# 11.QUANTUM NUMBERS

## SOLUTIONS

## TEACHING TASK

## JEE MAINS LEVEL QUESTIONS

1. Principal, azimuthal and magnetic quantum numbers are respectively related to :- **(FA & SA- 2 Marks)**

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

**Answer:B**

Solution:The quantum numbers are related to the following properties:

Principal quantum number (n) $\rightarrow$ Size of the orbital

Azimuthal quantum number (l) $\rightarrow$ Shape of the orbital

Magnetic quantum number (m) $\rightarrow$ Orientation of the orbital

2. The possible set of quantum no. for the unpaired electron of chlorine is : **(FA & SA- 3 Marks / 4 Marks)**

| | n | l | m | | n | l | m |
|---|---|---|---|---|---|---|---|
| A) | 2 | 1 | 0 | B) | 2 | 1 | 1 |
| C) | 3 | 1 | 1 | D) | 3 | 0 | 0 |

**Answer:C**

Solution:Chlorine (atomic number 17) has the electron configuration:

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

The unpaired electron is in the 3p subshell, so:

$n = 3$

$l = 1(p - orbital)$

$m = -1, 0, or +1$

3. The quantum numbers + 1/2 and – 1/2 for the electron spin represent -

A) Rotation of the electron in clockwise and anticlockwise direction respectively.
B) Rotation of the electron in anticlockwise and clockwise direction respectively.
C) Magnetic moment of the electron pointing up and down respectively,
D) Two quantum mechanical spin states which have no classical analogue.

**Answer:A**

Solution:

The clock wise(↑) direction spin is represented by $+\frac{1}{2}$ and

anticlock wise(↓) direction spin is represented by $-\frac{1}{2}$

4. The correct set of four quantum numbers for the valence electron of Rubidium (Z = 37) is **(FA & SA- 5 Marks / 8 Marks)**

A) n = 5, l = 0, m = 0, s = + $\frac{1}{2}$ B) n = 5, l = 1, m = 0, s = + $\frac{1}{2}$

C) n = 5, l = 1, m = 1, s = + $\frac{1}{2}$ D) n = 6, l = 0, m = 0, s = + $\frac{1}{2}$

**Answer:A**

Solution:Electronic configuration of Rubidium (Z = 37)

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$

For $5s^1$: n=5, l=0 (s orbital),m=0, s=+ 1/2 or-1/2

5. Number of electron having the quantum numbers n = 4, l = 0, s = $-\frac{1}{2}$ in $Zn^{+2}$ ion is/are :

A) 1 B) 0 C) 2 D) 5

**Answer:B**

Solution: Zn atom (Z = 30) electronic configuration

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

$Zn^{2+}$ ion: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$

n=4,l=0 means 4s orbital.

In $Zn^{2+}$, 4s orbital is empty (both 4s electrons removed).

So there are 0 electrons with n = 4, l = 0, s = $-\frac{1}{2}$

6. The maximum number of electrons in a shell with principal quantum number n=3 is:

A) 9 B) 18 C) 32 D) 2

**Answer:B**

Solution:The maximum number of electrons in a shell with principal quantum number n=3 is calculated using the formula:

Maximum electrons=$2n^2$

Substituting n=3:

$2\times3^2 = 2\times9 = 18$

7. The number of orbitals associated with the quantum numbers n=4,l=2 is:

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

**Answer:B**

Solution:The number of orbitals for quantum numbers n=4, l=2 depends only on the

azimuthal quantum number l. The number of orbitals is given by:
Number of orbitals=2l+1
Substituting l=2: 2×2+1=5

8. An electron is in the orbital defined by n=3,l=1,m=-1. Which one of the following is correct?
A) It is a 3d orbital oriented along z-axis.
B) It is a 3p orbital oriented along x or y axis.
C) It is a 3s orbital.
D) It is a 2p orbital.

