ARJUNA NEET BATCH

BY : DOLLY SHARMA

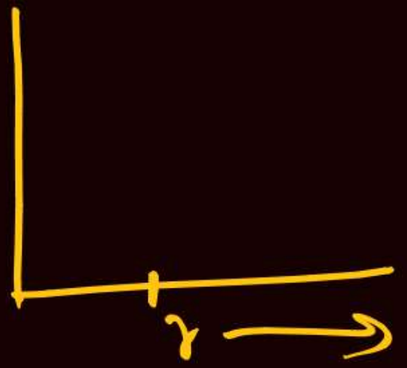
Structure of Atom

[LECTURE - 13]

PREVIOUS YEARS QUESTIONS

Quick Recap

Graph



① ψ vs r

② ψ^2 vs r

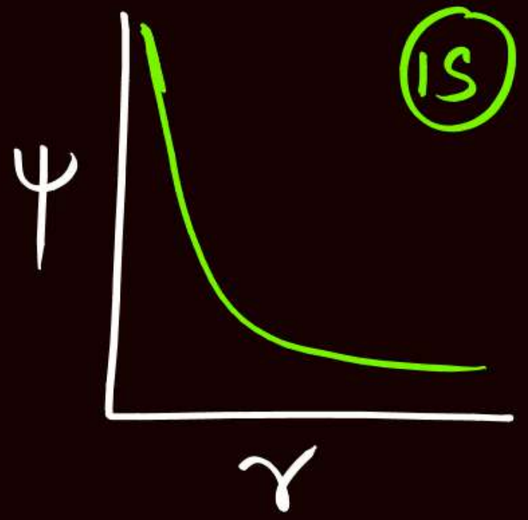
ψ -ive

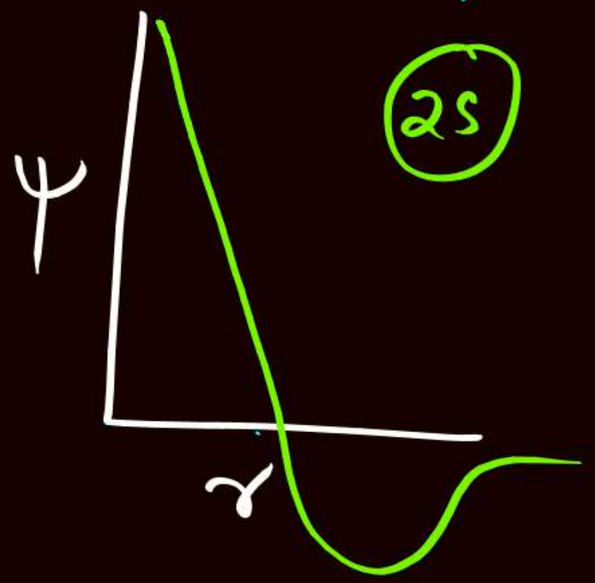
⇒ Spherical node / radial node ⇒ $n-l-1$

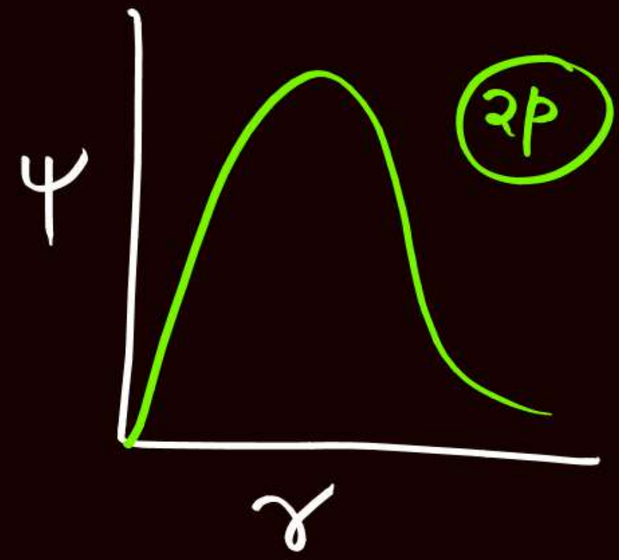
⇒ 1S or 2S का Graph hamesha maxima Se start hoga.

