ARJUNA NEET BATCH

BY : DOLLY SHARMA

Structure of Atom

LECTURE - 12

Quick Recap

③ Magnetic Q. No. (m) ⇒ $-l$ to $+l$

SAM ⇒ $\sqrt{s(s+1)}\,\frac{h}{2\pi}$

⇒ orientation of $e^{\ominus}$ in subshell

⇒

④ Spin Qu. No (s) $+\frac{1}{2}$ or $-\frac{1}{2}$

⇒ S.M = $2S+1$

$S = \frac{n}{2}$ n ⇒ no. of unpaired $e^{\ominus}$

1st

2nd

3rd → 8

→ 18

1

5

⇒ E.C.

① P

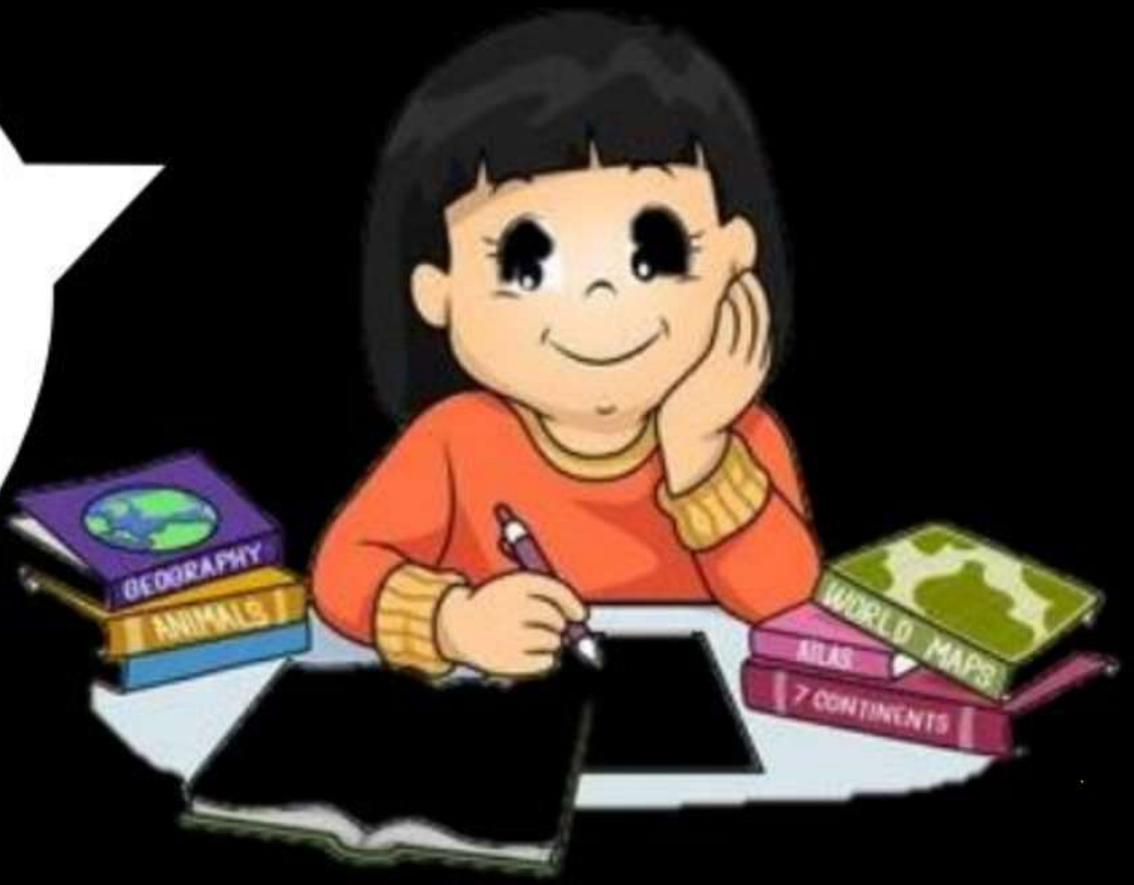
② A.

③ M

Objective of today's class

SHAPES OF SUBSHELLS, PREVIOUS YEAR QUESTIONS

Are u ready for the Homework



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Q. In the ground state, an element has 13 $e^{\ominus}$ in its M shell. The element is

(a) Mn
(b) Co
(c) Ni
(d) Fe

$\Rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$

At no $\rightarrow$ 25

1 H

2 He

3 Li

4 Be

5 B

6 C

7 N

8 O

9 F

10 Ne

11 Na

12 Mg

13 Al

14 Si

15 P

16 S

17 Cl

18 Ar

19 K

20 Ca

शक २१ Sc

22 Ti तीन

23 V वान

24 Cr क्रोम

25 Mn मना

26 Fe फिर

27 Co कोबो

28 Ni निकल

29 Cu Copper

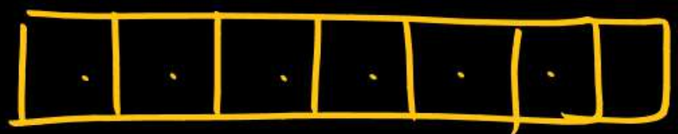
30 Zn. Zn.

Q. For principal quantum no(n = 5). The total no. of orbital having $l = 3$.

(a) 7
(b) 14
(c) 9
(d) 18

$n = 5$
$l = 3$

$\Rightarrow nl \Rightarrow 5f \rightarrow (2l+1) \rightarrow$ no. of orbitals



$2(3)+1 = 7$

NODE :- 3-D space around the nucleus where probability of finding $e^{\ominus}$ is zero is known as **NODE**.

- Spherical / Radial ⇒ $n - l - 1$
- Angular (l) (l)
- Total node ⇒ $n - l - 1 + l$ ⇒ $n - 1$

n ⇒ shell no.

l ⇒ Azimuthal Q. no.