**Answer:B**

Solution:For n=3,l=1,m=-1, the orbital is 3p.
Since m=-1, it is oriented along the x or y axis

9. What is the total number of orbitals having quantum numbers n=4 and l=1?
A) 1 B) 3 C) 5 D)10

**Answer:B**

Solution:n=4 and l=1:
The possible m values are –1, 0, +1 $\rightarrow$ 3 orbitals

10. Which of the following is incorrect about *l* value If n = 3 ?
A) 0 B) 1 C) 2 D) 3

**Answer:D**

Solution:For a given principal quantum number n, the azimuthal quantum number l can take integer values from 0 to n-1.
Given n=3, the allowed values of l are:
l=0 , l=1, l=2
The value l=3 is not allowed because l must be less than n.

## JEE ADVANCED LEVEL QUESTIONS

**Multi correct answer type:**

11. Which of the following statement(s) is (are) correct?
A) The electronic configuration of Cr is [Ar] $(3d)^5$ $(4s)^1$. (Atomic number of Cr = 24)
B) The magnetic quantum number may have positive values.
C) In silver atom, 21 electrons have a spin of one type and 26 of the opposite type. (Atomic number of Ag = 47)
D) None of these

**Answer:A,B**

Solution:- A) Cr = 24 = [Ar] $3d^5 4s^1$.
For extra stability chromium filled 3d

B). Magnetic quantum number ranges from $-l$ to $+l$. So +ve values present.

c). [Ag] = 47.
24 electron with spin $+\frac{1}{2}$
23 electron with spin $-\frac{1}{2}$

12. Which of the following information is correct about magnetic quantum number?
A) It gives the number of permitted orientation of subshells.
B) It tells about the zeeman effect.
C) It is denoted by the letter 'm'
D) None of the above

**Answer:A,B,C**

Solution:A) It gives the number of permitted orientations of orbitals in a subshell — yes (2l+1 values).
B) It tells about the Zeeman effect — yes (splitting in magnetic field depends on m).
C) It is denoted by the letter 'm' — yes.

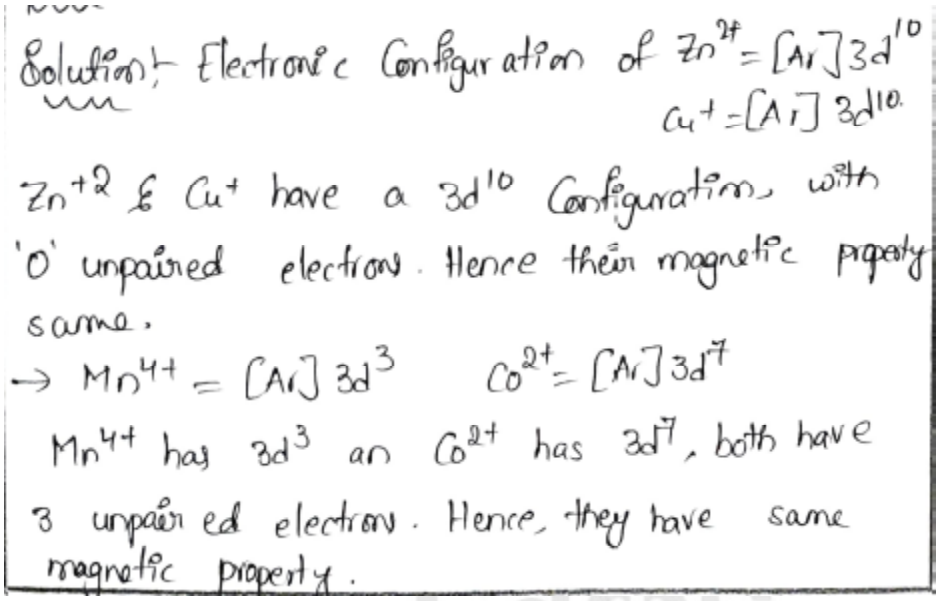
13. Which of the following statements is/are correct for an electron of quantum numbers n = 4 and m = 2?
A) The value of l may be 2. B) The value of l may be 3.
C) The value of s may be +1/2. D) The value of l may be 0, 1, 2, 3.

