Quantum number, Electronic configuration and Shape of orbitals

181. (c) $Be_4 = 1s^2, 2s^2 =$ (Ground state)

Number of unpaired electrons in the ground state of Beryllium atom is zero.

182. (b) Two unpaired electrons are present in

$\boldsymbol{Ni^{++}(z = 28)}$ cation

$Ni_{28}^{++} = [A$ | ⥮ | ⥮ | ⥮ | ↿ | ↿ | | |

$3d^8$ $4s^0$

183. (c) $O_2 = 1s^2 2s^2 2p^6 3s^2 3p^4$

$3s^2$ | ⥮ | $3p^4$ | ⥮ | ↿ | ↿ |

$\underbrace{\uparrow\ \uparrow}_{\text{2 Unpaired electrons}}$

184. (c) $Cr_{24} = (Ar)3d^5 4s^1$ but $Cr_{24}^{3+} = (Ar)3d^3 4s^0$

185. (a) $Zn_{30} = [Ar]3d^{10}4s^2$

$\boldsymbol{Zn^{++} = [Ar]3d^{10}4s^0}$

186. (d) Mn^{+2} ion will have five (maximum) unpaired electrons

$[Ar]$ | ↿ | ↿ | ↿ | ↿ | ↿ | | |

$3d^5$ 4

187. (c) Fe^{3+} ion will have five (maximum) unpaired electrons.

188. **(c) 5Maximum number of unpaired electrons in d-orbitals**

d-orbital: l = 2 → 5 orbitals → each can hold 1 or 2 electrons

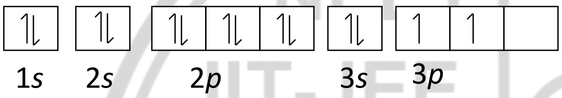
According to **Hund's rule**, maximum unpaired electrons occur when each orbital has **one electron** → 5 unpaired electrons

189. **(a) NO:** 15 total electrons → molecular orbital configuration → one unpaired electron

190. (c) Due to full filled *d*-orbital Cl^- has spherical symmetry.

191. (b) Atomic number 14 leaving 2 unpaired electron

$\mathbf{14Si = 1s^2 2s^2 2p^6 3s^2 3p^2}$



192. (a) Shell = *K*, *L*, *M* $= 1s^2\ 2s^2 2p^6\ 3s^2 3p^4$

Hence the number of *s* electron is 6 in that element.

193. (d) $C_6 = 1s^2, 2s^2 2p^2$ (Ground state)

$= \mathbf{1s^2 2s^1 2P_x^1 2p_y^1 2p_z^1}$ (Excited state)

In excited state no. of unpaired electron is 4.

194. (b) Max. no. of electrons in N-shell $(n = 4) = 2n^2 = 2 \times 4^2 = 32$.

195. (d) $26Fe = [Ar]3d^6, 4s^2$

$Fe^{2+} = [Ar]3d^6, 4s^0$

Number of *d*-electrons = 6

$17Cl = [Ne]3s^2, 3p^5$

$Cl^- = [Ne]3s^2, 3p^6$

Number of *p*-electrons = 6.

196. (a) Electrons in the atom $= 18 + 4 + 3 = 25$ *i.e.* $Z = 25$.

197. (c) The atomic number of bromine is 35 and the electronic configuration of Br is $Br_{35} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^2, 4p^5$

total electron present in *p*-orbitals of Br is –

$2p^6 + 3p^6 + 4p^5 = 17.$

198. (d) Fe^{2+}has $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^6$ configuration with 4 unpaired electron.

199. (b) $Fe^{2+}[Ar]3d^6 4s^0$

⥮	↿	↿	↿	↿

= 4

Fe^{2+}consist of maximum 4 unpaired electrons.

200. **(b) 10**

A **d-subshell** has **l = 2** → number of orbitals = 2l + 1 = 5

Each orbital can hold **2 electrons** → total electrons = 5 × 2 = 10

201. (a) $Fe^{3+}(z = 26)$

$\boldsymbol{Fe^{3+} = [Ar]3d^5 4s^0}$

↿	↿	↿	↿	↿		= 5
		3*d*			4*s*	

Total no. of unpaired electron=5

202. (b) $Co_{27} = [Ar]3d^7 4s^2$

$3d^7$

⥮	⥮	↿	↿	↿

3 unpaired electron are present in cobalt metal.

203. (b) According to Hund's rule, the pairing of electrons will not occur in any orbital of a subshell unit and unless, all the available of it have one electron each.

Electronic configuration of

$7N^{14} = 1s^2, 2s^2, 2p_x{}^1 2p_y{}^1 2p_z{}^1$

Hence it has 3 unpaired electron in 2*p*-orbital.

204. (c) $2s$orbital have minimum energy and generally electron filling increases order of energy according to the Aufbau's principle.

205. (d) According to Pauli's exclusion principle no two electrons in the same atom can have all the set of four quantum numbers identical.

206. (b) The second principal shell contains four orbitals *viz* $2s, 2p_x, 2p_y$ and $2p_z$.

207. (b) Follow Hund's multiplicity rules.

208. (c) According to the Aufbau's principle, electron will be first enters in those orbital which have least energy. So decreasing order of energy is $\mathbf{5p > 4d > 5s}$.

209. **(d) Same as that of 2p_z orbital**

All 2p orbitals (2p$_x$, 2p_y, 2p_z) in a free atom:

Have the **same principal quantum number (n = 2)** and **same azimuthal quantum number (l = 1)**

Therefore, they are **degenerate** → same energy in the absence of external fields

210. (b) No two electrons in an atom can have identical set of all the four quantum numbers.