RACE # 4

1. Principal, azimuthal and magnetic quantum numbers are respectively related to

(A) size, shape and orientation ✓
(B) shape, size and orientation
(C) size, orientation and shape
(D) none of these

Principal quantum Number size of shell, Azimuthal shape of subshell, magnetic quantum number orientation of electron cloud or orbital

2. Which of the following sets of quantum numbers can be correct for an electron in 4f-orbital :

(A) $n = 4, \ell = 3, m = -2, s = 0$
(B) $n = 4, \ell = 3, m = +4, s = -\frac{1}{2}$ $|m| \le \ell$
(C) $n = 4, \ell = 3, m = +1, s = +\frac{1}{2}$ ✓
(D) $n = 4, \ell = 2, m = -1, s = +\frac{1}{2}$

$4f \to n = 4$, $\ell = 3$

3. S_1 : According to Bohr model, the angular momentum of revolving electron is directly proportional to the atomic number of H-like species bearing the electron.

S_2 : An orbital cannot accomodate more than 2 electrons.

S_3 : All orbitals have directional character. → s is non direction orbital

(A) FTF (B) TFF (C) FFT (D) TTF

Angular moment of e^- = $n\frac{h}{2\pi}$ that is proportional to n

· an orbital □ accomodate max -2 electrons

4. If an electron has spin quantum number of +1/2 and magnetic quantum number of –1 it cannot be present in :

(A) f-orbital (B) d-orbital (C) p-orbital (D) s-orbital

for s-orbital $l=0$, $m=0$, $s=+\frac{1}{2}$

5. When the quantum number n,*l*,m,s are represented by 3,3,2,+1/2, the symbolism for the electron is -

(A) 3s (B) 3d (C) 3f (D) Impossible set of quantum number

$n=3$, $l=3$ $m=2$, $l=+\frac{1}{2}$ $n>l$

6. For a 6s electron the values of n,*l*,m,s respectively could be:

(A) 6,4,4,+1/2 (B) 1,0,0,+1/2 (C) 6,1,0,+1/2 (D) 6,0,0, +1/2

for 6s → n = 6, → l = 0 , m = 0, $s = \pm\frac{1}{2}$

7. Any p-orbital can accomodate up to

(A) four electrons (B) Two electrons in parallel spin

(C) Six electrons (D) Two electrons with opposite spin

A p-orbital $\boxed{}$ Can accomodate max. 2 electrons of opposite spin

8. Which one of the following sets of quantum numbers (n,*l*,m,s) represents an impossible arrangement?

(A) 3,2,–2,+1/2 (B) 4,0,0,+1/2 (C) 3,2,–3,+1/2 (D) 5,3,0,–1/2

$|m| > l$ which is impossible

9. What type of orbital is designated n = 2, ℓ = 3, m_ℓ = –2 ?

(A) 4p (B) 4d (C) 4f (D) Impossible set of quantum number

for n = 3, l = 3 (not possible n > l)

10. The maximum number of electrons that can be accomodated in s, p and d-subshells respectively are :

(A) 2 in each (B) 1, 3 and 5 (C) 2, 6 and 10 (D) 2, 6 and 14

Maximum No of $\bar{e}$ = 4l+2

for s → l = 0, electrons = 2

for p → l = 1 electrons = 6

for d

l = 2

electrons = 10

11. Which of the following quantum numbers has not been derived from Schrodinger wave equation:

(A) Principal quantum number (n) (B) Subsidiary quantum number (l)

(C) Magnetic quantum number (m) (D) Spin quantum number (s)

12. The orbital angular momentum corresponding to n = 4 and m = –3 is :

(A) 0 (B) $\frac{h}{\sqrt{2}\pi}$ (C) $\frac{\sqrt{6}h}{2\pi}$ ✓(D) $\frac{\sqrt{3}h}{\pi}$

$n = 4,\ \underline{l = 3}$ orbital angular momentum $= \sqrt{l(l+1)}\frac{h}{2\pi}$

$= \sqrt{3(3+1)}\frac{h}{2\pi} = \sqrt{3\times4}\frac{h}{2\pi} = \frac{\sqrt{3}h}{\pi}$

13. Orbital angular momentum of an electron is $\sqrt{3}\frac{h}{\pi}$. Then, the number of orientations of this orbital in space are:

(A) 3 (B) 5 (C) 7 (D) 9

$\sqrt{3}\frac{h}{\pi} = \sqrt{l(l+1)}\frac{h}{2\pi}$

$l = 3$

No of orientation = orbitals

$= 2l+1$

$= 2\times3+1 = 7$

Electronic configurations

4. What is the maximum possible number of electrons in an atom with (n + l = 7) :

(A) 18 (B) 50 (C) 32 (D) 8

$n + l = 7$		orbital
$7 + 0$	$\rightarrow 6s$	1
$6 + 1$	$\rightarrow 6p$	3
$5 + 2$	$\rightarrow 5d$	5
$4 + 3$	$\rightarrow 4f$	7
		16

No of electrons = orbitals × 2 = 16 × 2 = 32

15. Consider the ground state of Cr (Z = 24). The numbers of electrons with the azimuthal quantum numbers $l = 1$ and 2 respectively are

(A) 16 and 4 (B) 12 and 5 (C) 12 and 4 (D) 16 and 5

$$Cr(24) = 1s^2,\ 2s^2,\ 2p^6,\ 3s^2,\ 3p^6,\ 3d^5,\ 4s^1$$

$$l = \quad 0 \quad 0 \quad 1 \quad 0 \quad 1 \quad 2 \quad 0$$

$$\underbrace{e^- = 6 \qquad e = 6}_{12} \qquad \underbrace{e^- = 5}_{5}$$

16. Degenerate atomic orbitals have

(A) Equal energy (B) Nearly equal energy (C) Different energy (D) None of the above

Degenerate orbitals have same energy

17. What is a possible set of quantum numbers for the unpaired electron in the orbital box diagram below ?

$[Ar]$ $\underbrace{\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}}_{3d}$ $\underbrace{\boxed{\uparrow\downarrow}}_{4s}$ $\underbrace{\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow}}_{4p}$

(A) $n = 1, \ell = 1, m_\ell = -1, m_s = +1/2$
(B) $n = 4, \ell = 1, m_\ell = -1, m_s = +1/2$
(C) $n = 4, \ell = 2, m_\ell = -2, m_s = +1/2$
(D) $n = 4, \ell = 0, m_\ell = 0, m_s = +1/2$

unpaired e^- is in 4p

$n=4, \ l=1, \ m = -1, 0, +1 \quad s = \pm\frac{1}{2}$

18. Which element has the following ground state electron configuration ?

[Ar] | ↑↓ | ↑↓ | ↑↓ | ↑↓ | ↑↓ | (3d) | ↑↓ | (4s) | ↑↓ | ↑ | ↑ | (4p)

$18 + 10 + 2 + 4 \longrightarrow 34$ for Se

~~(A)~~ Se ✓   (B) As   (C) S   (D) Ge

19. Hund's rule states that the most stable arrangement of electrons (for a ground state electron configuration)

(A) Has three electrons per orbital, each with identical spins

(B) Has m_ℓ values greater than or equal to +1

~~(C)~~ ✓ Has the maximum number of unpaired electrons, all with the same spin in degenerate orbital

(D) Has two electrons per orbital, each with opposing spins

theoratical to learn

20. How many maximum electrons can be described by the quantum numbers n = 5, ℓ = 2 in a particular atom?

(A) 2   (B) 6   ~~(C)~~ ✓ 10   (D) 14

$n = 5$, $\ell = 2$, $5d \longrightarrow$ max. $e^- = 10$

21. The total number of electrons in Cr atom for which m = 0

(A) 1 (B) 8 (C) 12 (D) 16

$Cr\,(24) = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^1$

$l = 0 \quad 0 \quad 1 \quad 0 \quad 1 \quad 2 \quad 0$

$m = 0 \quad 0 \quad -1, 0, +1 \quad 0 \quad -1, 0, +1 \quad -2, -1, 0, +1, +2 \quad 0$

orbital

electrons = 12

22. The Pauli exclusion principle states that

(A) no two electrons in an atom can have the same set of four quantum numbers

(B) electrons can have either ±1/2 spins

(C) electrons with opposing spins are attracted to each other

(D) no two electrons in an orbital can have the same spin

23. Which of the following statements regarding subshell filling order for a neutral atom is/are correct ?

(I) Electrons are assigned to the 4s subshell before they are assigned to the 3d subshell

(II) Electrons are assigned to the 4f subshell before they are assigned to the 6s subshell

(III) Electrons are assigned to the 4d subshell before they are assigned to the 5p subshell

(A) I only (B) II only ✓(C) I and III (D) I, II and III

(I) According to (n+l) 4s first filled then 3d

(II) According to (n+l) 6s first filled then 4f

iii) According to (n+l) 4d filled before 5p