**Answer:A,B,C**

Solution:- $n = 4$, $m = 2$
Value of $l = 0$ to $(n-1)$ but $m = 2$
$\therefore l = 2$ & 3 only.
Value of s may be $+\frac{1}{2}$ & $-\frac{1}{2}$

14. In which of these options do both constituents of the pair have the same spin magnetic moment?
A) $Zn^{2+}$ and $Cu^{+}$ B) $Co^{2+}$ and $Ni^{2+}$ C) $Mn^{4+}$ and $Co^{2+}$ D) $Mg^{2+}$ and $Sc^{+}$

**Answer:A,C**




**Statement Type:**

A) Both statement I and II are correct and statement II is correct explanation of statement I.
B) Both statement I and II are correct and statement II is not correct explanation of statement I.
C) Statement I is correct and statement II is incorrect.
D) Statement I is incorrect and statement II is correct.

15. **Statement I** : For n = 3, $\ell$ may be 0, 1 and 2 and 'm' may be 0, ± 1 and ± 2.
**Statement II** : For each value of n, there are 0 to (n – 1) possible values of $\ell$; for each value of $\ell$, there are 0 to $\pm\ell$ values of m.

**Answer:A**
Solution:

For $n = 3$, $\ell = 0, 1, 2 \rightarrow$ (correct)

For each $\ell$:

$\ell = 0 \rightarrow m = 0$

$\ell = 1 \rightarrow m = -1, 0, +1$

$\ell = 2 \rightarrow m = -2, -1, 0, +1, +2$

So the possible $m$values are $0, \pm 1, \pm 2$

16. **Statement I** : Magnetic quantum number gives the orientation of the orbital.
**Statement II** : Magnetic quantum number is denoted by 'm'.

**Answer:A**

Solution:Magnetic quantum number indeed gives orientation of the orbital in space It is denoted by m (or $m_l$ specifically).

**Comprehension Type:**

Quantum numbers are a set of four numbers that describe the position, energy, shape, and spin of an electron in an atom.
The Four quantum numbers are:
1.Principal quantum number (n)
2.Azimuthal (angular momentum) quantum number (l)
3.Magnetic quantum number (m)
4.Spin quantum number (s)

17. Which of the following is not a quantum number?
A) Principal quantum number (n) B) Azimuthal quantum number (l)
C) Magnetic quantum number (m) D) Atomic number (Z)

**Answer:D**

Solution:Quantum numbers in atomic physics are:
Principal quantum number (n)
Azimuthal quantum number (l)
Magnetic quantum number ($m_l$)
Spin quantum number (s or $m_s$)
Atomic number (Z) is not a quantum number — it's the number of protons in the nucleus.

18. The spin quantum number (s) describes:
A) Energy of orbit B) Shape of orbital
C) Orientation of orbital D) Direction of electron spin

**Answer:D**

Solution:The spin quantum number ($m_s$) describes the intrinsic spin orientation of the electron ($+\frac{1}{2} or -\frac{1}{2}$), i.e., the direction of electron spin.

**Integer type:**

19. What is the maximum number of electrons possible in the shell with n=3?

**Answer:18**

Solution:The maximum number of electrons in a shell is given by $2n^2$ .
For n=3, $2\times 3^2 = 2\times 9 = 18$

20. How many orbitals are present in the subshell with l=2?

**Answer:5**

Solution:For a given l, the number of orbitals is 2l+1.

