GOVERNMENT OF KARNATAKA

DEPARTMENT OF SCHOOL EDUCATION (PRE-UNIVERSITY)

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CHAPTERWISE MULTIPLE CHOICE QUESTIONS FOR COMPETATIVE EXAM

SUBJECT: I PUC CHEMISTRY

NAME OF THE CHAPTER: UNIT: 02-STRUCTURE OF ATOM

SYNOPSIS

1. Fundamental Subatomic Particles

- **Electron (e^-):** Mass $m_e = 9.1 \times 10^{-31}$ kg, Charge e = -1.602×10^{-19} C, Specific charge (e/m_e) = 1.7588×10^{11} C kg^{-1}. Discovered by J.J. Thomson via Cathode Ray Tube experiments.
- **Proton (p^+):** Mass $m_p = 1.6726 \times 10^{-27}$ kg, Charge = $+1.602 \times 10^{-19}$ C. Discovered via Anode/Canal rays.
- **Neutron (n^0):** Mass $m_n = 1.6749 \times 10^{-27}$ kg, Charge = 0. Discovered by James Chadwick (1932) by bombarding Beryllium with α-particles.

2. Atomic Terms, Notation, and Iso-Species

- **Representation:** An element is written as ^{Z}A X, where Z = Atomic Number (protons) and A = Mass Number (p + n).
- **Neutrons (n):** n = A - Z.
- **Isotopes:** Same Z, different A (e.g., $^{1}_{1}H$, $^{1}_{2}H$, $^{1}_{3}H$ or $^{35}_{17}Cl$, $^{37}_{17}Cl$).
- **Isobars:** Same A, different Z (e.g., $^{14}_{6}C$ and $^{14}_{7}N$).
- **Isoelectronic Species:** Atoms/ions having the same total number of electrons (e.g., O^{2-}, F^-, Na^+, Mg^{2+} all have 10 e^-).

3. Early Atomic Models & Rutherford's Scattering

- **Thomson's Model:** "Plum Pudding / Watermelon Model" — Mass and positive charge assumed to be uniformly distributed. (Failed).
- **Rutherford's α-Particle Scattering Experiment:**
  - Most α-particles passed undeflected → Most space inside atom is empty.
  - Few deflected by small angles → Positive charge concentrated in a tiny volume called Nucleus.
  - Very few (~1 in 20,000) bounced back by 180°.
- **Dimensions:** Radius of atom ≈ 10^{-10} m, Radius of nucleus ≈ 10^{-15} m.
- **Drawback:** Could not explain atomic stability (accelerating electron should continuously lose energy and spiral into nucleus according to Maxwell's theory).

4. **Wave Nature of Light & Electromagnetic Radiation**

- Electromagnetic waves travel at speed of light $c = 3.0 \times 10^8$ m s^{-1} in vacuum.
- **Key Relations:**
  - $\nu = c / \lambda$
  - $\bar{\nu} = 1 / \lambda = \nu / c$

    (where ν = frequency in Hz or s^{-1}, λ = wavelength in m, $\bar{\nu}$ = wavenumber in m^{-1} or cm^{-1})

5. **Planck's Quantum Theory & Photoelectric Effect**

- Radiant energy is absorbed or emitted discretely in packets called quanta (or photons for light):
  - $E = h\nu = (h \times c) / \lambda$

    (Planck's constant $h = 6.626 \times 10^{-34}$ J s)
- **Total Energy:** $E_{total} = n \times h \times \nu$ (where n = number of photons).
- **Photoelectric Effect (Einstein's Equation):**
  - $E_{incident} = W_0 + K.E._{max}$
  - $h\nu = h\nu_0 + \frac{1}{2} m_e v^2$
  - ν_0 = Threshold Frequency (minimum frequency required for emission).
  - $W_0 = h\nu_0$ = Work Function of metal.
  - Kinetic energy of ejected photoelectron depends only on frequency ν, whereas the number of ejected electrons depends only on light intensity.