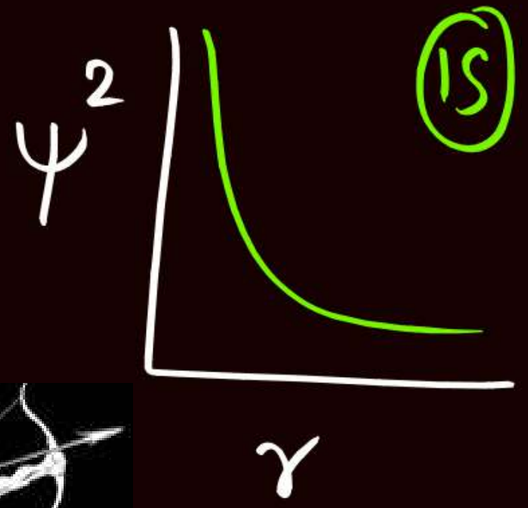
⇒ P का graph origin से होगा

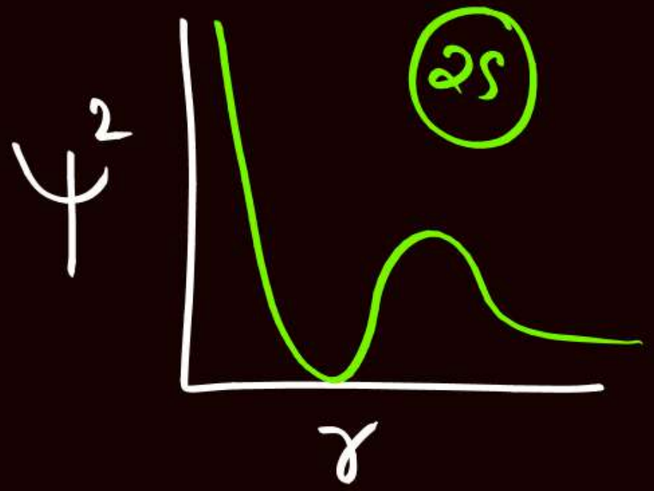
Spherical node / radial node = n-l

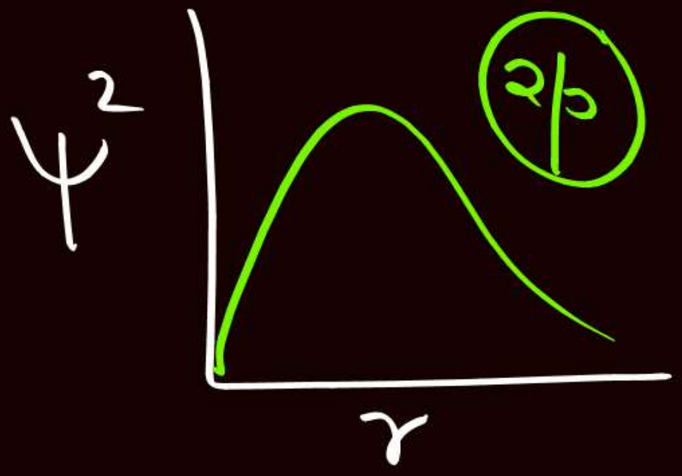










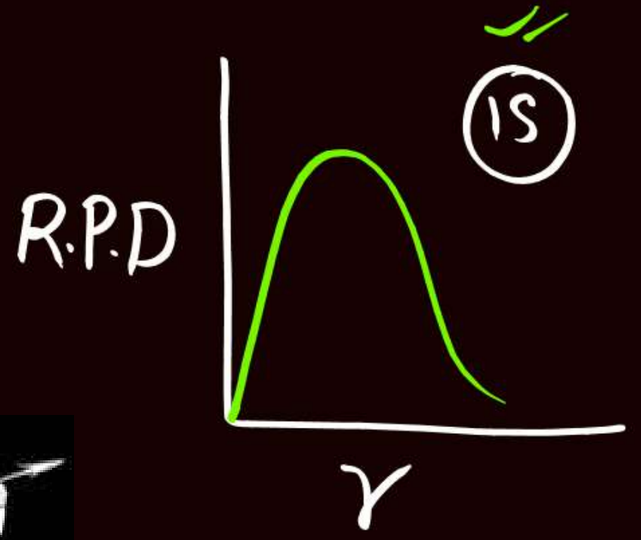


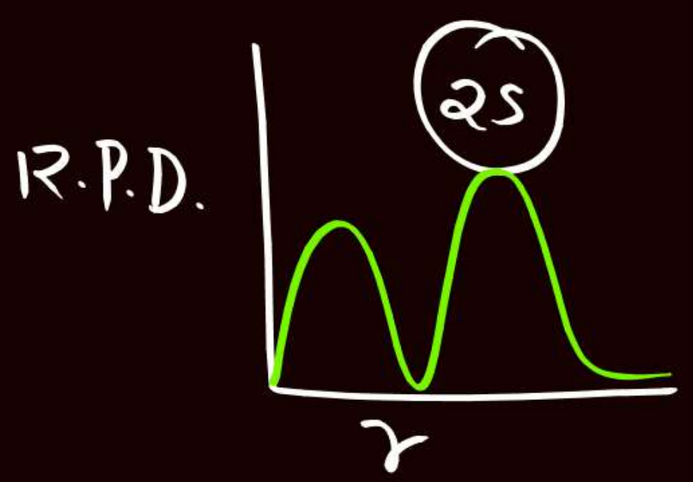
Radial Probability density with r

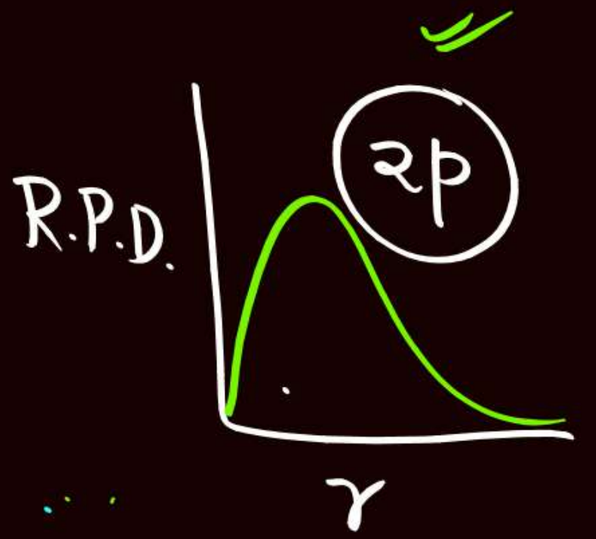
$(4\pi^2 r^2 d\psi^2$ v/s $r)$

⇒ graph always started from origin.

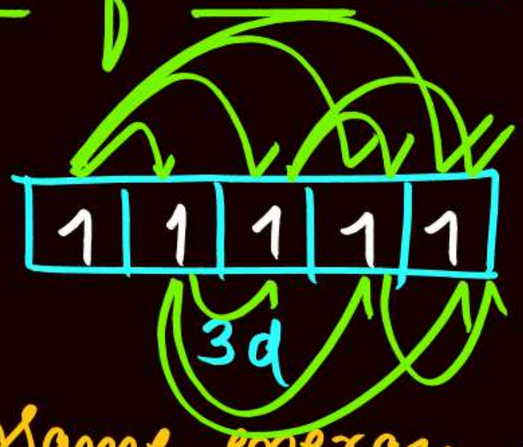
⇒ no. of peaks ⇒ $(n-l)$







Stability of Half-filled and Full-filled Orbital



① Symmetry

② Exchange Energy :- e$^{\ominus}$ having same energy and same spin have tendency to Exchange their position During this Exchange, Energy is released which is called

* EXCHANGE ENERGY

⇒ Greater the value of Exchange energy, higher will be the stability.

$$\text{No. of Exchanges} = \sum (n-1)$$

$n \Rightarrow$ no. of $e^{\ominus}$ with same energy and spin.

d^5 Exchange :- $\sum (5-1) \Rightarrow \sum 4 \Rightarrow 4+3+2+1 \Rightarrow 10$