For l=2: $2\times 2+1=4+1=5$

**Matrix Matching Type:**

21. **Column-I** **Column-II**

| | |
|---|---|
| a) Principal Quantum Number | A) shape of orbitals |
| b) Azimuthal Quantum Number | B) size and energy of the orbit |
| c) Magnetic Quantum Number | C) m - space orientations |
| d) Spin Quantum Number | D) spin of an electron |

**Answer:a-B,b-A,c-C,d-D**

Solution:

| | |
|---|---|
| a) Principal Quantum Number | B) size and energy of the orbit |
| b) Azimuthal Quantum Number | A) shape of orbitals |
| c) Magnetic Quantum Number | C) m - space orientations |
| d) Spin Quantum Number | D) spin of an electron |

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## ----LEARNERS TASK

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## CONCEPTUAL UNDERSTANDING QUESTIONS ( CUQ's )

1. The quantum number which cannot say any thing about an orbital is

A)n B)l C) m D) s

**Answer:D**

Solution: The quantum numbers that describe an orbital are the principal quantum number (n), the azimuthal quantum number (l), and the magnetic quantum number (m). These define the energy, shape, and orientation of the orbital, respectively. The spin quantum number (s) describes the intrinsic spin of an electron and does not provide any information about the orbital itself. Therefore, the spin quantum number (s) cannot say anything about an orbital.

2. An impossible set of four quantum number of an electron is

A) n = 4, l = 2, m = -2, s = + 1/2 B) n = 4,l = 0, m = 0, s = +1/2

C) n = 3, l = 2, m = -3, s = + 1/2 D) n = 5, l = 3, m = 0, s = - 1/2

**Answer:C**

Solution:For a valid set of quantum numbers:

l ranges from 0 to n-1

m ranges from -l to +l

$s = \pm\frac{1}{2}$

Check each option:

A) n=4, l=2, m=-2, s=+½ $\rightarrow$ valid

B) n=4, l=0, m=0, s=+½ $\rightarrow$ valid

C) n=3, l=2, m=-3, s=+½ $\rightarrow$ invalid (since ( m ) can only be –2 to +2)

D) n=5, l=3, m=0, s=-½ ) $\rightarrow$ valid

3. The direction of spin of an electron is represented by
   A) n B) l C) m D) s

**Answer:D**

Solution:The direction of spin of an electron is represented by the spin quantum number (s).

4. The electrons occupying the same orbital have the same values for all the quantum number except for
   A) n B) l C) m D) s

**Answer:D**

Solution:Electrons in the same orbital share the same n, l, and m quantum numbers, but differ in their spin quantum number (s).

5. The magnetic quantum number for the outermost electron in sodium atom is
   A) -2 B) 0 C) +1 D) -1

**Answer:B**

Solution:The electron configuration of sodium (Z = 11) is:$1s^2\ 2s^2\ 2p6\ 3s^1$
The outermost electron is in the 3s orbital. For an s orbital (l=0), the magnetic quantum number m=0.

6. The azimuthal quantum number and the principal quantum number of the 17th electron are
   A) $\ell$ = 1, n = 3 B) $\ell$ = 3, n = 2 C) $\ell$ = 2, n = 3 D) $\ell$ = 2, n = 1

**Answer:A**

Solution:Electronic configuration =$1s^2\ 2s^2\ 2p6\ 3s^2\ 3p^5$ $\rightarrow$that's 17 electrons (for chlorine).
The 17th electron is in 3p orbital.
So, n=3 and l=1 (for p-orbital)

7. The quantum numbers n = 3, l = 1, m = +1 and s = +1/2 represent the unpaired electron present in
   A) Sodium atom B) Aluminium atom
   C) Fluorine atom D) Potassium atom

**Answer:B**

Solution:Given: ( n = 3, l = 1, m = +1, s = +1/2 )
n = 3 $\rightarrow$ 3rd shell
l = 1 $\rightarrow$p-orbital $\rightarrow$ 3p
So, it's a 3p electron (unpaired).
Now check elements with an unpaired 3p electron:
Na: $1s^2\ 2s^2\ 2p^6\ 3s^1$ $\rightarrow$ 3s electron
Al: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ $\rightarrow$ one unpaired 3p electron $\rightarrow$Correct
F: $2p^5$ electron
K: $4s^1$ electron

8. In order to designate an orbital in an atom the no. of quantum no. required

A) One B) Two C) Three D) Four

**Answer:C**

Solution:To designate (identify) an orbital, we need three quantum numbers:n,l,m

9. A 3d electron having s = + 1/2 can have a magnetic quantum number

A) + 2 B) + 3 C) - 3 D) - 4

**Answer:A**

Solution:For a 3d electronn=3,l=2.