Q. Radial nodes present in 3s & 3p

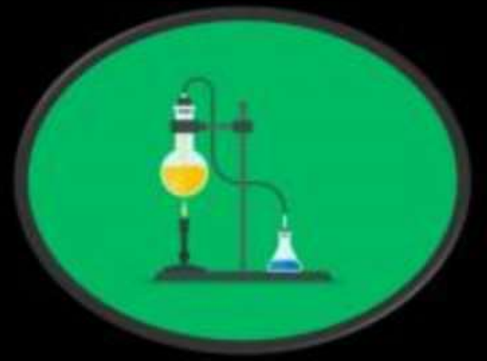
(a) 0,2 (b) 2,1

(c) 1,1 (d) 2,2

Radial node ⇒ $n-l-1$

3S ⇒ $3-0-1$ ⇒ (2)

3P ⇒ $3-1-1$ ⇒ (1)



Q. In an atom which has 2K, 8L, 18M & 2N $e^{\ominus}$ in the ground state. The total no of $e^{\ominus}$ having magnetic quantum no. (m = 0) is

(a) 6 (b) 10

(c) 7 (d) 14

no. of $e^{\ominus}$ ⇒ 2K, 8L, 18M & 2N $e^{\ominus}$

1st shell, 2nd shell, 3rd shell, 4th shell

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

m = 0, −1, 0, +1, 0, −1, 0, +1, −2, −1, 0, +1, +2, 0

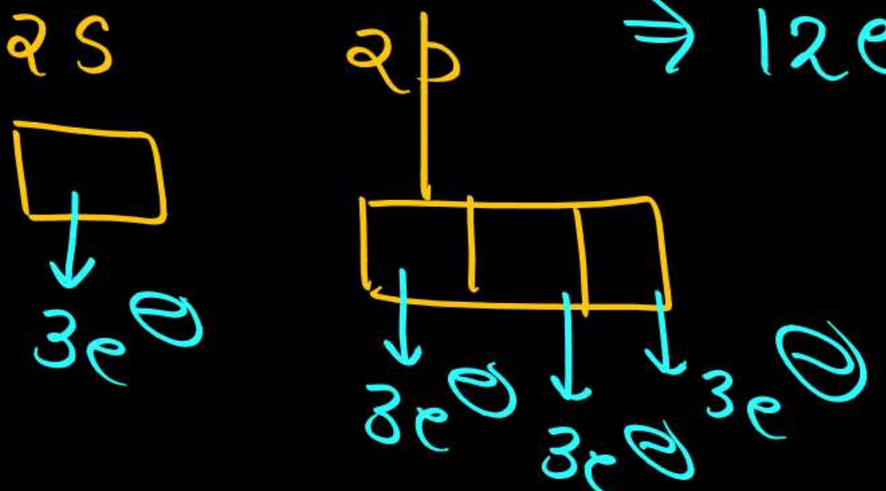
Q. If each orbital can hold maximum of $3e^{\ominus}$ the no. of elements in 2nd period of periodic table.

(a) 27 (b) 8

(c) 18 (d) 12

No. of elements in a period = no. of $e^{\ominus}$s.

2^{nd} Period $\Rightarrow$



$\Rightarrow 12e^{\ominus} \rightarrow$ 12 elements

Q. Isoelectronic species are-

(a) CO, CN^-, NO^+, C_2^{2-}

(b) CO^-, CN, NO, C_2^{2-}

(c) CO^+, CN^+, NO^-, C_2

(d) CO, CN, NO, C_2

Isoelectronic species ⇒ Species having similar no. of $e^\ominus$s.

$CO \rightarrow 6+8 \Rightarrow 14e^\ominus$

$CN^- \rightarrow 6+7+1 \Rightarrow 14e^\ominus$

$NO^+ \rightarrow 7+8-1 \Rightarrow 14e^\ominus$

$C_2^{2-} \rightarrow 6\times2+2 \Rightarrow 14e^\ominus$

$\therefore$

Q. Find the total no. of $e^{\ominus}$ is chromium(24) having

(i) $n = 3$ ⟶ $13\,e^{\ominus}$

(ii) $n = 3$ $l = 2$ ⟶ $nl \Rightarrow 3d \Rightarrow 5\,e^{\ominus}$

(iii) $m = 0$ ⟶ $12\,e^{\ominus}$

Exception

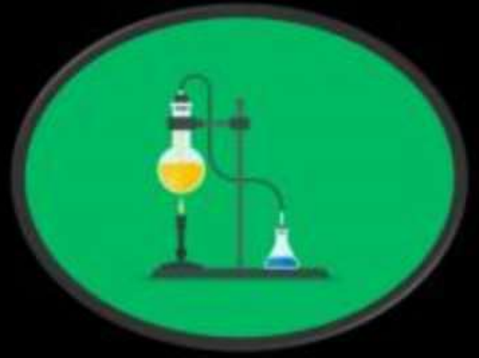
$_{24}Cr \Rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^4$ (Incorrect)