d^4 Exchange :- $\sum (4-1) \Rightarrow \sum 3 \Rightarrow 3+2+1 \Rightarrow 6$

$d^{10} \Rightarrow \{5 + \{5 \Rightarrow 10 + 10 \Rightarrow 20$

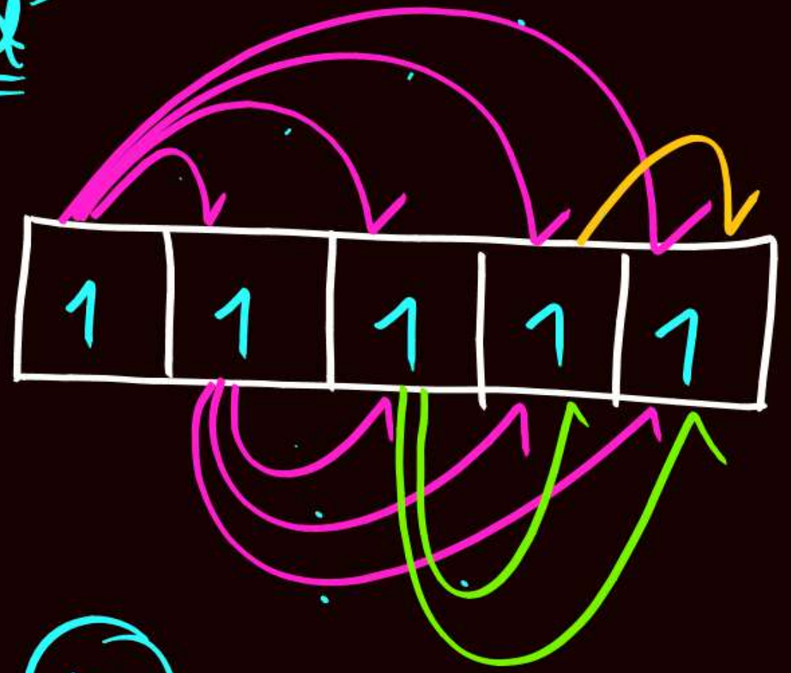
1L	1L	1L	1L	1L

$d^{9} \Rightarrow \{5 + \{4 \Rightarrow 10 + 6$

$\Rightarrow (16)$

1L	1L	1L	1L	1

d^{5}



10

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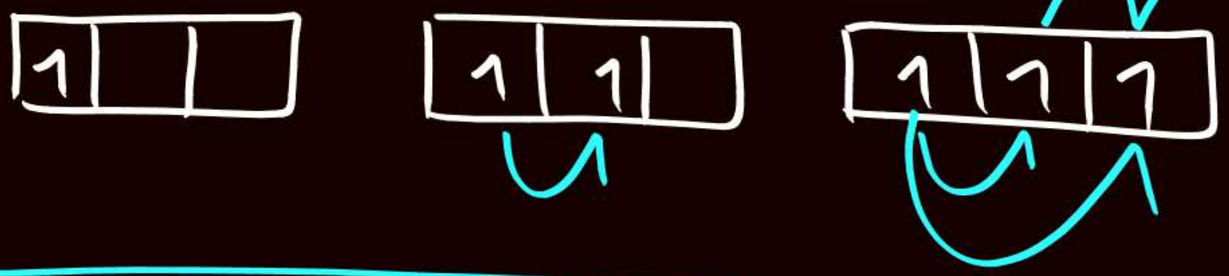
$p^1 < p^2 < p^3$



$Cr \Rightarrow [Ar]\ 3d^5\ 4s^1$

$_{24}Cr \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ \boxed{3d^4}$

$4s^2 \xrightarrow{1e^{\ominus}} 4s^1\ 3d^5$

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

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Electronic Configuration

Noble gases

- $_{2}He$
- $_{10}Ne$
- $_{18}Ar$
- $_{36}Kr$
- $_{54}Xe$
- $_{86}Rn$

$_{6}C \rightarrow 1s^2, 2s^2, 2p^2 \Rightarrow [He]\,2s^2\,2p^6$

Core $e^{\ominus}$s — Valence $e^{\ominus}$

$_{26}Fe \Rightarrow 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,4s^2\,3d^6 \Rightarrow [Ar]\,3d^6\,4s^2$