Possible m values = –2, –1, 0, +1, +2.

So, an electron with s=+½ can have m=+2

10. The quantum number which determines the orientation of electron orbit is

A) n B) l C) m D) s

**Answer:C**

Solution:The quantum number that determines the orientation of the electron orbit is the magnetic quantum number, m.

## JEE MAINS LEVEL QUESTIONS

1. For an electron with quantum numbers n=3,l=2,m=-2, the orbital corresponds to : **(FA & SA- 2 Marks)**

A) 3s B) 3p C) 3d D) 4P

**Answer:C**

Solution:Given quantum numbers:

n = 3 $\rightarrow$ Principal quantum number $\rightarrow$ 3rd shell

l = 2 $\rightarrow$ Azimuthal quantum number $\rightarrow$ d-subshell

m = –2 $\rightarrow$ One of the orientations of the d-orbitals

Hence, the orbital corresponds to 3d

2. Which of the following set a of quantum numbers is correct for an electron in 4f orbital?

**[AIEEE 2004]**

A) n = 4, l =3, m = +4, s = +1/2 B) n = 4, l = 4, m = –4, s = –1/2

C) n = 4, l = 3, m = +1, s = +1/2 D) n = 3, l=2, m =–2, s = +1/2

**Answer:C**

Solution:For an f-orbital, the azimuthal quantum number ( l = 3 ).

The magnetic quantum number ( m ) can range from –3 to +3.

The principal quantum number for a 4f orbital is ( n = 4 ).

Now check the options:

A) m = +4 $\rightarrow$ (invalid, since m can't be +4)

B) l = 4 $\rightarrow$ (invalid, for f, l must be 3)

C) n = 4, l = 3, m = +1, s = +½ ) $\rightarrow$ (all valid)

D) n = 3, l = 2 $\rightarrow$ (that's a 3d orbital, not 4f)

3. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, l = 1 and 2 are, respectively **[AIEEE 2004]**

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

**Answer:B**

Solution:The ground state electron configuration of chromium is:

$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$

For l=1 (p orbitals): $2p^6$ : 6 electrons, $3p^6$ : 6 electrons

Total: 6+6=12 electrons

For l=2 (d orbitals): $3d^5$: 5 electrons

Total: 5 electrons

4. In a multi-electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric field ? **[AIEEE 2005]**

(i) n = 1, l = 0, m = 0 (ii) n =2, l = 0, m = 0 (iii) n = 2, l = 1, m = 1

(iv) n = 3, l = 2, m =1 (v) n = 3, l = 2, m = 0

A) (iv) and (v) B) (iii) and (iv) C) (ii) and (iii) D) (i) and (ii)

**Answer:A**

Solution:In a multi-electron atom (no external fields) energy depends on n and l (and not on m).

Orbitals with the same n and l are degenerate.

Pairs given: (iv) and (v) are both n = 3, l = 2 $\rightarrow$ same energy

5. Which of the following set of quantum numbers represents the highest energy of an atom ? **[AIEEE 2008]** **(FA & SA- 5 Marks / 8 Marks)**

A) n = 3, l = 0, m = 0, s = + $\frac{1}{2}$ B) n = 3, l = 1, m =1, s = + $\frac{1}{2}$

C) n = 3, l = 2, m = 1, s = + $\frac{1}{2}$ D) n = 4, l = 0, m = 0, s = + $\frac{1}{2}$

**Answer:C**

Solution:- n+l Value high means it has higher energy level.

c) n = 3, l = 2, m = 1, S = $+\frac{1}{2}$

n+l = 3+2 = 5 [High energy].

