51\times10^5\ J\ mol^{-1}$

39. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter-orbit jumps of the electron for Bohr orbits in an atom of hydrogen **[2003]**

(a) $3\rightarrow2$ (b) $5\rightarrow2$

(c) $4\rightarrow1$ (d) $2\rightarrow5$

40. A gas absorbs a photon of 355 *nm* and emits at two wavelengths. If one of the emission is at 680 *nm*, the other is at **[2011]**

(a) 1035 *nm* (b) 325 *nm*

(c) 743 *nm* (d) 518 *nm*

41. 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 **[2010]**

($c=3\times10^8 ms^{-1}$ and $N_A=6.02\times10^{23} mol^{-1}$)

(a) 494 *nm* (b) 594 *nm*

(c) 640 *nm* (d) 700 *nm*

42. Ionisation energy of He^+ is $19.6\times10^{-18} J\ atom^{-1}$. The energy of the first stationary state ($n=1$) of Li^{2+} is **[2010]**

(a) $8.82\times10^{-17} J\ atom^{-1}$ (b) $4.41\times10^{-16} J\ atom^{-1}$

(c) $-4.41\times10^{-17} J\ atom^{-1}$ (d) $-2.2\times10^{-15} J\ atom^{-1}$

43. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0\times10^{3}\,ms^{-1}$ (Mass of proton $=1.67\times10^{-27}\,kg$ and $h=6.63\times10^{-34}\,Js$) **[2009]**

(a) $0.032\,nm$ (b) $0.40\,nm$

(c) $2.5\,nm$ (d) $14.0\,nm$

44. The de-Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 *metres* per second is approximately **[2003]**

(a) 10^{-33} *metres* (b) 10^{-31} *metres*

(c) 10^{-16} *metres* (d) 10^{-25} *metres*

45. Uncertainty in position of a 0.25 kg particle is $10^{-5}m$. Uncertainty of velocity is $(h=6.6\times10^{-34}\,Js)$ **[2002]**

(a) $1.2\times10^{34}\,m/\sec$ (b) $2.1\times10^{-29}\,m/\sec$

(c) $1.6\times10^{-20}\,m/\sec$ (d) $1.7\times10^{-9}\,m/\sec$

46. The uncertainty in the position of an electron (mass = 9.1×10^{-28} g) moving with a velocity of $3.0\times10^{4}\,cms^{-1}$, accurate upto 0.001% will be

(Use $\frac{h}{4\pi}$ in the uncertainty expression, where $h=6.626\times10^{-27}\,erg-s$) **[2006]**

(a) $1.92cm$ (b) $7.68cm$

(c) $5.76cm$ (d) $3.84cm$

47. In an atom, an electron is moving with a speed of $600m/s$ with an accuracy of 0.005%. Certainty with which the position of the electron can be located is $(h=6.6\times10^{-34}\,kg\,m^{2}s^{-1}$, mass of electron, $e_m=9.1\times10^{-31}kg)$ **[2009]**

(a) $1.52\times10^{-4}m$ (b) $5.10\times10^{-3}m$

(c) $1.92\times10^{-3}m$ (d) $3.84\times10^{-3}m$

48. Which of the following sets of quantum numbers represents the highest energy of an atom **[2007]**

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

49. 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 **[2005]**

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

(a) (1) and (2) (b) (2) and (3)

(c) (3) and (4) (d) (4) and (5)

50. Which of the following sets of quantum numbers is correct for an electron in $4f$ orbital **[2004]**

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

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

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

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

51. 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 order of increasing energy as **[2012]**

(a) (3) < (4) < (2) < (1) (b) (4) < (2) < (3) < (1)

(c) (2) < (4) < (1) < (3) (d) (1) < (3) < (2) < (4)

52. Consider the ground state of $(Z=24)$. The numbers of electrons with the azimuthal quantum numbers, $l=1$ and 2 are, respectively **[2004]**

(a) 16 and 4 (b) 12 and 5

(c) 12 and 4 (d) 16 and 5

53. The electronic configuration of gadolinium (atomic no. 64) is **[2011]**

(a) $[Xe]4f^{8}5d^{9}6s^{2}$ (b) $[Xe]4f^{7}5d^{1}6s^{2}$

(c) $[Xe]4f^{3}5d^{5}6s^{2}$ (d) $[Xe]4f^{6}5d^{2}6s^{2}$

8. NEET/ AIPMT/ CBSE-PMT

1. Based on equation $E=-2.178\times10^{-18}J\left(\frac{Z^{2}}{n^{2}}\right)$ certain conclusions are written. Which of them is not correct **[2013]**

(a) For $n=1$, the electron has a more negative energy than it does for $n=6$ which means that the electron is more loosely bound in the smallest allowed orbit