$4s^2$ → $2e^{\ominus}$

$_{9}F \Rightarrow 1s^2\,2s^2\,2p^5$

$1s^2$ → Core $e^{\ominus}$

$2s^2\,2p^5$ → 7 Valence $e^{\ominus} \Rightarrow [He]\,2s^2\,2p^5$

21 $Sc \rightarrow [Ar]\ 3d^1 4s^2$

22 $Ti \rightarrow [Ar]\ 3d^2 4s^2$

23 $V \rightarrow [Ar]\ 3d^3 4s^2$

** 24 $Cr \rightarrow [Ar]\ 3d^5 4s^1$

25 $Mn \rightarrow [Ar]\ 3d^5 4s^2$

26 $Fe \rightarrow [Ar]\ 3d^6 4s^2$

27 $Co \rightarrow [Ar]\ 3d^7 4s^2$

$i \rightarrow [Ar]\ 3d^8 4s^2$

29 $Cu \rightarrow [Ar]\ 3d^{10} 4s^1$

30 $Zn \rightarrow [Ar]\ 3d^{10} 4s^2$

Magnetic moment

$$\mu = \sqrt{n(n+2)}$$

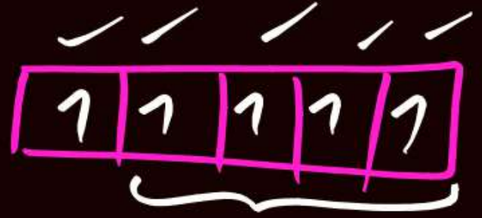
$n \rightarrow$ no. of unpaired $e^{\ominus}$