6. **Hydrogen Line Spectrum & Rydberg Formula**

- Spectral transitions between energy levels emit light of discrete wavelengths given by the Rydberg Equation:
  - $\bar{\nu} = 1 / \lambda = R_H \times Z^2 \times [(1 / n_1^2) - (1 / n_2^2)]$

    (Rydberg Constant $R_H = 109{,}677$ $cm^{-1} = 1.097 \times 10^7$ m^{-1})

7. **Spectral Series Summary Table**

Series	**n_1**	**n_2**	**Spectral Region**
Lyman	1	2, 3, 4, ...	**Ultraviolet (UV)**
Balmer	2	3, 4, 5, ...	**Visible**
Paschen	3	4, 5, 6, ...	**Infrared (IR)**
Brackett	4	5, 6, 7, ...	**Infrared (IR)**
Pfund	5	6, 7, 8, ...	**Infrared (IR)**

- **Number of Emission Lines:** Total lines generated when an electron drops from level n to ground state (n = 1) is given by:
    - Total lines = $[n \times (n - 1)] / 2$

8. **Bohr's Postulates for Hydrogen & Single-Electron Ions (He^{+}, Li^{2+}, Be^{3+})**

- Electrons revolve only in non-radiating stationary orbits.
- **Quantization of Angular Momentum:**
    - $m_e \times v \times r = n \times (h / 2\pi)$ (where n = 1, 2, 3, ...)

9. **Key Bohr Formulas for Single-Electron Species**

- **Radius of n^{th} orbit:**
    - $r_n = (52.9 \times n^2) / Z$ pm $= (0.529 \times n^2) / Z$ Å *(For Hydrogen ground state $n = 1, Z = 1 \rightarrow r_1 = 52.9$ pm $= a_0$)*
- **Energy of n^{th} orbit:**
    - $E_n = -2.18 \times 10^{-18} \times (Z^2 / n^2)$ J atom^{-1} $= -13.6 \times (Z^2 / n^2)$ eV atom^{-1}
    - *Negative sign indicates that the electron is bound to the nucleus (lower energy than free electron at rest where $E_\infty = 0$).*
- **Velocity of electron:** $v_n \propto Z / n$.

10. **Limitations of Bohr's Model**

1. Fails to explain spectra of multi-electron atoms.
2. Cannot explain fine structure splitting of spectral lines.
3. Cannot explain Zeeman Effect (splitting in magnetic field) and Stark Effect (splitting in electric field).
4. Violates Heisenberg Uncertainty Principle (assumes well-defined paths/trajectories).

11. **Dual Nature of Matter (de Broglie Hypothesis)**

- All moving particles exhibit wave-like behavior.
- **de Broglie Wavelength Equation:**
    - $\lambda = h / p = h / (m \times v) = h / \sqrt{(2 \times m \times K.E.)}$
- **For Charged Particle (accelerated through potential V):**
    - $\lambda = h / \sqrt{(2 \times m \times q \times V)}$
- **Connection with Bohr's Postulate:** Circumference of n^{th} Bohr orbit is an integral multiple of de Broglie wavelength:
    - $2\pi \times r_n = n \times \lambda$

12. Heisenberg's Uncertainty Principle

- It is impossible to determine simultaneously both the precise position and precise momentum (or velocity) of a microscopic particle:
  - $\Delta x \times \Delta p \geq h / 4\pi \Rightarrow \Delta x \times (m \times \Delta v) \geq h / 4\pi$ *(Δx = Uncertainty in position, Δv = Uncertainty in velocity)*
- **Significance:** Significant only for subatomic particles (e.g., electrons); negligible for macroscopic objects. Rules out the existence of definite Bohr orbits!

13. Quantum Mechanical Model & Wave Function (ψ)

- Derived from the Schrödinger Wave Equation: $\hat{H}\psi = E\psi$.
- **Wave Function (ψ):** Has no direct physical meaning; acts as an orbital wave function.
- **Probability Density ($|\psi|^2$):** Represents the probability of finding an electron at a given point per unit volume. Always positive.

14. Orbit vs. Orbital

- **Orbit:** A well-defined 2D circular path around the nucleus (Bohr concept; invalid).
- **Orbital:** A 3D region of space around the nucleus where the probability of finding an electron is maximum (~90%).

15. The Four Quantum Numbers

Quantum Number	Symbol	Permissible Values	Represents / Significance
Principal	n	1, 2, 3, ...	Shell number, size, and major energy level.
Azimuthal (Subsidiary)	l	0 to (n - 1)	Subshell, 3D shape, and orbital angular momentum.
Magnetic Orbital	m_l	-l ... 0 ... +l	Spatial orientation of orbital (2l + 1 values).
Electron Spin	m_s	+½, -½	Spin direction (↑ or ↓).