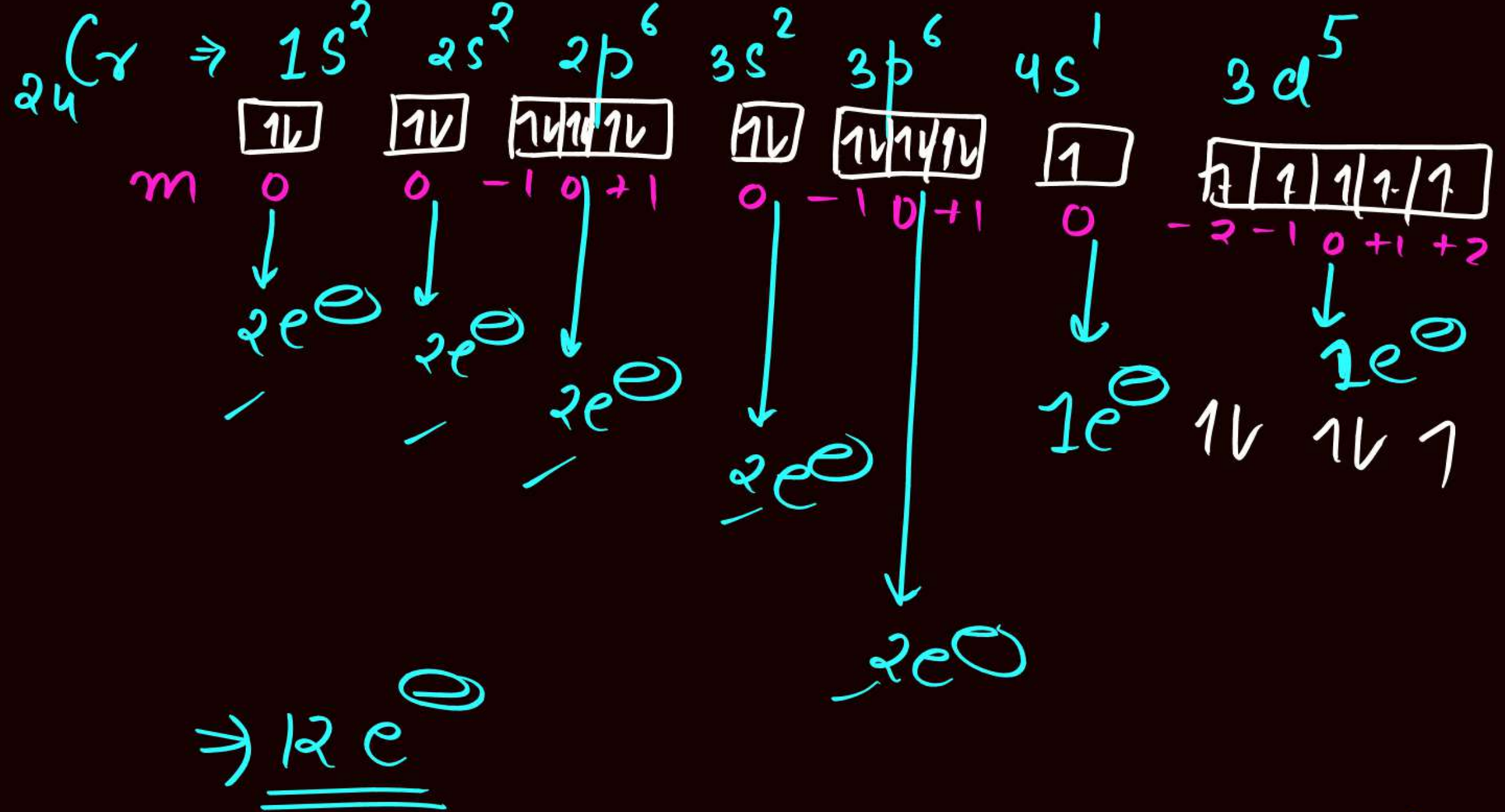
Correct E.C. $\Rightarrow 1s^2\ 2s^2\ 2p^6\ \underline{3s^2}\ \underline{3p^6}\ 4s^1\ \underline{3d^5}$

half filled

d → | ↑ | ↑ | ↑ | ↑ | ↑ |

3d




24Cr ⇒ 1s² 2s² 2p⁶ 3s² 3p⁶ 4s¹ 3d⁵
m
0
0 −1 0 +1
0 −1 0 +1
0
−2 −1 0 +1 +2
2e⊖
2e⊖
2e⊖
2e⊖
2e⊖
1e⊖
1e⊖
⇒ 12 e⊖

Q. Find n, l, m & s for last $e^{\ominus}$ of Na.

$Na \Rightarrow 1s^2, 2s^2, 2p^6, 3s^1$

$3s^1$

$n = 3$

$l = 0$

$m = 0$

$s = +1/2$ or $-1/2$

Q. Following represents which orbital

(i) Ψ 4,2,0

(ii) Ψ 3,1,0

(iii) Ψ 4,1,0

$\Psi_{n,l,m}$

(i) $\Psi_{4,2,0}$

$n=4, l=2, m=0$

$4d_{z^2}$

(ii) $\Psi_{3,1,0}$

$n=3$

$l=1$

$m=0$

$3p_z$

(iii) $\Psi_{4,1,0}$

$n=4$

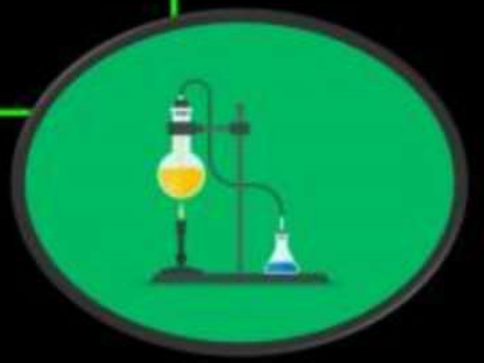
$l=1$

$m=0$

$4p_z$

Q. Calculate spherical, angular & total nodes for following?

Orbital		Spherical/radial node $(n-\ell-1)$		Angular nodes (ℓ)		Total $(n-1)$
1s	→	0	→	0	→	0
2s	→	1	→	0	→	1
2p	→	0	→	1	→	1
3s	→	2	→	0	→	2
3p	→	1	→	1	→	2
4s	→	3	→	0	→	3
4p	→	2	→	1	→	3
4d	→	1	→	2	→	3
4f	→	0	→	3	→	3



SHAPES OF SUBSHELLS

⇒ S- SUBSHELL ⇒ Spherical, Non-directional, Unidirection.