$n \uparrow$, Magnetic Natur

if all $e^{\ominus}$ are paired ⇒ Diamagnetic

if unpaired $e^{\ominus}$ are present ⇒ Paramagnetic

Mn^{+2} ⇒ $3d^5 4s^2$ ⇒ $3d^5$

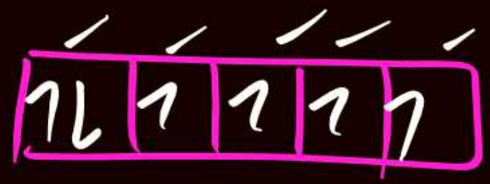


5

$\mu = \sqrt{5(5+2)}$

$= \sqrt{35}$

Fe^{+2} ⇒ $3d^6 4s^2$ ⇒ $3d^6$

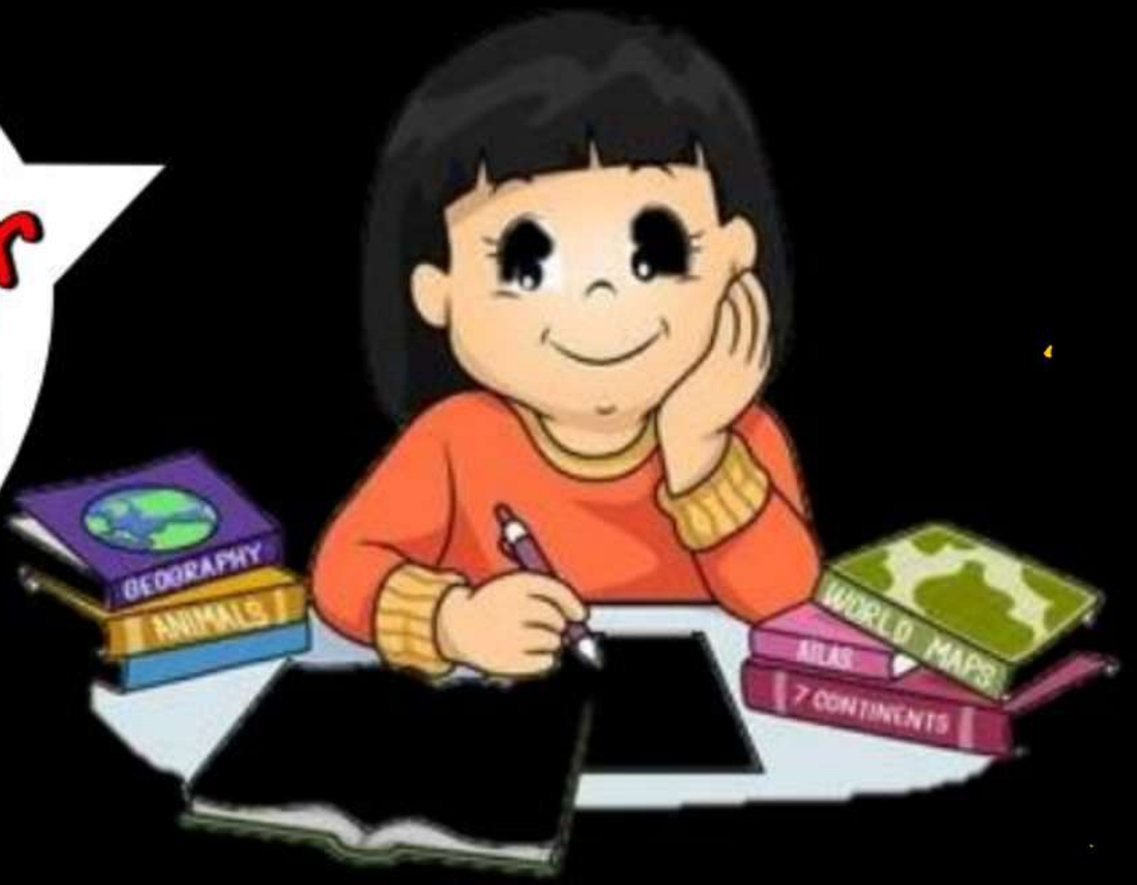


4

$= \sqrt{4(4+2)}$

$= \sqrt{24}$

Previous Year questions



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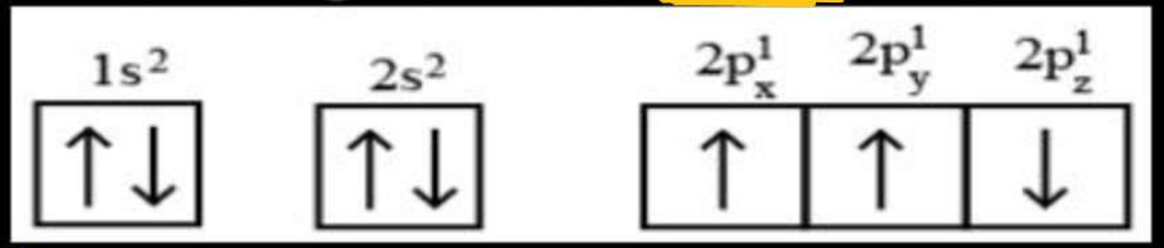
Q. Which one is a wrong statement? **[NEET-2018]**

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

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

(C) The value of m for dZ^2 is zero Correct.

(D) The electron configuration of N atom is

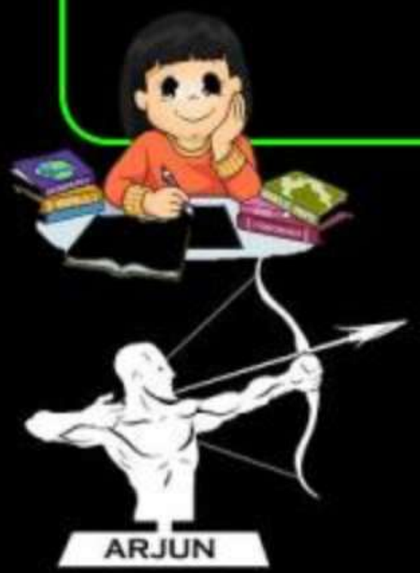


$\Rightarrow N \Rightarrow 1s^2\ 2s^2\ 2p^3$