16. Subshell Shapes & Value Summary

- **l = 0 (s-subshell):** Spherical shape (1 orbital).
- **l = 1 (p-subshell):** Dumbbell shape (3 orbitals: p_x, p_y, p_z).
- **l = 2 (d-subshell):** Double-dumbbell shape (5 orbitals: d_{xy}, d_{yz}, d_{zx}, $d_{x^2-y^2}$, d_{z^2}).
- **l = 3 (f-subshell):** Complex shape (7 orbitals).

- **Orbital Angular Momentum Formula:**
    - $L = \sqrt{[\, l \times (l + 1)\,]} \times (h / 2\pi)$

17. Radial and Angular Nodes

- **Node:** Region where the probability density $|\psi|^2 = 0$.
- **Radial Nodes (Spherical Nodes):** = $n - l - 1$
- **Angular Nodes (Nodal Planes):** = l
- **Total Nodes:**
    - Total Nodes = $(n - l - 1) + l = n - 1$

18. Rules for Filling Orbitals in Atoms

1. **Aufbau Principle:** Orbitals are filled in order of increasing energy based on the **(n + l) Rule**:
    - Lower $(n + l)$ orbital is filled first.
    - If two orbitals have the same $(n + l)$ value, the orbital with **lower n** has lower energy and fills first.
    - *Order:* 1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p < 5s < 4d ...
2. **Pauli's Exclusion Principle:** No two electrons in an atom can have the same set of all four quantum numbers.
    - *Consequence:* An orbital can hold a maximum of **2 electrons** of opposite spins.
    - *Capacity Formulas:* Max e^- in a shell = $2n^2$; Max e^- in a subshell = $2 \times (2l + 1)$.
3. **Hund's Rule of Maximum Multiplicity:** Electron pairing in degenerate orbitals (p, d, f) does not occur until each orbital is singly occupied with parallel spins.

19. Stability of Half-Filled and Fully-Filled Subshells

Configurations with half-filled (p^3, d^5, f^7) or fully-filled (p^6, d^{10}, f^{14}) subshells possess extra stability due to:

1. **Symmetrical Distribution of Electrons:** Leads to lower mutual shielding and stronger nuclear attraction.
2. **Maximum Exchange Energy:** Electrons with parallel spins exchange positions in degenerate orbitals, releasing stabilizing exchange energy.

20. Exceptional Electronic Configurations (Crucial for Questions)

Due to extra stability of half-filled and fully-filled subshells, an electron shifts from 4s to 3d:

- **Chromium (Cr, Z = 24):** [Ar] $3d^5\ 4s^1$ *(Expected [Ar] $3d^4\ 4s^2$)*
- **Copper (Cu, Z = 29):** [Ar] $3d^{10}\ 4s^1$ *(Expected [Ar] $3d^9\ 4s^2$)*
- **Chromium Ion (Cr^{3+}):** [Ar] $3d^3\ 4s^0$ *(Electrons are removed first from 4s, then from 3d)*
- **Iron Ion (Fe^{3+}, Z = 26):** [Ar] $3d^5\ 4s^0$

MULTIPLE CHOICE QUESTIONS

2.1 Discovery of sub-atomic particles

1. What is wrong about anode rays?

   a) They are produced by ionization of molecules of the residual gas.

   b) Their e/m ratio is constant.

   c) They do not originate from the anode.

   d) They are deflected by electrical and magnetic field.

2. Which property of neuron and proton is approximately same?

   a) Symbol　　b) Mass

   c) Relative charge　　d) Actual charge

3. Cathode rays are

   a) electromagnetic waves　　b) stream of α - particles

   c) stream of electrons　　d) stream of positrons

4. How many number of electrons are present in a particle which carries a charge of $5.5 \times 10^{-16} C$?

   a) 1560　　b) 3432

   c) 2432　　d) 8240　　[KCET 2014]