⇒ Radial node / Spherical node ⇒ $n-l-1$

⇒ Angular node / Nodal plane ⇒ l

Exception

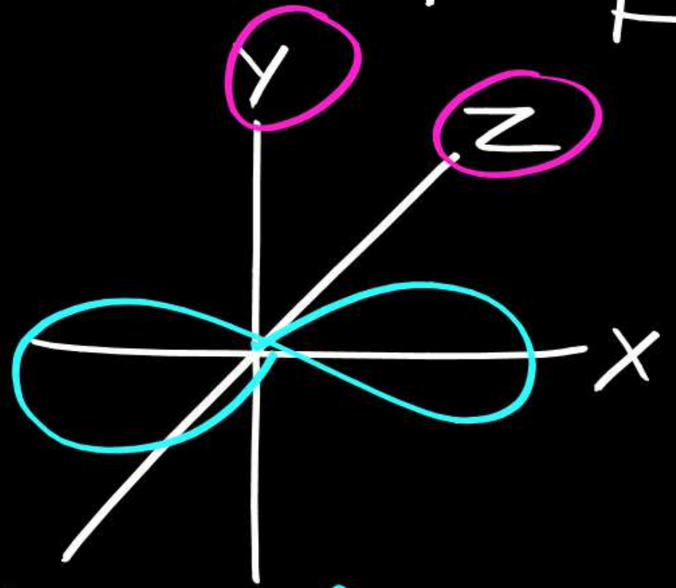
d_{z^2} ⇒ Angular node / Nodal plane ⇒ 0