O.A.M $= \sqrt{l(l+1)}\,h$

S orbital $l = 0$

$\rightarrow 0$.



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

correct.

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

correct

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

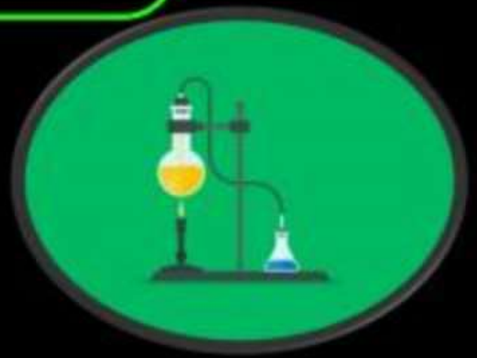
correct.

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

Incorrect.

$2s = 2p$

Energy



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

[NEET-Phase-2-2016]

(A) 2

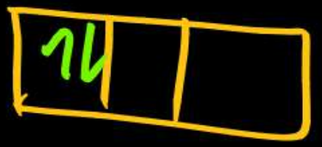
(B) 6

(C) 10

(D) 14

$n = 3 \quad l = 1$

3p



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

$1s^2$

	1	2
n =	1	1
l =	0	0
m =	0	0
s =	$+1/2$	$-1/2$

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

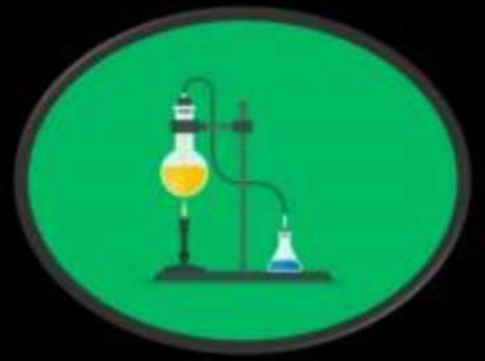
Orbital Angular Momentum $= \sqrt{l(l+1)}\ \frac{h}{2\pi}$