(b) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus

(c) Larger the value of n, the larger is the orbit radius

(d) Equation can be used to calculate the change in energy when the electron change orbit

2. The value of Planck's constant is $6.63 \times 10^{-34}\ Js$. The velocity of light is $3.0 \times 10^{8}\ ms^{-1}$. Which value is closest to the wavelength in nanometres of a quantum of light with frequency of $8 \times 10^{15}\ s^{-1}$ **[2013]**

(a) 3×10^{7} (b) 2×10^{-25}

(c) 5×10^{-18} (d) 4×10^{1}

3. Which one is the wrong statement **[2017]**

(a) de-Broglie's wavelength is given by $\lambda = \frac{h}{m\upsilon}$, where $m =$ mass of the particle, $\upsilon =$ group velocity of the particle

(b) The uncertainty principle is $\Delta E \times \Delta t \geq \frac{h}{4\pi}$

(c) Half filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement

(d) The energy of 2s orbital is less than the energy of 2p orbital in case of hydrogen like atoms

4. What is the maximum numbers of electrons that can be associated with the following set of quantum numbers

$n = 3$, $l = 1$ and, $m = -1$ **[2013]**

(a) 2 (b) 10

(c) 6 (d) 4

5. Two electrons occupying the same orbital are distinguished by **[2016]**

(a) Principal quantum number

(b) Magnetic quantum number

(c) Azimuthal quantum number

(d) Spin quantum number

6. How many electrons can fit in the orbital for which $n = 3$ and $l = 1$ **[2016]**

(a) 14 (b) 2

(c) 6 (d) 10

7. Which of the following pairs of d -orbitals will have electron density along the axes **[2016]**

(a) $d_{xy}, d_{x^2-y^2}$ (b) d_{z^2}, d_{xz}

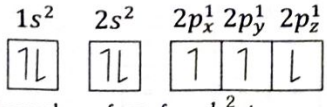
(c) d_{xz}, d_{yz} (d) $d_{z^2}, d_{x^2-y^2}$

8. Which one is a wrong statement **[2018]**

(a) Total orbital angular momentum of electron in 's' orbital is equal to zero

(b) An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbers

(c) The electronic configuration of N atom is



(d) The value of m for d_z^2 is zero

9. AIIMS

1. The charge on the atom containing 17 protons, 18 neutrons and 18 electrons is **[1996]**

(a) +1 (b) –2

(c) –1 (d) Zero

2. The isoelectronic pair is **[2005]**

(a) Cl_2O, ICl_2^- (b) ICl_2^-, ClO_2

(c) IF_2^+, I_3^- (d) ClO_2^-, ClF_2^+

3. Select correct statement (s) **[2008]**

(a) Cyanamide ion (CN_2^{2-}) is isoelectronic with CO_2 and has the same linear structure

(b) Mg_2C_3 reacts with water to form propyne

(c) CaC_2 has $NaCl$ type lattice

(d) All of the above

4. The most probable radius (in pm) for finding the electron in He^+ is **[2005]**

(a) 0.0 (b) 52.9

(c) 26.5 (d) 105.8

5. Which one of the following is not the characteristic of Planck's quantum theory of radiation **[1991]**

(a) The energy is not absorbed or emitted in whole number or multiple of quantum

(b) Radiation is associated with energy

(c) Radiation energy is not emitted or absorbed continuously but in the form of small packets called quanta

(d) The magnitude of energy associated with a quantum is proportional to the frequency

6. The spectrum of He is expected to be similar to **[1980]**

(a) H (b) Li^+

(c) Na (d) He^+

7. Spectrum of Li^{2+} is similar to that of **[2002]**

(a) H (b) He

(c) Be (d) Ne

8. In which one of the following pairs of experimental observations and phenomenon does the experimental observation correctly account for phenomenon **[1983]**

	Experimental observation	**Phenomenon**
(a)	X -ray spectra	Charge on the nucleus
(b)	α -particle scattering	Quantized electron orbit
(c)	Emission spectra	The quantization of energy
(d)	The photoelectric effect	The nuclear atom

9. The de-Broglie wavelength of a particle with mass $1gm$ and velocity $100m/sec$ is **[2000]**

(a) $6.63\times10^{-33}m$ (b) $6.63\times10^{-34}m$

(c) $6.63\times10^{-35}m$ (d) $6.65\times10^{-35}m$

10. The de-Broglie wavelength associated with a ball of mass $1kg$ having kinetic energy $0.5\,J$ is **[2006]**

(a) $6.626\times10^{-34}m$ (b) $13.20\times10^{-34}m$

(c) $10.38\times10^{-21}m$ (d) 6.626×10^{-34} Å

11. The position of both an electron and a helium atom is known within $1.0nm$ and the momentum of the electron is known within $50\times10^{-26}kg\,ms^{-1}$. The minimum uncertainty in the measurement of the momentum of the helium atom is **[2001]**