⇒ p- subshell :- dumbell $\ell = 1$

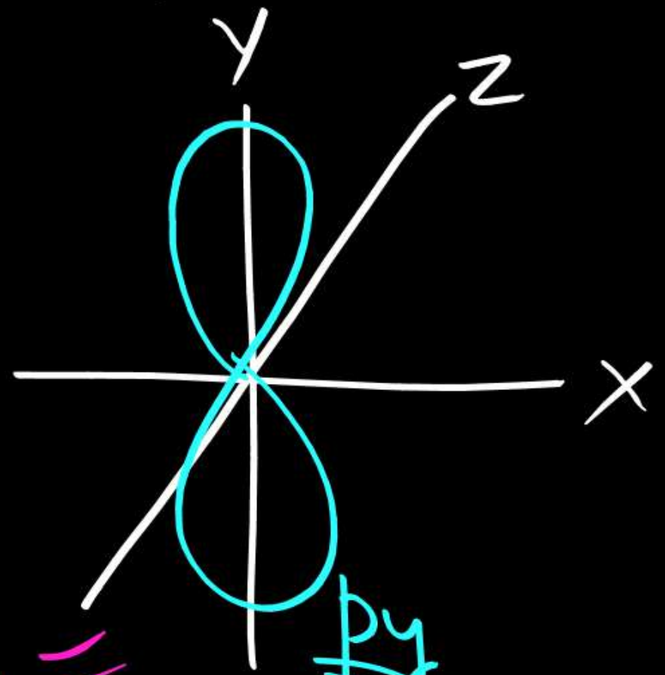
$m = -1, \boxed{0, +1}$

$p_x \quad \boxed{p_z} \quad p_y$

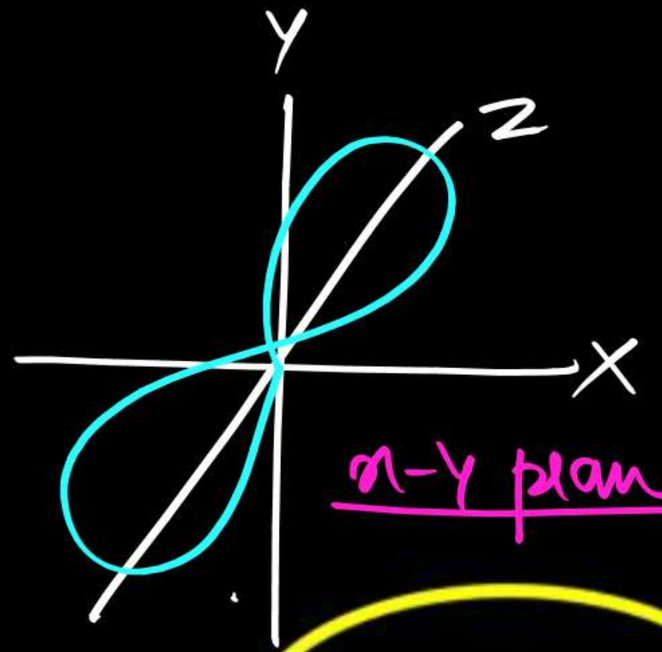
(1)
Angular node
⇒ 1



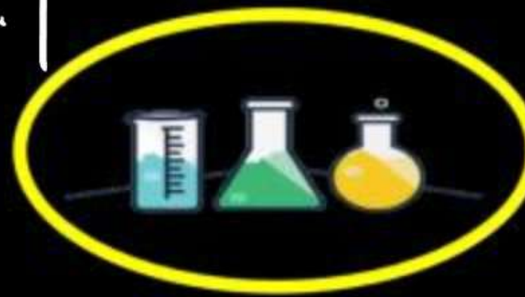
p_x (nodal plane)
≡ Y-Z plane



p_y
≡ X-Z plane



X-Y plane
≡ p_z

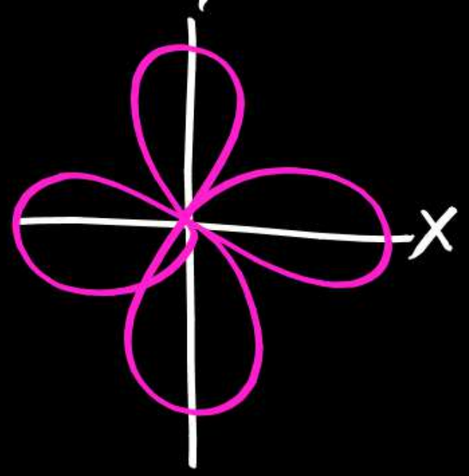


⇒ d subshell :→ double dumbell $l = 2$

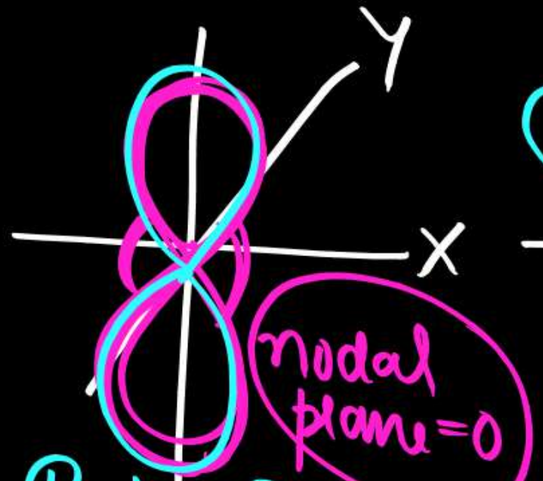
$m \Rightarrow -2, -1, 0, +1, +2.$

on the axis | (in b/w the axis)

$d_{x^2-y^2}$

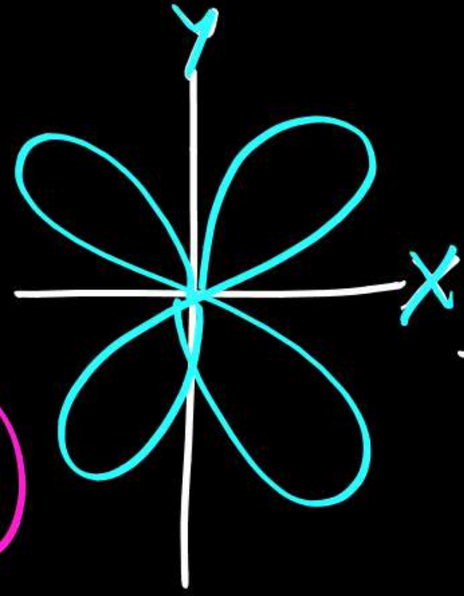


d_{z^2} ($m=0$)

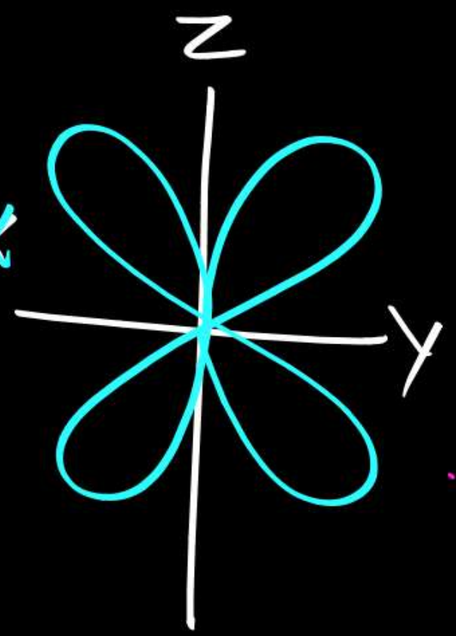


Baby-Soother type

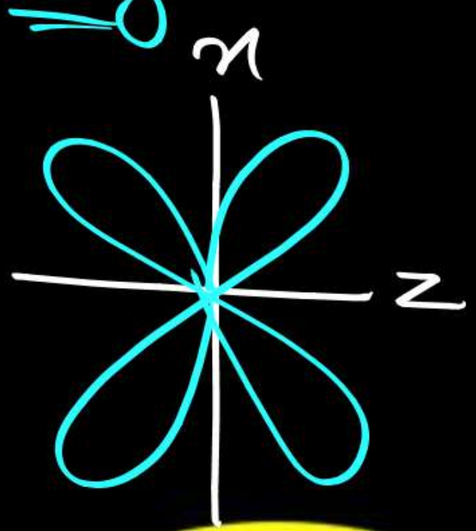
d_{xy}



d_{yz}



d_{zx}



$d_{z^2} \Rightarrow m = 0$ (nodal plane = 0)

$d_{x^2-y^2}, d_{xy} \Rightarrow \pm 2\ (m)$

$d_{xz}, d_{yz} \Rightarrow \pm 1\ (m)$

$d_{x^2-y^2}$:⇒ 2 nodal plane at 45° with each other (X, Y axis)

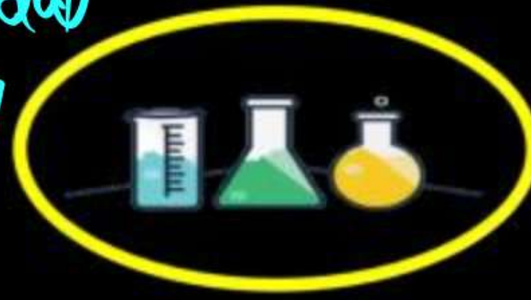
// (in blw the axis)