6. The electrons identified by quantum numbers n and $\ell$ : **[AIEEE 2012]**

A) n = 4, $\ell$ = 1 B) n = 4, $\ell$ = 0 C) n = 3, $\ell$ = 2 D) n = 3, $\ell$ = 1

can be placed in order of increasing energy as :

A) (C) < (D) < (B) < (A) B) (D) < (B) < (C) < (A)

C) (B) < (D) < (A) < (C) D) (A) < (C) < (B) < (D

**Answer:B**

Solution:The energy of an electron in an atom is determined by the Aufbau principle, which follows the order: 1s<2s<2p<3s<3p<4s<3d<4p<...
We are given four electron configurations:

A: n=4,l=1 $\rightarrow$ 4p orbital

B: n=4,l=0 $\rightarrow$ 4s orbital

C: n=3,l=2 $\rightarrow$ 3d orbital

D: n=3,l=1 $\rightarrow$ 3p orbital
Using the Aufbau order:
3p (D) has the lowest energy.

Next is 4s (B).

Then 3d (C).

Finally 4p (A) has the highest energy.

So the increasing energy order is: (D)<(B)<(C)<(A)

or

A) $n=4, l=1 \rightarrow n+l=5$.
B) $n=4, l=0 \rightarrow n+l=4$.
C) $n=3, l=2 \rightarrow 3+2=5$
D) $n=3, l=1 \rightarrow n+l=4$.
$D < B < C < A$

7. The correct set of four quantum numbers for the valence elections of rubidium atom (Z = 37) is : **[JEE MAIN 2014]**

A) 5, 1, 1, + $\frac{1}{2}$ B) 5, 0, 1, + $\frac{1}{2}$ C) 5, 0, 0, + $\frac{1}{2}$ D) 5, 1, 0, + $\frac{1}{2}$

**Answer:C**

Solution:Electronic configuration of Rubidium (Z = 37)

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$

For $5s^1$: n=5, l=0 (s orbital),m=0, s=+ 1/2 or -1/2

8. A principal quantum number of an atom is related to the
A) size of the orbital B) spin angular momentum
C) orbital angular momenum D) orietation of the orbital in space

**Answer:A**

Solution:The principal quantum number (n) is associated with the size and energy of an orbital.

9. Which set of quantum number represents permissible values?

A) n = 3, $l$ = 1, m = 1, s = +1/2 B) n = 3, $l$ = 1, m = 4, s = +1

C) n = 3, $l$ = 2, m = 4, s = +1/2 D) n = 1, $l$ = –1, m = –1, s = –1/2

**Answer:A**

Solution:Rules:n=1,2,3,...

l=0 to n-1

m=-l to +l

s=+1/2or -1/2

A)n=3,l=1,m=1,s=+½ $\rightarrow$ All valid

B)s=+1 $\rightarrow$ (spin must be ±½)

C) m=4 $\rightarrow$ (for l=2, m ranges from –2 to +2)

D) l=–1 $\rightarrow$ (l cannot be negative)

10. A neutral atom of an element has two 'K' eight 'L' nine 'M' and two 'N' electrons. The total numbers of electrons present in the orbitals having I value 1 are

**(FA & SA- 3 Marks / 4 Marks)**

A)6 B)8 C) 10 D) 12

**Answer:D**

Solution:Electonic configuration(Z=21)= $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$

l=0 means p orbital

$2p^6 \rightarrow 6$ Electrons

$3p^6 \rightarrow 6$ Electrons

Total=6+6=12 Electrons

## JEE ADVANCED LEVEL QUESTIONS

**Multi correct answer type:**

11. Which of the following sets of quantum number is/are correct ?

A) n = 3, l = 3, m = 0, s = $\frac{1}{2}$ B) n = 3, l = 2, m = 2, s = $-\frac{1}{2}$

C) n = 3, l = 1, m = 2, s = $-\frac{1}{2}$ D) n = 3, l = 0, m = 0, s = $+\frac{1}{2}$

**Answer:B,D**

Soluton:

A) $n=3,\ l=3,\ m=0,\ s=\frac{1}{2}$.

