ARJUNA NEET BATCH

DPP- 11

Structure of Atom

1. The wavelength associated with a ball of 200 g and moving with a speed of 5m/hour is of the order of

(A) 10^{-10} m (B) 10^{-20} m

(C) 10^{-30} m (D) 10^{-40} m

$m = 200\,g \Rightarrow \frac{200}{10^3} \Rightarrow 200 \times 10^{-3}\,kg$

$V = 5\,m/hour$

$\Rightarrow \frac{5\,m}{60 \times 60}\,m/s$

$\lambda = \frac{h}{mV}$

1 hour $\Rightarrow$ 60 minutes

$\Rightarrow$ 60 seconds

$\times 60 \times 60$

$\lambda = \frac{6.626 \times 10^{-34}\,Js}{200 \times 10^{-3} \times 5}$

$\Rightarrow 23.9 \times 10^{-31}\,m$

$\Rightarrow 2.39 \times 10^{-30}\,m$

ARJUNA

2. The set of quantum numbers not applicable to an electron

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

(C) 1,0,0, –1/2 (D) 2,0,0, +1/2

$n \Rightarrow 1$ to ∞, $n \neq$ fraction, $-ive$

$l \Rightarrow l \not> n \Rightarrow$ 0 to $n-1$

$m \ni -l$ to $+l$ $\quad m \not> l$

$S \ni +\frac{1}{2}$ or $-\frac{1}{2}$

$(nl)_m$

1p → X

3. The principal and azimuthal quantum number of electrons in 4f orbitals are

(A) 4,2
(B) 4,4
(C) 4,3
(D) 3,4

4f ⇒ nl

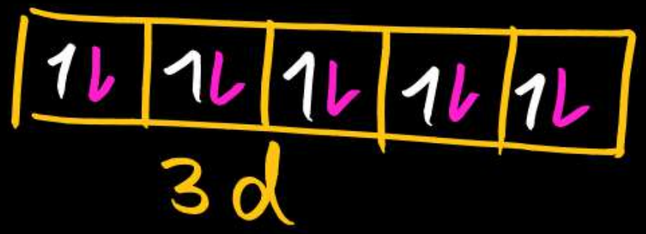
n = 4
l = ?
0

4, 3

l = 0 → s
= 1 → p
= 2 → d
→ 3 → f

4. How many 3d electrons can have spin quantum number $-\frac{1}{2}$?

(A) 5
(B) 7
(C) 8
(D) 10



$1 \rightarrow +1/2$

$1 \rightarrow -1/2$

ARJUNA

5. The correct order of increasing energy of atomic orbital is

(A) 5p < 4f < 6s < 5d

(B) 5p < 6s < 4f < 5d

(C) 4f < 5p < 5d < 6s

(D) 5p < 5d < 4f < 6s

Energy → Multielectronic species

↓

Bohr Bury Rule

	5p	<	6s	<	4f	<	5d
n+l	6		6		7		7

n+l ↑ Energy ↑

If value of n+l is same

n ↑ E ↑

6. Which shell would be the first to have 'g' sub-shell?

(A) L
(B) M
(C) N
(D) O

K → 1st
L → 2nd
M → 3rd
N → 4th

O → 5th shell

shell no ⇒ no. of subshells

1st shell → 1 subshell → 1S
2nd shell → 2 subshell → 2S, 2P
3rd shell → 3 subshell → 3S, 3P, 3D,
4th shell → 4 subshell → 4S, 4P, 4D, 4F
5th shell → 5 subshell → 5S, 5P, 5D, 5F (5G)

7. For which one of the following set of quantum numbers an electron will have the highest energy?

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

(A) $3+2 \Rightarrow 5$

(B) $4+2 \Rightarrow 6$

(C) $4+1 \Rightarrow 5$

(D) $5+0 \Rightarrow 5$

Energy ↓

$n+l$ ↑, E ↑

If $n+l$ is same

n ↑, E ↑

ARJUNA

8. The energies of orbitals of H-atom are in the order

(A) $3s < 3p < 4s < 3d < 4p$

(B) $3s < 3p < 3d < 4s < 4p$

(C) $3s = 3p = 3d < 4s = 4p$

(D) $3s = 3p = 3d < 4s < 4p$

H-atom
↓
Unielectronic

Energy

$n \uparrow$, $\in \uparrow$

if n is same, E same

9. Which of the following set of quantum number is possible?

(A) $n = 4, l = 2, m = -2, s = -2$

(B) $n = 4. l = 4, m = 0. s = 1/2$

(C) $n = 4, l = 3, m = -3, s = 1/2$

(D) $n = 4. l = 0, m = 0, s = 0$

4f

$n = 1$ to ∞ $\quad n \neq 0, -ive, \infty$

$l \Rightarrow \quad l = 0$ to $n-1 \quad l \not> n$

$m \Rightarrow \quad m = -l$ to $+l \quad m \not> l$

$S \Rightarrow +\frac{1}{2}$ or $-\frac{1}{2}$

10. The maximum number of electrons in an atom which can have n = 4 is

(A) 4
(B) 8
(C) 16
(D) 32

$n=4$ No. of electrons in a shell $\Rightarrow 2n^2$

$\Rightarrow 2(4)^2$

$\Rightarrow 32\,e^{\ominus}$

11. In the presence of magnetic field, the possible number of orientations for an orbital of azimuthal quantum number 3, is