(a) $50kg\,ms^{-1}$ (b) $60\,kg\,ms^{-1}$

(c) $80\times10^{-26}kg\,ms^{-1}$ (d) $50\times10^{-26}kg\,ms^{-1}$

12. The uncertainties in the velocities of two particles, A and B are 0.05 and $0.02ms^{-1}$, respectively. The mass of B is five times to that of the mass of A. What is the ratio of uncertainties $\left(\frac{\Delta x_A}{\Delta x_B}\right)$ in their positions **[2008]**

(a) 2 (b) 0.25

(c) 4 (d) 1

13. Principal, azimuthal and magnetic quantum numbers are respectively related to **[1999]**

(a) Size, shape and orientation

(b) Shape, size and orientation

(c) Size, orientation and shape

(d) None of the above

14. The total number of orbitals in an energy level designated by principal quantum number n is equal to **[1997]**

(a) $2n$ (b) $2n^2$

(c) n (d) n^2

15. Which of the following set of quantum numbers is possible **[2001]**

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

(b) $n=3;\ l=4;\ m=0$ and $s=-\frac{1}{2}$

(c) $n=4;\ l=0;\ m=2$ and $s=+\frac{1}{2}$

(d) $n=4;\ l=4;\ m=3$ and $s=+\frac{1}{2}$

16. Which of the following set of quantum number is not valid **[2001]**

(a) $n=1,\ l=2$ (b) $n=2,\ m=1$

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

17. Azimuthal quantum number defines **[2002]**

(a) e/m ratio of electron

(b) Spin of electron

(c) Angular momentum of electron

(d) Magnetic momentum of electron

18. The quantum number 'm' of a free gaseous atom is associated with **[2003]**

(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

19. For principal quantum number $n=4$ the total number of orbitals having $l=3$ **[2004]**

(a) 3 (b) 7

(c) 5 (d) 9

20. The statements **[1982]**

(i) In filling a group of orbitals of equal energy, it is energetically preferable to assign electrons to empty orbitals rather than pair them into a particular orbital.

(ii) When two electrons are placed in two different orbitals, energy is lower if the spins are parallel are valid for.

(a) Aufbau principle

(b) Hund's rule

(c) Pauli's exclusion principle

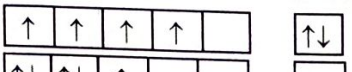
(d) Uncertainty principle

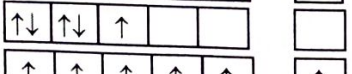
21. Which of the following explains the sequence of filling the electrons in different shells **[1998]**

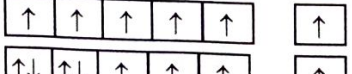
(a) Hund's rule (b) Octet rule

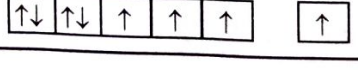
(c) Aufbau principle (d) All of these

22. Which one is the correct outer configuration of chromium **[1980]**

(a) 

(b) 

(c) 

(d) 

23. 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 **[1980]**

(a) $[Rn]5f^{14},6d^4,7s^2$ (b) $[Rn]5f^{14},6d^1,7s^27p^3$

(c) $[Rn]5f^{14},6d^6,7s^0$ (d) $[Rn]5f^{14},6d^5,7s^1$

24. Which one is the electronic configuration of Fe^{+2} **[1989]**

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

(b) $1s^2,2s^22p^6,3s^23p^63d^4,4s^2$

(c) $1s^2,2s^22p^6,3s^23p^63d^5,4s^1$

(d) None of these

25. The configuration $1s^2,2s^22p^5,3s^1$ shows **[1997]**

(a) Excited state of O_2^-

(b) Excited state of neon

(c) Excited state of fluorine

(d) Ground state of fluorine atom

26. Number of unpaired electrons in $1s^22s^22p^3$ is **[2000]**

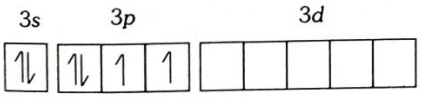
(a) 2 (b) 0

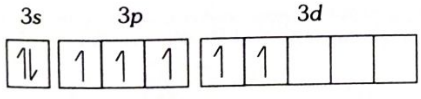
(c) 3 (d) 1

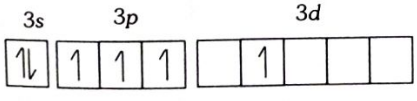
27. Which of the following is not correct for electron distribution in the ground state **[1982]**