For $n=3$ $l$ values 0, 1, 2

$n \neq l$.

B) $n=3,\ l=2,\ m=2,\ s=\frac{1}{2}$.

For $n$, $l$ values 0 to $n-1$ } Possible.

For $l$, $m$ values $-l$ to $+l$ }

C) $n=3,\ l=1,\ m=2,\ s=\frac{1}{2}$ } not possible

For $l=1$, $m$ values $-1, 0, +1$ }

D) $n=3,\ l=0,\ m=0,\ s=+\frac{1}{2}$ } possible.

For $l=0,\ m=0$ }

**Statement Type:**

A) Both statement I and II are correct and statement II is correct explanation of statement I.

B) Both statement I and II are correct and statement II is not correct explanation of statement I.

C) Statement I is correct and statement II is incorrect.

D) Statement I is incorrect and statement II is correct.

12. **Statement I** : Magnetic quantum number gives the orientation of the orbital.
**Statement II** : Magnetic quantum number is denoted by 'm'.

**Answer:A**

Solution:Magnetic quantum number indeed gives orientation of the orbital in space It is denoted by m (or $m_l$ specifically).

13. **Statement I** : Magnetic quamtum number was proposed by Lande.
**Statement II** : The number of degenerate orbitals of s - subshel l = 0

**Answer:C**

Solution:

Statement I: The magnetic quantum number $m_l$, which describes the orientation of orbitals in space and helps explain the Zeeman effect, was proposed by Alfred Landé.

Statement II: The number of degenerate orbitals in a subshell is given by the formula (2l+1) (where l is the azimuthal quantum number). For an s-subshell, the value of l is 0.

Therefore, the number of orbitals is 2(0)+1=1. All orbitals within a subshell are

degenerate in the absence of an external magnetic field. Thus, there is one degenerate orbital for an s-subshell, not zero

**Comprehension Type:**

Following table gives the information about the quantum numbers and it values.

| Number of sub level | $l$ - value | No. of orientation in space ($2l + 1$) | m - value |
|---|---|---|---|
| s – sub level | $l = 0$ | $2 \times 0 + 1 = 1$ | 0 |
| p – sub level | $l = 1$ | $2 \times 1 + 1 = 3$ | -1, 0, +1 |
| d – sub level | $l = 2$ | $2 \times 2 + 1 = 5$ | -2, -1, 0, +1, +2 |
| f – sub level | $l = 3$ | $2 \times 3 + 1 = 7$ | -3, -2, -1, 0, +1, +2, +3 |

14. Beryllium fourth electron will have the four quantum numbers

| S.No | *n* | *l* | *m* | *s* |
|---|---|---|---|---|
| 1) | 1 | 0 | 0 | 0.5 |
| 2) | 1 | 1 | 1 | 0.5 |
| 3) | 2 | 1 | 0 | 0.5 |
| 4) | 2 | 0 | 0 | –1/2 |

**Answer:D**

Solution:- Be = $1s^2\ 2s^2$

For fourth electron,

$n = 2$

$l = 0$

$m = 0$

$s = -\frac{1}{2}$

15. Which of the following represents the correct set of four quantum number of a 4d electron?

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

**Answer:D**

Solution:

Solution:- Quantum Numbers for 4d.

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

D):- $n=4$, $l=2$, $m=1$, $s=+1/2$ is possible.

