Quantum number, Electronic configuration and Shape of orbitals

31. (d) The two electrons will have opposite spins.

32. **(a) Spherically symmetrical**

A **completely filled d-orbital (d^{10})** means all five d-orbitals have **2 electrons each**.

When all orbitals in a subshell are filled, the **electron cloud distribution becomes spherically symmetrical** because the directional effects of individual orbitals cancel out.

33. (c) If $m = -3$, then $l = 3$, for this value n must be 4.

34. (d) No. of electrons= $2n^2$hence no. of orbital $= \frac{2n^2}{2} = n^2$.

35. (d) No. of electrons= $2n^2$ hence no. of orbital $= \frac{2n^2}{2} = n^2$.

36. (c) If $n = 3$ then $l = 0$ to $n - 1$ & $m = -l$ to $+l$

37. (b) $Na_{11} = 2,8,1 = 1s^2, 2s^2 2p^6, 3s^1$
$n = 3, l = 0, m = 0, s = +1/2$

38. (b) 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.

39. (d) As a result of attraction, some energy is released. So at infinite distance from the nucleus energy of any electron will be maximum. For bringing electrons from ∞to the orbital of any atom some work has to be done be electrons hence it bill loose its energy for doing that work.

40. (c) This space is called nodal space where there is no possibility of oressene of electrons.

41. (d) For *s* orbital $l = 0\ m = 0$.

42. (c) For M^{th} shell, $n = 3$; so maximum no. of electrons in M^{th} shell $= 2n^2 = 2 \times 3^2 = 18$.

43. (c) $m = -l$ to $+l$ including zero.

44. (a) Number of radial nodes = (*n* – *l* – 1)
For 3*s*: *n* = 3, *l* = 0
(Number of radial node = 2)
For 2*p*: *n* =2, *l* = 1
(Number of radial node = 0)

45. (a) It consists only $s$orbital which is circular.

46. (a) 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.

47. (b) If value of *l* is 2 then $m = -2, -1, 0, +1, +2$. $m = -l$ to $+l$ including zero. (5 values of magnetic quantum number)

48. (c) *s, p, d* orbitals present in *Fe*
$\boldsymbol{Fe_{26} = 1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^2 3d^6}$

49. **(c) Double dumb-bell**

The **d-orbitals** have specific shapes. There are **five d-orbitals**: d_xy, d_yz, d_zx, d_x²–y², and d_z².

The **d_xy orbital**:
Lies **between the x and y axes** in the xy-plane
Has **four lobes** (like a cloverleaf)

50. (b) According to Aufbau rule.

51. (c) 3*d* 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.

52. (b) $K_{19} = 1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^1$

for $4s^1$electrons.

$n = 4, l = 0, m = 0$ and $s = +\frac{1}{2}$.

53. **(b) Azimuthal quantum number**

Angular momentum of an electron (orbital angular momentum) is given by the formula:

L=$\sqrt{\mathbf{l(l+1)}}\,\hbar$

where **l = azimuthal (orbital) quantum number**.

Principal quantum number (n) → determines energy level, not angular momentum

Magnetic quantum number (m$_l$) → determines orientation of angular momentum, not its magnitude

54. (b) 3*d* 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.

55. (c) It has 3 orbitals p_x, p_y, p_z.

56. **(c) 5**

d-subshell → **l = 2** (azimuthal quantum number)

Number of orbitals in a subshell = **2l + 1**

Number of orbitals=2(2)+1=5

57. (b) If $l = 2$ then it must be d orbital which can have 10 electrons.

58 **(b) Two electrons in the same atom cannot have the same spin**

Pauli's exclusion principle states:

No two electrons in the same atom can have the same set of all four quantum numbers.

In simpler terms: **each electron must be unique in terms of n, l, m_l, and s**.

This implies that **two electrons in the same orbital must have opposite spins**.

Looking at the options:

(a) → Not correct; same energy is allowed.

(b) → Correct in the sense that **electrons in the same orbital must have opposite spins**.

(c) → This is **Hund's rule**, not Pauli.

(d) → This is **Aufbau principle**, not Pauli.

59. (c) for d orbital $l = 2$.

60. (c) $m = -l$ to $+l$ including zero.