5. The magnitude of the charge on the electron is 4.8×10^{-10} esu. What is the magnitude of the charge on the proton on the nucleus of helium atom?　　[KCET 2013]

   a) $6.4 \times 10^{-10} esu$　　b) $9.6 \times 10^{-10} esu$

   c) 4.8×10^{-10} esu　　d) 14.4×10^{-10} esu

6. Mass number of an atom is the sum of　　[KCET 2015]

   a) number of electrons + number of neutrons

   b) number of protons + number of electrons

   c) number of protons + number of neutrons

   d) number of protons + number of neutrons + number of electrons

2.2 Atomic models

7. The number of protons, neutrons and electrons in the ion ${}^{32}_{16}s^{2-}$ respectively are　　[KCET 2016]

   a) 16,16,18　　b) 16,18,16

   c) 16,16,16　　d) 18,16,16

8. Mg^{2+} is isoelectronic with

   a) Cu^{2+}　　b) Ca^{2+}

   c) Zn^{2+}　　d) Na^{+}

9. The group having isoelectronic species is　　[KCET 2017]

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

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

10. Which is not isoelectronic with the other three? [KCET 2018]

a) O_2 b) CN^-

c) CO d) NO^+

11. Rutherford's scattering experiment is related to the size of the

a) atom b) electron

c) nucleus d) neutron

12. An ion with mass number 56 contains 3 units of positive charge and30.4% more neutrons than electrons. What would be the symbol of this ion? [JEE MAIN 2019]

a) $^{56}_{26}Fe^{3+}$ b) $^{56}_{27}Co^{2+}$

c) $^{56}_{26}Fe^{2+}$ d) $^{58}_{27}Co^{3+}$

2.3 Developments leading to the Bohr's model of atom

13. If wavelength of photon is$2.2 \times 10^{-11}\ m$ and $h = 6.6 \times 10^{-34}\ J\ s$, then momentum of photon

a) $6.89 \times 10^{-43}\ kg\ m\ s^{-1}$ b) $3 \times 10^{-23}\ kg\ m\ s^{-1}$

c) $1.452 \times 10^{-44}\ kg\ m\ s^{-1}$ d) $3.33 \times 10^{-22}\ kg\ m\ s^{-1}$ [KCET 2018]

14. With regard to photoelectric effect, identify the correct statement among the following. [KCET 2019]

a) Energy ofe^- ejected increases with the increase in the intensity of incident light.

b) Number ofe^- ejected increases with the increase in the intensity of incident light.

c) Number ofe^- ejected increases with the increase in work function.

d) Number ofe^- ejected increases with the increase in the frequency of incident light.

15. The number of photons emitted per second by a 60 watt source of monochromatic light of wavelength 663 nm is$(h = 6.63 \times 10^{-34}\ J\ s)$

a) 3×10^{-20} b) 1.5×10^{20}

c) 2×10^{20} d) 4×10^{-20}

16. If wavelength of1^{st} line of Balmer series is $6500\overset{o}{A}$, then wavelength of 2^{nd} line of Balmer series is

a) $8775\overset{o}{A}$ b) $4814.8\overset{o}{A}$

c) $180.5\overset{o}{A}$ d) $3250\overset{o}{A}$ [KCET 2017]

17. The shortest wavelength of the line in hydrogen atomic spectrum of Lyman series when$R_H = 109678\ cm^{-1}$ is [KCET 2016]

a) $1215.67\overset{o}{A}$ b) $1127.30\overset{o}{A}$

c) $1002.7\overset{o}{A}$ d) $911.7\overset{o}{A}$

18. Which one of the following corresponds to a photon of highest energy?

a) $\bar{v} = 30\ cm^{-1}$ b) $\lambda = 300\ nm$

c) $v = 3 \times 10^8\ s^{-1}$ d) $E = 6.626 \times 10^{-27}\ J$

19. Given below are the spectral lines for an atom of hydrogen. Mark the lines which are not correctly matched with the value of n_1 and n_2 ? [KCET 2020]

	Series	n_1	n_2	Region
(i)	Lyman	1	$2, 3, \ldots$	Ultraviolet
(ii)	Balmer	2	$3, 4, \ldots$	Infrared
(iii)	Paschen	3	$4, 5, \ldots$	Infrared
(iv)	Pfund	4	$5, 6, \ldots$	Far Infrared

a) (i) and (iv) b) (i) and (iii)

c) (i) and (ii) d) (ii) and (iv)

20. A certain metal when irradiated by light$(v = 3.2 \times 10^{16}\ Hz)$ emits photoelectrons with twice of K.E. as did photoelectrons when the same metal is irradiated by light ($v = 2.0 \times 10^{16}\ Hz$) . The v_0 of the metal is

a) $4 \times 10^{12}\ Hz$ b) $1.2 \times 10^{16}\ Hz$

c) $1.2 \times 10^{14}\ Hz$ d) $8 \times 10^{15}\ Hz$ [JEE MAIN 2018]