**Integer type:**

16. In F (Fluorine), the number of electrons with l=1 is_____

**Answer:5**

Solution:Fluorine (Z=9): electron configuration $1s^2 2s^2 2p^5$.

l=0 → s orbitals

l=1 → p orbitals

Electrons in $2p^5$ : all 5 electrons have l=1.

No other electrons have l=1.

17. The maximum number of electrons that can have quantum numbers n = 4 and $m_l$ = 0 is_____

**Answer:8**

Solution:Let's find all possible l values for n = 4:

l = 0, 1, 2, 3 → (s, p, d, f)

For each l, if $m_l$ = 0 is possible, each orbital can hold 2 electrons (one with +½ and one with −½ spin).

| l | subshell | $m_l$ possible | electrons |
|---|---|---|---|
| 0 | 4s | yes ($m_l$ = 0) | 2 |
| 1 | 4p | yes ($m_l$ = 0) | 2 |
| 2 | 4d | yes ($m_l$ = 0) | 2 |
| 3 | 4f | yes ($m_l$ = 0) | 2 |

Total = 2 + 2 + 2 + 2 = 8 electrons

**Matrix Matching Type:**

18.

| Column I (Subshell) | | Column II (Orbitals and electrons) |
|---|---|---|
| a) s–subshell | ( ) | A) 3 orbitals, maximum 6 electrons |
| b) p–subshell | ( ) | B) 1 orbital, maximum 2 electrons |
| c) d–subshell | ( ) | C) 5 orbitals, maximum 10 electrons |
| d) f–subshell | ( ) | D) 7 orbitals, maximum 14 electrons |

**Answer:a-B,c-A,c-C,d-D**

Solution:

| | |
|---|---|
| a) s–subshell | B) 1 orbital, maximum 2 electrons |
| b) p–subshell | A) 3 orbitals, maximum 6 electrons |
| c) d–subshell | C) 5 orbitals, maximum 10 electrons |
| d) f–subshell | D) 7 orbitals, maximum 14 electrons |

19.

| Column I | | Column II |
|---|---|---|
| A) n = 4, $\ell = 2$, m = 0 | ( ) | A) $4dz^2$ |
| B) n = 3, $\ell = 1, m = \pm 1$ | ( ) | B) $3p_x$(or) 3py |
| C) n = 4, $\ell = 0$, m = 0 | ( ) | C) 4s |
| D) n = 3, $\ell = 2, m = \pm 2$ | ( ) | D) $3d_{xy}$ |

**Answer:A-A,B-B,C-C,D-D**

Solution:

| | |
|---|---|
| A) n = 4, $\ell = 2$, m = 0 | A) $4dz^2$ |
| B) n = 3, $\ell = 1, m = \pm 1$ | B) $3p_x$(or) 3py |
| C) n = 4, $\ell = 0$, m = 0 | C) 4s |
| D) n = 3, $\ell = 2, m = \pm 2$ | D) $3d_{xy}$ |

# KEY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | TEACHING TASK | | | | | |
| | | | JEE MAINS LEVEL QUESTIONS | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| B | C | A | A | B | B | B | B | B | D |
| | | | JEE ADVANCED LEVEL QUESTIONS | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| A,B | A,B,C | A,B,C | A,C | A | A | D | D | 18 | 5 |
| 21-a-B,b-A,c-C,d-D | | | | | | | | | |
| | | | | LEARNERS TASK | | | | | |
| | | | CONCEPTUAL UNDERSTANDING QUESTIONS ( CUQ's ) | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| D | C | D | D | B | A | B | C | A | C |
| | | | JEE MAINS LEVEL QUESTIONS | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| C | C | B | A | C | B | C | A | A | D |
| | | | JEE ADVANCED LEVEL QUESTIONS | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| B,D | A | C | D | D | 5 | 8 | a-B,c-A,c-C,d-D | | |
| 19 | | | | | | | | | |
| A-A,B-B,C-C,D-D | | | | | | | | | |