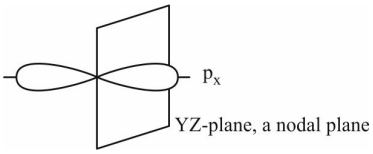
46.(AD) Only these configurations follow Hund's rule. In (B) and (C), the spin of unpaired electrons is not same and so they are not correct configurations of nitrogen atom.

47.(C) Assertion is correct $Be(1s^2, 2s^2)$ has stable electronic configuration, removing an electron require more energy than the same for $B(2p^1)$. Reason is incorrect (Aufbau principle).

48.(A) Nodal plane is an imaginary plane on which probability of finding an electron is minimum. Every *p*-orbital has one nodal plane:



49.(B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$ is ground state electronic configuration of Cr.

50.(C) Using the de-Broglie's relationship: $\lambda = \dfrac{h}{mv} = \dfrac{6.625\times10^{-34}}{\dfrac{5\times0.2}{3600}} = 2.3\times10^{-30}$ m

51.(D) $+\dfrac{1}{2}$ and $-\dfrac{1}{2}$ just represents two quantum mechanical spin states which have no classical analogue.

52.(D) Rutherford used $\alpha-$particle (He^{2+} nuclei) in his experiment.

53.(C) $1s^7$ violate Pauli exclusion principle, according to which an orbital cannot have more than two electrons.

54.(D) **Apply** $r_n = 0.529\dfrac{n^2}{Z}$ Å. For H-atm, $r_1 = 0.529$Å

55.(A) The number of radial nodes is given by expression (n – *l* – 1).
For 3s, number of nodes = $3-0-1=2$; For 2p, number of nodes $= 2-1-1=0$

56. **A → R; B → Q; C → P; D → S;**

A. $V_n = -\dfrac{1}{4\pi\varepsilon_0}\left(\dfrac{Ze^2}{r}\right)$; $K_n = -\dfrac{1}{8\pi\varepsilon_0}\left(\dfrac{Ze^2}{r}\right) \Rightarrow \dfrac{V_n}{K_n} = -2$ _____ (r)

B. $E_n = -\dfrac{Ze^2}{8\pi\varepsilon_0 r} \propto r^{-1} \Rightarrow x = -1$ _____ (q)

C. Angular momentum $= \sqrt{l(l+1)}\dfrac{h}{2\pi} = 0$ in 1s-orbital _____ (p)

D. $r_n = \dfrac{a_0 n^2}{Z} \Rightarrow \dfrac{1}{r_n} \propto Z$ _____ (s)

57. **A → Q; B → P, Q, R, S; C → P, Q, R; D → P, Q, R;**

A. Orbital angular momentum

$$(L) = \sqrt{l(l+1)}\frac{h}{2\pi}$$ i.e. L depends on azimuthal quantum number only.

B. To describe a one electron wave function, three quantum numbers *n*, *l* and *m* are needed. Further to abide by Pauli exclusion principle, spin quantum number(s) is also needed.

C. For shape, size and orientation, only n, l and m are needed.

D. Probability density (Ψ^2) can be determined if n, l and m are known.

58.(B) S_1 is spherically symmetrically state, i.e. it correspond to a s-orbital. Also, it has one radial node.

Number of radial nodes = $n - l - 1 \quad \Rightarrow \quad n - 0 - 1 = 1 \quad \Rightarrow \quad n = 2$ i.e. $S_1 = 2s - \text{orbital}$.

59.(C) Ground state energy of electron in H-atom (E_H)

$$E_H = \frac{kZ^2}{n^2} = k\ (Z = 1, n = 1); \quad \text{For } S_1 \text{ state of } Li^{2+}, \quad E = \frac{k(3)^2}{2^2} = \frac{9}{4}k = 2.25k$$

60.(B) In S_2 state, $E(Li^{2+}) = K$ (given) $\quad K = \frac{qk}{n^2} \quad \Rightarrow \quad n = 3$

Since, S_2 has one radial node. $\quad 3 - l - 1 = 1 \quad \Rightarrow \quad l = 1$

61.(C) According to Bohr's model, $\quad mvr = \frac{nh}{2\pi} \Rightarrow (mv)^2 = \frac{n^2h^2}{4\pi^2r^2} \quad \Rightarrow KE = \frac{1}{2}mv^2 = \frac{n^2h^2}{8\pi^2r^2m}$

Also, Bohr's radius for H-atom is, $r = n^2a_0$

Substituting 'r' in Eq. (1) gives K.E. $= \frac{h^2}{8\pi^2n^2a_0^2m}$ when $n = 2$, K.E. $= \frac{h^2}{32\pi^2a_0^2m}$

62.(C) Radial nodes for 1s = 0.

63.(A) Incorrect combination is (I) (iii) (R) because in the expression of ψ_{n,ℓ,m_ℓ} for 1s-orbital, the exponential part must have $e^{-\frac{Zr}{a_0}}$.

64.(D) The correction combination is (I) (i) (s) as ψ_{n,ℓ,m_ℓ} in the column 2 (i) has exponential part as $e^{-\frac{Zr}{a_0}}$.

$$\frac{E_4 - E_2}{E_6 - E_2} = \frac{\frac{13.6Z^2}{16}(4-1)}{\frac{13.6Z^2}{36}(9-1)} = \frac{\frac{3\times 13.6Z^2}{16}}{\frac{8\times 13.6Z^2}{16}} = \frac{27}{32}$$

65.(C) The correct combination for any hydrogen – like species is [II] (ii) (P).

2s-orbital has one radial node and ψ_{n,ℓ,m_ℓ} v/s r plot will start from a finite value and sign changes once from +ve to –ve.

66.(B)

67.(ACD)