$\Rightarrow \sqrt{2(2+1)}\ \hbar$

$\sqrt{6}\ \hbar$

or

$\sqrt{l(l+1)}\ \hbar$



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

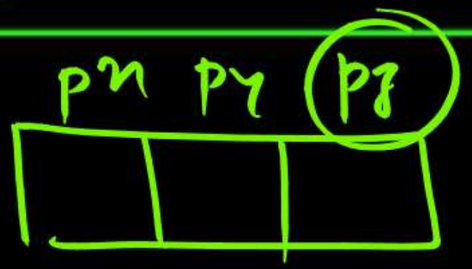
(B) 2

(C) 3

(D) 4

$(nl)_m \Rightarrow 3p_z$

$=$



$3p$

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}

$\lambda = 45\ nm \Rightarrow 45 \times 10^{-9}\ m$

$E = \frac{hc}{\lambda}$

$E \Rightarrow$ Joule $\Rightarrow$? $\quad \lambda = m$

$hc \Rightarrow 2 \times 10^{-25}$

$E \Rightarrow \frac{2 \times 10^{-25}}{45 \times 10^{-9}}$

$\Rightarrow 4.42 \times 10^{-18}$ J

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

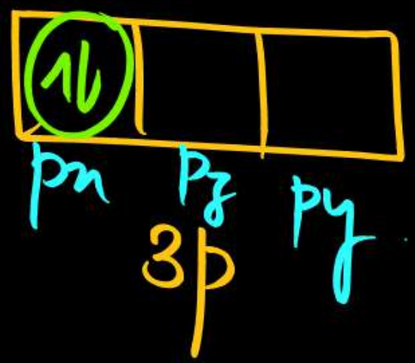
(B) 4

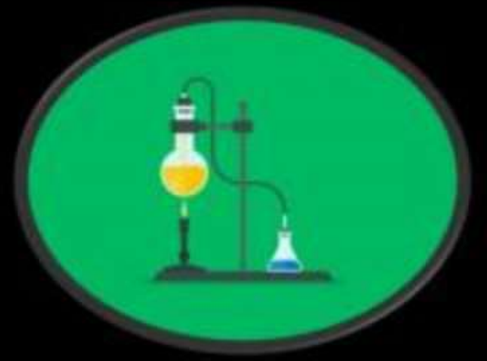
(C) 2

(D) 10

$(nl)_m \Rightarrow 3p_x$

$\Rightarrow$





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

$= v = 3 \times 10^{17}$ nms^{-1}

$\lambda = ?$

$\nu = 6 \times 10^{16}$ s^{-1}

$h = 6.63 \times 10^{-34}$ Js

$\nu = \frac{c}{\lambda}$

$\lambda = \frac{c}{\nu} \rightarrow \frac{3 \times 10^{17}\ \text{nms}^{-1}}{6 \times 10^{16}\ \text{s}^{-1}}$

$\rightarrow 0.5 \times 10^{2-1}$

$\rightarrow$ (50)

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]

$r \propto \frac{n^2}{Z}$

(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 Incorrect

(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. The correct set of four quantum numbers for the valence electron of rubidium atom (Z = 37) is [NEET-2013]

(A) 5,0,0 + 1/2

(B) 5,1,0 + 1/2

(C) 5,1,1 + 1/2

(D) 6,0,0 + 1/2

$Z = 37$ ⟶

→ Li

→ Na

→ K

→ Rb

$Rb \rightarrow [Kr]\,5s^1$

Valence e⁻ of Rb

$n = 5$

$l = 0$

$m = 0$

$s = +1/2$

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

$n = 4$

$l = 3$ ⇒ 4f

4f

No. of $e^{\ominus}$ in a subshell $= 4l + 2$

$= 4 \times 3 + 2$

$= 14 e^{\ominus}$

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

O.A.M $\Rightarrow \sqrt{l(l+1)}\,h \Rightarrow \sqrt{1(1+1)} \Rightarrow \sqrt{2}\,h$