21. Wave number and frequency of yellow radiation having wavelength $5800\overset{o}{A}$ are

a) $1.66 \times 10^{-8}\ cm^{-1}; 7.21 \times 10^{14}\ s^{-1}$ b) $1.724 \times 10^4\ cm^{-1}; 5.172 \times 10^{14}\ s^{-1}$

c) $1.92 \times 10^{-4}\ cm^{-1}; 5.172 \times 10^{19}\ s^{-1}$ d) $2.246 \times 10^4\ cm^{-1}; 1.72 \times 10^{10}\ s^{-1}$

22. Emission transitions in the Paschen series to orbit $n = 3$ from orbit n can be represented as $v = 3.29 \times 10^{15}(\ Hz)\left[\frac{1}{(3)^2} - \frac{1}{n^2}\right]$. The value of n if the transition is observed at 1285 nm (wavelength) is

a) 4 b) 3

c) 6 d) 5 [KCET 2019]

23. The electron in the hydrogen atom undergoes transition from higher orbitals to orbital of radius 211.6 pm. This transition is associated with [NEET 2020]

a) Brackett series b) Lyman series

c) Balmer series d) Paschen series

24. A 100 watt bulb emits monochromatic light of wavelength 400 nm. Calculate the number of photons emitted per second by the bulb.

a) $2 \times 10^{-20}\ s^{-1}$ b) $1 \times 10^{-20}\ s^{-1}$

c) $3 \times 10^{20}\ s^{-1}$ d) $2 \times 10^{20}\ s^{-1}$

2.4 Bohr's model for Hydrogen atom

25. The energy associated with first orbit of He^+ is

a) 0 J b) $-0.545 \times 10^{-18}\ J$

c) $-4.58 \times 10^{-18}\ J$ d) $-8.72 \times 10^{-18}\ J$

26. The energy of electron in the n^{th} Bohr orbit of H - atom is

a) $\frac{-13.6}{n^2} eV$

b) $\frac{-13.6}{n^4} eV$

c) $\frac{-13.6}{n^3} eV$

d) $\frac{-13.6}{n} eV$

27. The radius of which of the following orbit is same as that of the Bohr's first orbit of hydrogen atom?

a) $Be^{3+}(n=2)$

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

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

d) $He^{+}(n=2)$ [KCET 2017]

28. If the electron falls from $n=5$ to $n=4$ in the H - atom, then emitted energy is

a) 0.306 eV

b) 0.65 eV

c) 1.89 eV

d) 12.09 eV

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

a) $-41\ kJ\ mol^{-1}$

b) $-82\ kJ\ mol^{-1}$

c) $-1312\ kJ\ mol^{-1}$

d) $-164\ kJ\ mol^{-1}$

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

a) Photoelectric effect

b) Zeeman effect

c) Stark effect

d) none of these

31. The ionisation potential of the ground state of hydrogen atom is 2.17×10^{-11} ergs per atom. Calculate the wavelength of the photon that is emitted when an electron in 3^{rd} Bohr orbit return to 1^{st} orbit in hydrogen atom.

a) $1026\overset{o}{A}$

b) $1370\overset{o}{A}$

c) $8212\overset{o}{A}$

d) $2737\overset{o}{A}$

32. Calculate the energy of H - atom orbital (J atom^{-1}) whose angular momentum is $4.2178 \times 10^{-34}\ kg\ m^2/sec$. [KCET 2020]

a) -87.8×10^{-19}

b) -34.88×10^{-18}

c) -1.36×10^{-19}

d) -5.45×10^{-19}

33. What would be the wavelength and name of series respectively for the emission transition for H - atom if it starts from the orbit having radius 1.3225 nm and ends at 211.6 pm?

a) 600 nm, Lyman

b) 434 nm, Balmer

c) 434 pm, Paschen

d) 545 pm, Pfund

2.5 Towards Quantum mechanical model of the atom

34. Two particles A and B are in motion. If the wavelength associated with 'A' is 33.33 nm, the wavelength associated with ' B ' whose momentum is $1/3rd$ of 'A' is [KCET 2018]

a) $2.5 \times 10^{-8}\ m$

b) $1.25 \times 10^{-7}\ m$

c) $1.0 \times 10^{-7}\ m$

d) $1.0 \times 10^{-8}\ m$

35. What will be the uncertainty in velocity of an electron when the uncertainty in its position is $1000\overset{o}{A}$?