d_{xy} :⇒ lobes lies in blw xy axis

⇒ 2 Nodal plane → xz, yz

d_{yz} ⇒ 2 Nodal plane → xy, xz

d_{zx} → 2 Nodal plane yz; yx

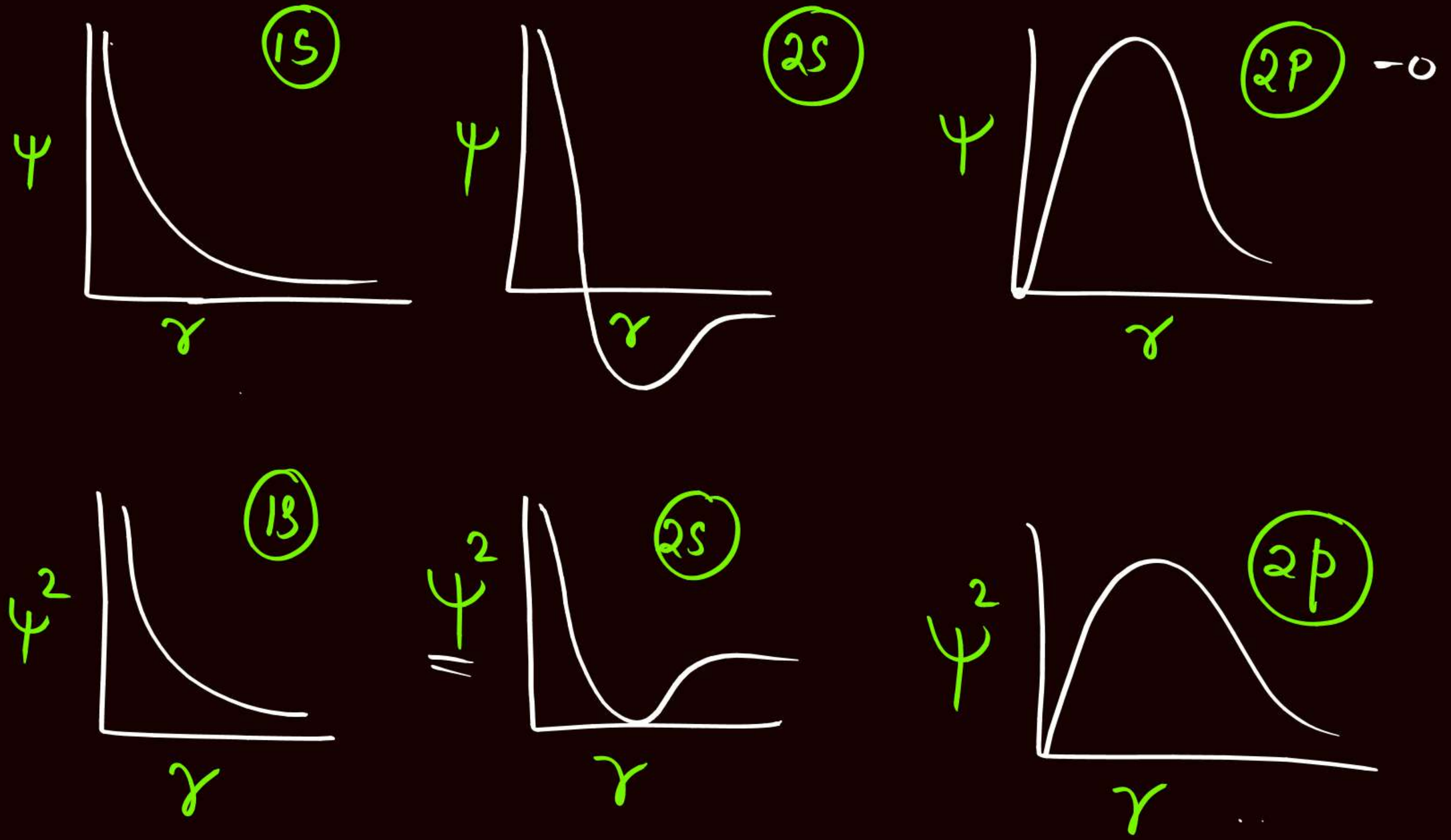


GRAPHS :-

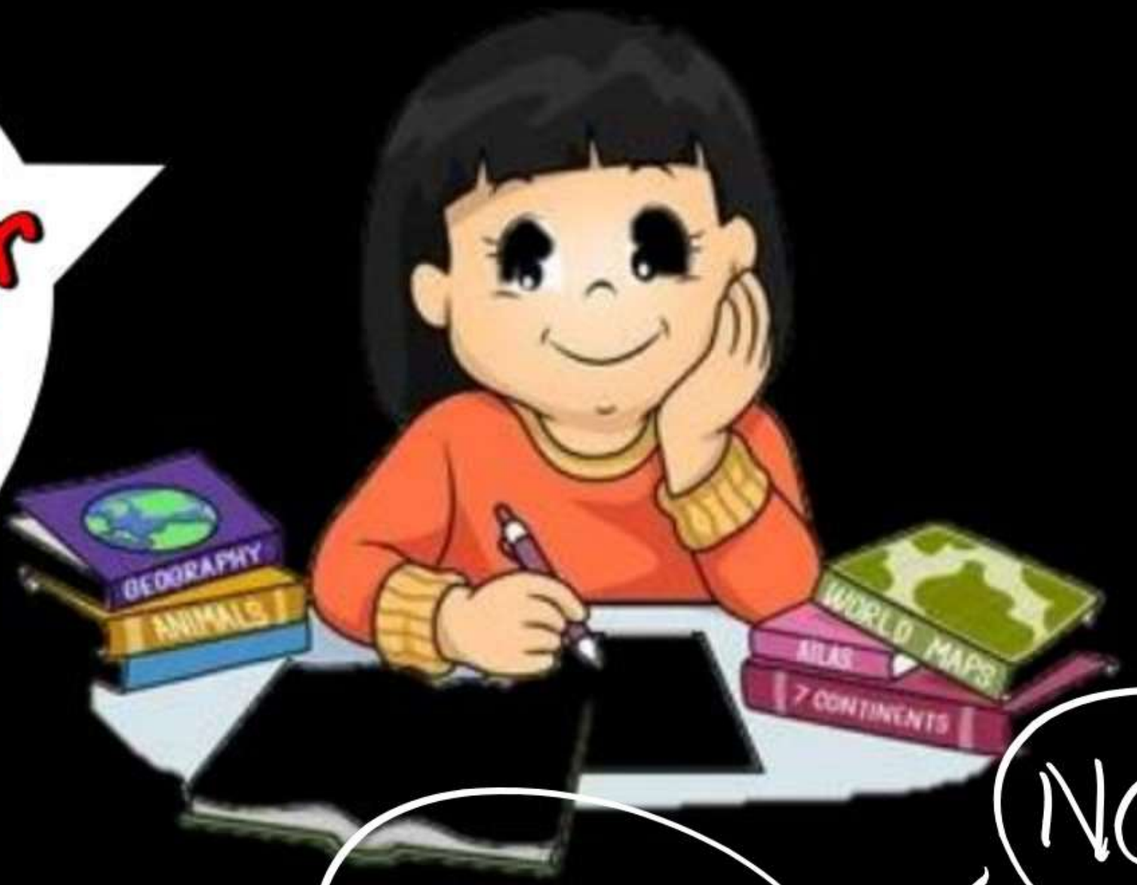
⇒ Graph of Ψ and Ψ^2 w.r.t r represents radial node in the graph ⇒ $(n-l-1)$

