Quantum number, Electronic configuration and Shape of orbitals

211. **(a) Aufbau principle**

Aufbau principle states that **electrons fill lower energy orbitals first, then higher energy orbitals**.

This explains the order of filling of orbitals in an atom.

212. (a) In particular shell, the energy of atomic orbital increases with the value of l.

213. (b) **Cu and Ag**

Explanation:

Aufbau principle states that electrons are filled in orbitals in order of increasing energy (according to the n+ln + ln+l rule).
But some atoms show **exceptional electronic configurations** due to extra stability of half-filled or fully filled orbitals.
Examples:
Chromium (Cr, Z = 24): Expected: [Ar] $3d^4s^2$ → Actual: [Ar] 3d54s13
Copper (Cu, Z = 29): Expected: [Ar] $3d^94s^2$ → Actual: [Ar] $3d^{10}4s^1$
Silver (Ag, Z = 47): Expected: [Kr] $4d^95s^2$ → Actual: [Kr] $4d^{10}5s^1$

214. (c) Aufbau principle explains the sequence of filling of orbitals in increasing order of energy.

215. (a) According to Aufbau principle electron are filling increasing order of energy. Therefore the electronic configuration $1s^22s^22p^6$ obeys Aufbau principle.

216. (d) Electronic configuration of the Cr_{24} is $[Ar]4s^1 3d^5$ or

↿	↿	↿	↿	↿		↿	= 6
		3*d*				4*s*	

217. (b) According to the Aufbau principle electron filling minimum to higher energy level.

218. (b) Cu and Ag

Aufbau principle exceptions

Aufbau principle: electrons fill orbitals from lower to higher energy.
Exceptions occur in some transition elements due to extra stability of **half-filled (d^5) and fully-filled (d^{10}) d-subshells**.
Common exceptions:
Chromium (Cr, Z = 24): [Ar] $3d^5\ 4s^1$ instead of [Ar] $3d^4\ 4s^2$
Copper (Cu, Z = 29): [Ar] $3d^{10}\ 4s^1$ instead of [Ar] $3d^9\ 4s^2$
Silver (Ag, Z = 47): [Kr] $4d^{10}\ 5s^1$ instead of $4d^9\ 5s^2$

219. (b) According to Aufbau principle electron are filled in various atomic orbital in the increasing order of energy

$1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p < 5s < 4d < 5p < 6s < 4f < 5d < 6p < 7s$.

220. (d) According to Aufbau's rule.

221. (b) Non degenerate

p-orbitals: l = 1 → 3 orbitals (p_x, p_y, p_z)

In absence of magnetic field: all three are **degenerate** → same energy

In presence of magnetic field (Zeeman effect): the degeneracy is **lifted**

Each orbital has different **magnetic quantum number (m_l = –1, 0, +1)** → energies split

222. (b) We know that for *d*-electron $l = 2$.

$\mu = \sqrt{l(l+1)}\frac{h}{2\pi}$; $\mu = \sqrt{2(2+1)}\frac{h}{2\pi}$

$\mu = \sqrt{2(2+1)}\frac{h}{2\pi}$; $\mu = \sqrt{6}\frac{h}{2\pi}$.

223. (a) Number of nodal centre for $2s$ orbitals $(n-1) = 2-1 = 1$.

224. (d) Since *s*-orbital have $l = 0$

Angular momentum = $\sqrt{l(l+1)} \times \frac{h}{2\pi} = 0 \times \frac{h}{2\pi} = 0$.

225. (d) Azimuthal quantum number (*l*) = 3 shows the presence of *f* orbit, which contain seven orbitals and each orbital have 2 electrons. Hence $7 \times 2 = 14$ electrons.

226. **(a)** $3d^3$ → three orbitals each with 1 electron → all unpaired

227. (b) According to Aufbau principle.

228. (a) Atomic number of deuterium = 1; $1D^2 \rightarrow 1s^1$