a) $5.79 \times 10^{-10}\ m\ s^{-1}$
b) $5.79 \times 10^{4}\ m\ s^{-1}$
c) $5.79 \times 10^{2}\ m\ s^{-1}$
d) $5.79 \times 10^{8}\ m\ s^{-1}$

36. 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) $5.27 \times 10^{-30}\ m$
c) $5.25 \times 10^{-28}\ m$
d) $1.05 \times 10^{-26}\ m$

37. What will be the uncertainty in velocity of a bullet with a mass of 10 g whose position is known with$\pm 0.01\ mm$?

a) $5.275 \times 10^{-33}\ m\ s^{-1}$
b) $5.275 \times 10^{-28}\ m\ s^{-1}$
c) $5.275 \times 10^{-25}\ m\ s^{-1}$
d) $5.275 \times 10^{-5}\ m\ s^{-1}$

38. A microscope using suitable photons is employed to locate an electron in an atom within a distance of$0.1\overset{o}{A}$. What is the uncertainty involved in the measurement of its velocity?

a) $5.79 \times 10^{6}\ m/s$
b) $6.69 \times 10^{8}\ m/s$
c) $4.42 \times 10^{6}\ m/s$
d) $7.32 \times 10^{8}\ m/s$

39. The accelerating potential that must be imparted to a proton beam to give it an effective wavelength of 0.05 nm is (wt. of one mole of proton = 1.008 g) [KCET 2017]

a) 3.25 eV
b) 52.05 eV
c) 0.325 eV
d) 5.205 eV

40. If the de Broglie wavelength of a particle of mass m is 100 times its velocity, then its value in terms of its mass (m) and Planck's constant (h) is

a) $\frac{1}{10}\sqrt{\frac{m}{h}}$
b) $\frac{1}{10}\sqrt{\frac{h}{m}}$
c) $10\sqrt{\frac{h}{m}}$
d) $10\sqrt{\frac{m}{h}}$

41. Uncertainty in position of an electron (mass= $9.1 \times 10^{-28}\ g$) moving with a velocity of $3 \times 10^{4}\ cm/s$ accurate upto 0.001% will be (Use $h/(4\pi)$ in uncertainty expression where $h = 6.626 \times 10^{-27}$ erg second) [KCET 2021]

a) 1.93 cm
b) 3.84 cm
c) 5.76 cm
d) 7.68 cm

2.6 Quantum mechanical model of atom

42. Consider the following sets of quantum numbers: Which of the below setting is not permissible arrangement of electrons in an atom?

a) n - 4, l - 0, m - 0, s - $-\frac{1}{2}$
b) n - 3, l - 2, m - - 2, s - $-\frac{1}{2}$

c) n - 3, l - 2, m - - 3, s - $+\frac{1}{2}$ d) n - 5, l - 3, m - 3, s - $+\frac{1}{2}$

43. The correct set of quantum numbers for the unpaired electron of chlorine atom is [NEET 2016]

a) $3,1,1,\pm\frac{1}{2}$ b) $2,1,-1,+\frac{1}{2}$

c) $3,0,0,\pm\frac{1}{2}$ d) $2,0,0,+\frac{1}{2}$

44. The number of angular and radial nodes in$3p$ orbital respectively are [NEET 2018]

a) 2, 1 b) 2, 3

c) 1, 1 d) 3, 1

45. In any subshell, the maximum number of electrons having same value of spin quantum number is

a) $4l+2$ b) $l+2$

c) $2l+1$ d) $\sqrt{l(l+1)}$

46. Subsidiary quantum number specifies

a) nuclear stability b) orientations of orbital

c) size of orbital d) shape of orbital

47. What is the maximum number of orbitals that can be identified with the following quantum numbers?

n = 3, l = 1, m $_l$ = 0 [KCET 2018]

