QUANTUM NUMBER

1. The correct electronic configuration and spin-only magnetic moment (BM) of Gd^{3+} (Z = 64), respectively, are

(1) $[Xe]5f^7$ and 8.9

(2) $[Xe]4f^7$ and 7.9

(3) $[Xe]5f^7$ and 7.9

(4) $[Xe]4f^7$ and 8.9

2. In the sixth period, the orbitals that are filled are

(1) 6s, 5f, 6d, 6p

(2) 6s, 6p, 6d, 6f

(3) 6s, 5d, 5f, 6p

(4) 6s, 4f, 5d, 6p

3. Consider the hypothetical situation where the azimuthal quantum number, *l*, takes values 0, 1, 2, ... n + 1, where n is the principal quantum number. Then, the element with atomic number :

(1) 13 has a half-filled valence subshell

(2) 9 is the first alkali metal

(3) 8 is the first noble gas

(4) 6 has a 2p-valence subshell

4. The number of subshells associated with n = 4 and m = –2 quantum numbers is :

(1) 4 (2) 8

(3) 16 (4) 2

SOLUTION

1. Official Ans. by NTA (2)

Sol. Electronic configuration of Gd^{3+} is

$_{64}Gd^{3+} = [Xe]4f^7$

[Xe] 1 1 1 1 1 1 1

Gd^{3+} having 7 unpaired electrons.

Magnetic moment (μ) = $\sqrt{n(n+2)}$B.M.

$\mu = \sqrt{7(7+2)}$B.M.

= 7.9 B.M.

n $\Rightarrow$ Number of unpaired electrons.

2. Official Ans. by NTA (4)

Sol. As per $(n + \ell)$ rule in 6th period, order of orbitals filling is 6s, 4f, 5d, 6p.

3. Official Ans. by NTA (1)

Official Ans. by ALLEN (2,3)

Sol. l = 0 to (n + 1)

n = 1	n = 2
l = 0, 1, 2	l = 0, 1, 2, 3

$(n + l) \Rightarrow \frac{1s}{1}\frac{1p}{2}\frac{1d}{3}$ $\quad\quad$ $\frac{2s}{2}\frac{2p}{3}\frac{2d}{4}\frac{2f}{5}$

n = 3

l = 0, 1, 2, 3, 4

$\frac{3s}{3}\frac{3p}{4}\frac{3d}{5}\frac{3f}{6}\frac{3g}{7}$

Now, in order to write electronic configuration, we need to apply $(n + l)$ rule

Energy order : 1s < 1p < 2s < 1d < 2p < 3s < 2d…

Option 1) 13 : $1s^2 1p^6 2s^2 1d^3$ is not half filled

Option 2) 9 : $1s^2 1p^6 2s^1$ is the first alkali metal because after losing one electron, it will achieve first noble gas configuration

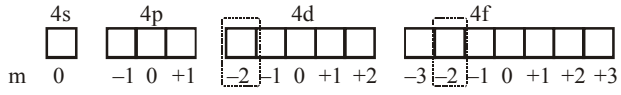
Option 3) 8 : $1s^2 1p^6$ is the first noble gas because after $1p^6$ e^- will enter 2s hence new period

Option 4) 6 : $1s^2$ $1p^4$ has 1p valence subshell.

4. Official Ans. by NTA (4)

Sol. For n = 4

ℓ = 0, 1, 2, 3



$\therefore$ 4d & 4f subshell associated with n = 4, m = –2