Quantum number, Electronic configuration and Shape of orbitals

61. (d) When $n = 3$ shell, the orbitals are $n^2 = 3^2 = 9$.
No. of electrons $= 2n^2$
Hence no. of orbital $= \frac{2n^2}{2} = n^2$.

62. (d) Configuration of $Ne = 1s^2 2s^2 2p^6$
$F^- = 1s^2 2s^2 2p^6$
$Na^+ = 1s^2 2s^2 2p^6$
$Mg^{++} = 1s^2 2s^2 2p^6$
$Cl^- = 1s^2 2s^2 2p^6 3s^2 3p^6$.

63. (d) $Unh_{106} = [Rn]5f^{14}, 6d^5, 7s^1$

64. (c) K^+ and Ca^{++} have the same electronic configuration $(1s^2, 2s^2 2p^6, 3s^2 3p^6)$

65. (b) For *s*-orbital, $l = 0$.

66. (d) $3s^1$ is valency electrons of Na for this $n = 3, l = 0, m = 0, s = \frac{+1}{2}$

67. (c) $7N = 1s^2, 2s^2 2p_x^1, 2p_y^1, 2p_z^1$. Hund's rule states that pairing of electrons in the orbitals of a subshell (orbitals of equal energy) starts when each of them is singly filled.

68. (d) (4) and (5) belong to d -orbital which are of same energy.

69. (c) Atomic no. 17 is of chlorine.

70. (b) The *s*-orbital has spherical shape due to its non- directional nature.

71. (a) According to the Aufbau's principle the new electron will enter in those orbital which have least energy. So here $4p$-orbital has least energy then the others.

72. (c) According to Aufbau's principle.

73. (c) $1s^2 2s^2 2p^6, 3s^2 3p^6, 4s^2 3d^6 = 2,8,14,2.$

74. (c) Ground state of $Cu^{29} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$ $Cu^{2+} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^9$.

75. **Iron (Fe) atomic number:** 26 → 26 electrons

Neutral Fe configuration: **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$**
- Often written as: **[Ar] $4s^2\ 3d^6$**

Fe^{2+} ion:
Fe^{2+} → loses **2 electrons**
Electrons are removed first from the outermost shell (4s) → $4s^2$ electrons are removed before 3d electrons
So, Fe^{2+} configuration:
Fe^{2+}=[Ar]$3d^6$
Expanded: **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$**
(a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$

76. (c) No. of electrons in 3^{rd} shell = $2n^2$= $2(3)^2 = 18$

77. (c) $F_9 = 1s^2 2s^2 2p^5$

78. (c) When $l = 3$ then
$m = -3, -2, -1, 0, +1, +2, +3$. $m = -l$ to $+l$ including zero.

79. **(d) 5s Krypton (Kr) atomic number = 36**

Electronic configuration: **[Ar] $4s^2\ 3d^{10}\ 4p^6$** (outermost shell: n = 4, p-orbital filled)
Adding the 37th electron → next element is Rubidium (Rb, Z = 37)
Electrons fill according to **Aufbau principle** → fill the **lowest available energy orbital**
After $4p^6$, the next lowest energy orbital is **5s**
:

80. (d) $m = -1$ is not possible for s orbital $(l = 0)$.

81. **(b) Shape**

The azimuthal quantum number (l) is related to:

l (azimuthal or angular momentum quantum number) determines the **shape of the orbital**.
l = 0 → s-orbital → spherical
l = 1 → p-orbital → dumb-bell
l = 2 → d-orbital → cloverleaf
l = 3 → f-orbital → complex

82. **(c) 6**

Total number of electrons in orbitals with n = 2 and l = 1

n = 2 → second shell
l = 1 → p-orbitals
Number of orbitals in a subshell = 2l + 1 = 3
Each orbital can hold **2 electrons** → total = 3 × 2 = 6

83. **(a) $1s^2\ 2s^2\ 2p^2$**

Electronic configuration of Carbon (C, Z = 6)

6 electrons → configuration: **$1s^2\ 2s^2\ 2p^2$**

84. (a) Both $2p$ and $3p$-orbitals have dumb-bell shape.

85. (b) $3d$ subshell filled with 5 electrons (half-filled) is more stable than that filled with 4 electrons. $1, 4s$ electrons jumps into $3d$ subshell for more sability.

86. (c) The shape of $2p$orbital is dumb-bell.

87. (a) $\mathbf{25Mn = [Ar]3d^5 4s^2}$ $Mn^{2+} = [Ar]3d^5 4s^0$

88. **(b) Distance of electron from nucleus**

Principal quantum number (n) determines:

Energy level of the electron
Average distance of the electron from the nucleus
Other quantum numbers:
l (azimuthal) → shape of orbital
m_l (magnetic) → orientation of orbital
s (spin) → spin of electron

89. (c) For *p*-orbital, $l = 1$ means dumb-bell shape.

90. **(b) 6**

Given: n = 3, l = 1

l = 1 → p-subshell
Number of orbitals in a subshell = 2l + 1
Number of orbitals=2(1)+1=3\text{Number of orbitals} = 2(1) + 1 = 3Number of orbitals=2(1)+1=3
Each orbital can hold **2 electrons** → total electrons = 3 × 2 = 6