$p \rightarrow l=1$

or

$\Rightarrow \sqrt{2}\frac{h}{2\pi} \Rightarrow \frac{\sqrt{2}\,h}{\sqrt{2}\times\sqrt{2}\,\pi}$

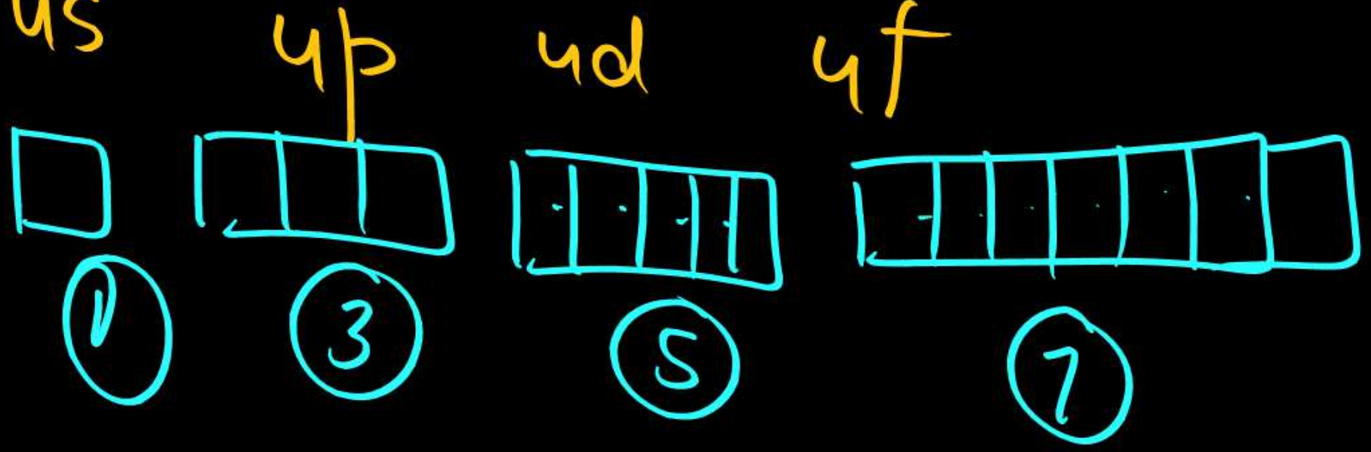
Q. The total number of atomic orbitals in fourth energy level of an atom is [AIPMT (Prelims)-2012]

(A) 4 (B) 8

(C) 16 (D) 32

Total no. of orbitals in a shell $= n^2 = 16$

Total no. of $e^{\ominus}$ in a shell $= 2n^2$



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) $\lambda_1 = 4\lambda_2$

$E_1 = 25\ eV$

$E_2 = 50\ eV$

$E \propto \frac{1}{\lambda}$

$$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} \Rightarrow \frac{25}{50} = \frac{\lambda_2}{\lambda_1}$$

$$2\lambda_2 = \lambda_1$$

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

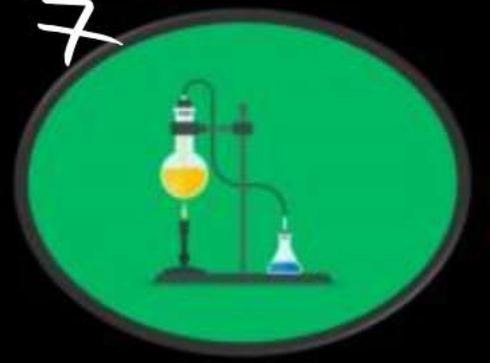
(C) $ns \rightarrow (n-1)d \rightarrow (n-2)f \rightarrow np$

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

ns (n-2)f (n-1)d np

6s 4f < 5d < 6p

n+l → 6 7 7 7



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

Most Energetic photon

n_2 (2) ↑ n_1 (1) ↓

$\Delta E = -13.6 z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2}\right)$

least Energetic photon

n_1 ↑

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

$\lambda = \frac{h}{mv} \Rightarrow \frac{6.626 \times 10^{-34}\ \text{Js} \times}{0.66 \times 100\ \text{m/s}}$

$\Rightarrow 1.0 \times 10^{-35}\ \text{m}$

thanks
for watching