a) 2 b) 1

c) 3 d) 4

48. The region where probability density function reduces to zero is called

a) nodal surfaces b) probability density region

c) wave function d) orientation surfaces

49. Which of the following sets of quantum numbers belongs to highest energy?

a) $n=3, l=0, m=0, s=+\frac{1}{2}$ b) $n=4, l=0, m=0, s=+\frac{1}{2}$

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

50. The correct set of four quantum numbers for the outermost electron of sodium$(Z=11)$ is [KCET 2019]

a) $3,1,0,1/2$ b) $3,1,1,1/2$

c) $3,0,0,1/2$ d) $3,2,1,1/2$

51. Which atom(X) is indicated by the following configuration? $X \rightarrow [Ne]3s^2 3p^3$

a) Phosphorus b) Chlorine

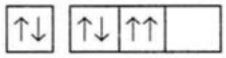
c) Nitrogen d) Sulphur

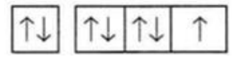
52. Which of the following configurations does not follow Hund's rule of maximum multiplicity?

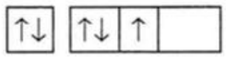
a) $1s^2 2s^2 2p^6 3s^2 3p^4 4s^2$ b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

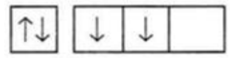
c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$ d) $1s^2 2s^2 2p^6 3s^2 3p^2$

53. The orbital diagram in which both Pauli's exclusion principle and Hund's rule are violated is

a) 

b) 

c) 

d)  [KCET 2017]

54. Describe the orbital with following quantum numbers: [KCET 2016]

1. $n = 3, l = 2$
2. $n = 4, l = 3$

a) (i)$3p$, (ii) $4f$

b) (i)$3d$, (ii) $4d$

c) (i)$3f$, (ii) $4f$

d) (i)$3d$, (ii) $4f$

55. How many electrons in an atom have the following quantum numbers? $n = 4, m_s = -1/2$ [KCET 2020]

a) 18

b) 32

c) 16

d) 8

56. The electronic configurations of Eu (Atomic No. 63), Gd (Atomic No. 64) and Tb (Atomic No. 65) are

a) $4f^7 6s^2, [Xe]4f^8 6s^2$ and $4f^8 5d^1 6s^2$

b) $4f^6 5d^1 6s^2, [Xe]4f^7 5d^1 6s^2$ and $4f^9 6s^2$

c) $4f^6 5d^1 6s^2, [Xe]4f^7 5d^1 6s^2$ and $4f^8 5d^1 6s^2$

d) $4f^7 6s^2, [Xe]4f^7 5d^1 6s^2$ and $4f^9 6s^2$

57. The magnetic quantum number for$d$ - orbital is given by

a) 0,1,2

b) $0, \pm 1, \pm 2$

c) 2

d) 5

58. An electron is in one of the $3d$ - orbitals. What are the possible values of n, l and m for this electron?

a) $n = 3, l = 2, m_l = -2, -1, 0, +1, +2$

b) $n = 3, l = 0, m_l = 0$

c) $n = 3, l = 3, m_l = -3, -2, -1, 0, +1, +2, +3$

d) $n = 3, l = 1, m_l = -1, 0, +1$

59. The electronic configuration ofCr^{3+} is

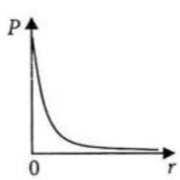
a) $3d^2 4s^1$

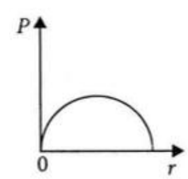
b) $3d^5 4s^1$

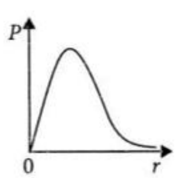
c) $3d^4 4s^2$

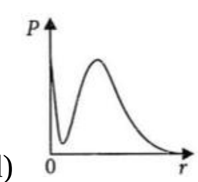
d) $3d^3 4s^0$

60. 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 [KCET 2020]

a) 

b) 

c) 

d) 

Answer Key

Q.No	Key	Q.No	Key	Q.No	Key	Q.No	Key	Q.No	Key
1	B	2	B	3	C	4	B	5	B
6	C	7	A	8	D	9	A	10	A
11	C	12	A	13	B	14	B	15	C
16	B	17	D	18	B	19	D	20	D
21	B	22	D	23	C	24	D	25	D
26	A	27	A	28	A	29	B	30	B
31	A	32	C	33	B	34	C	35	C
36	B	37	B	38	A	39	C	40	C
41	A	42	C	43	A	44	C	45	C
46	D	47	B	48	A	49	C	50	C
51	A	52	A	53	A	54	D	55	C
56	D	57	B	58	A	59	D	60	C

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