⇒ Spherical node ⇒ $n-l-1$

→ Value of Ψ and Ψ^2 is always started from maxima.


1S
ψ
r
2S
ψ
r
2P
ψ
r
1S
ψ²
r
2S
ψ²
r
2P
ψ²
r

Previous year questions

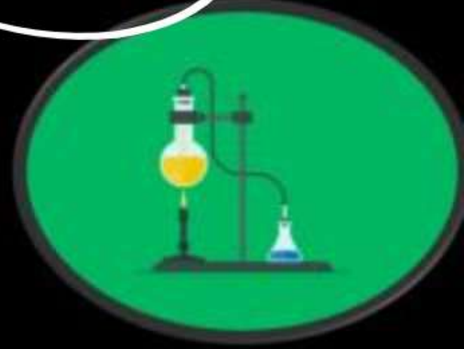


next week

NCERT

DPP - Solution → 25 Question

PYQ → Recording



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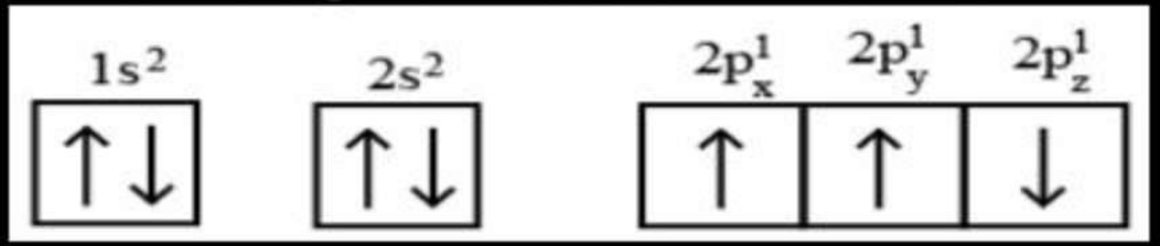
Q. Which one is a wrong statement? **[NEET-2018]**

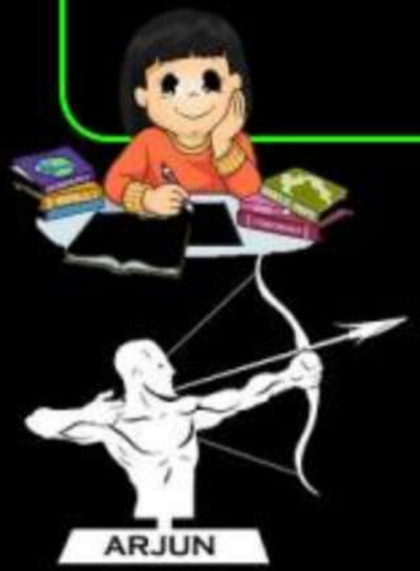
(A) Total orbital angular momentum of electron in 's' orbital is equal to zero

(B) An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbers

(C) The value of m for dZ2 is zero

(D) The electron configuration of N atom is





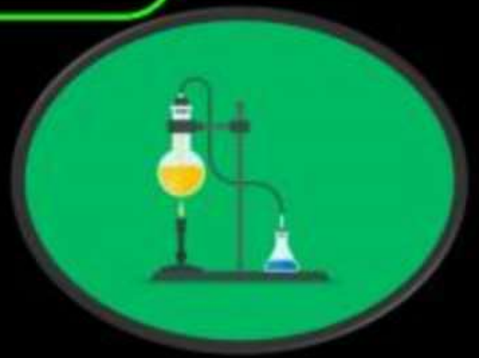
Q. Which one is the wrong statement? **[NEET-2017]**

(A) de-Broglie's wavelength is given by $\lambda = \frac{h}{mv}$, where m = mass of the particle, v = group velocity of the particle

(B) The uncertainty principle is $\Delta E \times \Delta t^3 \frac{h}{4\pi}$

(C) Half-filled and fully orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement

(D) The energy of 2*s* orbital is less than the energy of 2*p* orbital in case of hydrogen like atoms



Q. How many electrons can fit in the orbital for which n = 3 and l = 1?

[NEET-Phase-2-2016]