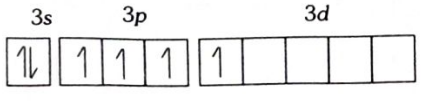
		4s			3d		
(a)	Co(Ar)	↑↓	↑↓	↑↓	↑	↑	↑
(b)	Ni(Ar)	↑↓	↑↓	↑↓	↑↓	↑	↑
(c)	Cu(Ar)	↑↓	↑↓	↑↓	↑↓	↑↓	↑
(d)	Zn(Ar)	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓

28. Which of the following has maximum energy **[2002]**

(a) 

(b) 

(c) 

(d) 

29. For the energy levels in an atom, which one of the following statements is correct **[1983]**

(a) There are seven principal electron energy levels

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

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

(d) The $4s$ sub-energy level is at a higher energy than the $3d$ sub-energy level

10. Assertion and Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false.

(e) If assertion is false but reason is true.

1. Assertion : The position of an electron can be determined exactly with the help of an electron microscope.

Reason : The product of uncertainty in the measurement of its momentum and the uncertainty in the measurement of the position cannot be less than a finite limit.

2. Assertion : A spectral line will be seen for a $2p_x - 2p_y$ transition.

Reason : Energy is released in the form of wave of light when the electron drops from $2p_x - 2p_y$ orbital.

3. Assertion : The energy of an electron is largely determined by its principal quantum number.

Reason : The principal quantum number n is a measure of the most probable distance of finding the electron around the nucleus.

4. Assertion : The value of n for a line in Balmer series of hydrogen spectrum having the highest wave length is 4 and 6.

Reason : For Balmer series of hydrogen spectrum, the value $n_1 = 2$ and $n_2 = 3, 4, 5$.

5. Assertion : Absorption spectrum consists of some bright lines separated by dark spaces.

Reason : Emission spectrum consists of dark lines.

6. Assertion : Cathode rays do not travel in straight lines.

Reason : Cathode rays penetrate through thick sheets.

7. Assertion : Electrons revolving around the nucleus do not fall into the nucleus because of centrifugal force.

Reason : Revolving electrons are planetary electrons.

8. Assertion : Threshold frequency is a characteristic for a metal.

Reason : Threshold frequency is a maximum frequency required for the ejection of electron from the metal surface.

9. Assertion : $3d_{z^2}$ orbital is spherically symmetrical.

Reason : $3d_{z^2}$ orbital is the only d-orbital which is spherical in shape.

10. Assertion : Energy of the orbitals increases as $1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f < .....$ in a hydrogen atom.

Reason : Energy of the electron depends completely on principal quantum number.

11. Assertion : Atomic orbital in an atom is designated by n, l, m_l and m_s.

Reason : These are helpful in designating electron present in an orbital.

2. Structure of Atom – Answers Keys

1. Discovery and Properties of Anode, Cathode Rays Neutron and Nuclear Structure

1	b	2	c	3	a	4	d	5	b
6	b	7	a						

2. Atomic Number, Mass Number, Atomic Species

1	d	2	c	3	c	4	b	5	c
6	a	7	c	8	b	9	d	10	d

3. Atomic Models and Planck's Quantum Theory

1	c	2	c	3	a	4	b	5	d
6	d	7	b	8	b	9	c	10	c
11	d	12	b	13	b	14	d	15	a
16	a	17	a	18	a	19	b	20	e
21	b	22	c	23	d	24	a	25	c
26	c	27	a	28	c	29	b	30	c
31	c	32	c						

4. Dual Nature of Electron

1	b	2	a	3	a	4	d	5	b
6	c	7	c	8	c				

5. Uncertainty Principle and Schrodinger Wave Equation

1	c	2	c	3	b	4	b	5	d
6	b	7	d	8	a				

6. Quantum Number, Electronic Configuration and Shape of Orbitals

1	c	2	bd	3	b	4	c	5	b
6	b	7	b	8	a	9	b	10	c
11	a	12	a	13	b	14	a	15	d
16	c	17	a	18	d	19	d	20	d
21	d	22	a	23	d				

7. IIT-JEE/ AIEEE

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

8. NEET/ AIPMT/ CBSE-PMT

1	a	2	d	3	d	4	a	5	d
6	c	7	d	8	c				

9. AIIMS

1	c	2	d	3	d	4	c	5	a
6	b	7	a	8	c	9	a	10	b
11	d	12	a	13	a	14	d	15	a
16	a	17	c	18	c	19	b	20	b
21	c	22	c	23	a	24	a	25	b
26	c	27	c	28	b	29	ab		

10. Assertion and Reason

1	e	2	d	3	a	4	e	5	d
6	d	7	b	8	c	9	d	10	c
11	e								