(A) 2

(B) 6

(C) 10

(D) 14

Q. Which of the following pairs of d-orbitals will have electron density along the axes? **[NEET-Phase-2-2016]**

(A) d_{z^2}, d_{xz}

(B) d_{xz}, d_{yz}

(C) $d_{z^2}, d_{x^2-y^2}$

(D) $d_{xy}, d_{x^2-y^2}$

Q. Two electrons occupying the same orbital are distinguished by [NEET-2016]

(A) Spin quantum number

(B) Principal quantum number

(C) Magnetic quantum number

(D) Azimuthal quantum number

Q. The angular momentum of electron in 'd' orbital is equal to

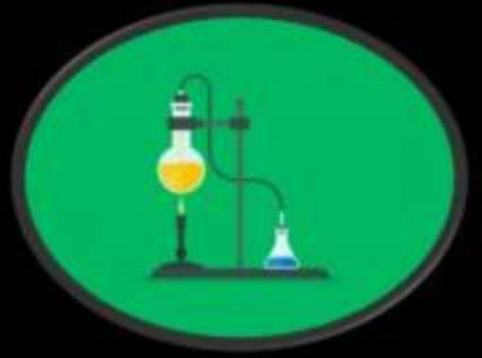
[AIPMT-2015]

(A) $0\ \hbar$

(B) $\sqrt{6}\ \hbar$

(C) $\sqrt{2}\ \hbar$

(D) $2\sqrt{3}\ \hbar$



Q. What is the maximum number of orbital than can be identified with the following quantum numbers?

$n = 3, l = 1, m = 0$ [AIPMT-2014]

(A) 1 (B) 2

(C) 3 (D) 4

Q. Calculate the energy in joule corresponding to light of wavelength 45 nm: (Planck's constant h = 6.63×10^{-34} Js ; speed of light c = 3×10^{8} ms^{-1}) **[AIPMT-2014]**

(A) 6.67×10^{15}

(B) 6.67×10^{11}

(C) 4.42×10^{-15}

(D) 4.42×10^{-18}

Q. What is the maximum number of electrons that can be associated with the following set of quantum number ?

$n = 3, l = 1$ and $m = -1$ [NEET-2013]

(A) 6

(B) 4

(C) 2

(D) 10

Q. The value of Planck's constant is 6.63×10^{-34} Js. The speed of light is 3×10^{17} nms^{-1}. Which value is closest to the wavelength in nanometer of a quantum of light with frequency of 6×10^{16} s^{-1}. [NEET-2013]

(A) 25

(B) 50

(C) 75

(D) 10

Q. Based on equation , $E = -2.178 \times 10^{-18}\ J \left(\frac{Z^2}{n^2}\right)$ certain conclusions are written. Which of them is not correct? [NEET-2013]

(A) Larger the value of n, the larger is the orbit radius

(B) Equation can be used to calculate the change in energy when the electron changes orbit

(C) For n = 1, the electron has a more negative energy than it does for n = 6 which means that the electron is more loosely bound in the smallest allowed orbit

(D) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus

Q. Maximum number of electron in a subshell with l = 3 and n = 4 is

[AIPMT (Prelims)-2012]

(A) 10

(B) 12

(C) 14

(D) 16

Q. The orbital angular momentum of p-electron is given as

[AIPMT (Mains)-2012]

(A) $\frac{h}{\sqrt{2}\pi}$

(B) $\sqrt{3}\frac{h}{2\pi}$

(C) $\sqrt{\frac{3}{2}}\frac{h}{\pi}$

(D) $\sqrt{6}\frac{h}{2\pi}$

Q. The total number of atomic orbitals in fourth energy level of an atom is [AIPMT (Prelims)-2012]

(A) 4

(B) 8

(C) 16

(D) 32

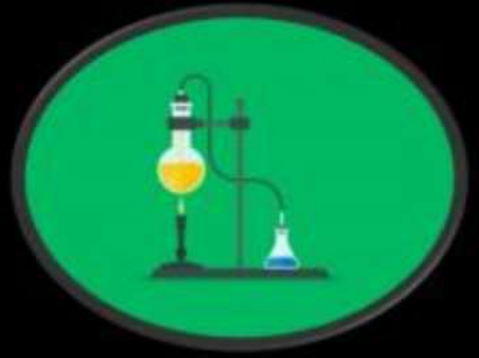
Q. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelength i.e. λ_1 and λ_2 will be **[AIPMT (Prelims)-2011]**

(A) $\lambda_1 = 1/2\ \lambda_2$

(B) $\lambda_1 = \lambda_2$

(C) $\lambda_1 = 2\lambda_2$

(D) $\lambda_1 = 4\lambda_2$



Q. If n = 6 , the correct sequence for filling of electrons will be

[AIPMT (Prelims)-2011]

(A) $ns \rightarrow np \rightarrow (n-1)d \rightarrow (n-2)f$

(B) $ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$

(C) $ns \rightarrow (n-1)d \rightarrow (n-2)f \rightarrow np$

(D) $ns \rightarrow (n-2)f \rightarrow np \rightarrow (n-1)d$

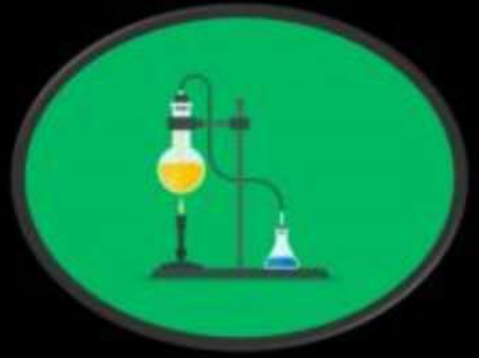
Q. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon? **[AIPMT (Mains)-2011]**

(A) n = 6 to n = 5

(B) n = 5 to n = 3

(C) n = 6 to n = 1

(D) n = 5 to n = 4



Q. A 0.66 kg ball is moving with a speed of 100 m/s. The associated wavelength will be ($h = 6.6 \times 10^{-34}$ Js)

[AIPMT (Mains)-2010]

(A) 6.6×10^{-32} m

(B) 6.6×10^{-34} m

(C) 1.0×10^{-35} m

(D) 1.0×10^{-32} m

thanks
for watching