(A) Three
(B) One
(C) Five
(D) Seven

$l = 3$ → f subshell

$m = -l$ to $+l$

↓ orientation of orbital

$-3, -2, -1, 0, +1, +2, +3$

No. of orbitals in a subshell

⇒ $2l + 1$

⇒ $2(3) + 1$

⇒ 7 orbitals

ARJUNA

12. For a 'p' electron, the orbital angular momentum is

(A) $\sqrt{6}\hbar$ (B) $\sqrt{2}\hbar$

(C) $\hbar$ (D) $2\hbar$

Orbital A. Momentum $\Rightarrow \sqrt{l(l+1)}\,\hbar$ or $\sqrt{l(l+1)}\,\frac{h}{2\pi}$

$p \rightarrow l = 1 \Rightarrow \sqrt{1(1+1)}\,\hbar$

$\Rightarrow \sqrt{2}\,\hbar$

13. Which of the following electronic level would allow the hydrogen to absorb a photon but not emit a photon?

(A) 3s
(B) 2p
(C) 2s
(D) 1s

14. Which of the following transition will emit maximum energy in hydrogen atom?

(A) $4f \rightarrow 2s$

(B) $4d \rightarrow 2p$

(C) $4p \rightarrow 2s$

(D) All have same energy

$n_2 = 4$

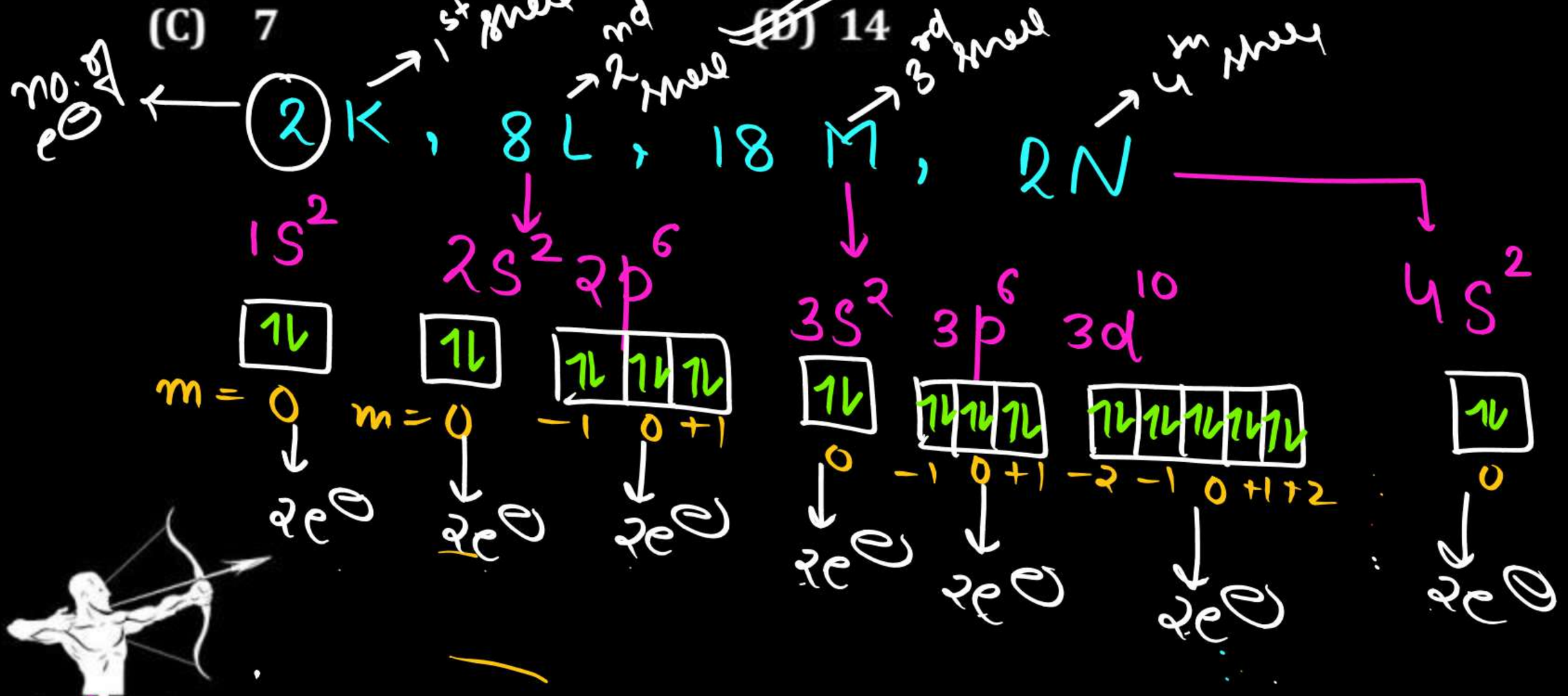
$n_1 = 2$

Max. E. diff $\Rightarrow$ $n_2 \uparrow$ $n_1 \downarrow$

15. In an atom, which has 2K, 8L, 18M and 2N electros in the ground state. The total number of electrons having magnetic quantum number, m = 0 is

(A) 6 (B) 10

(C) 7 (D) 14

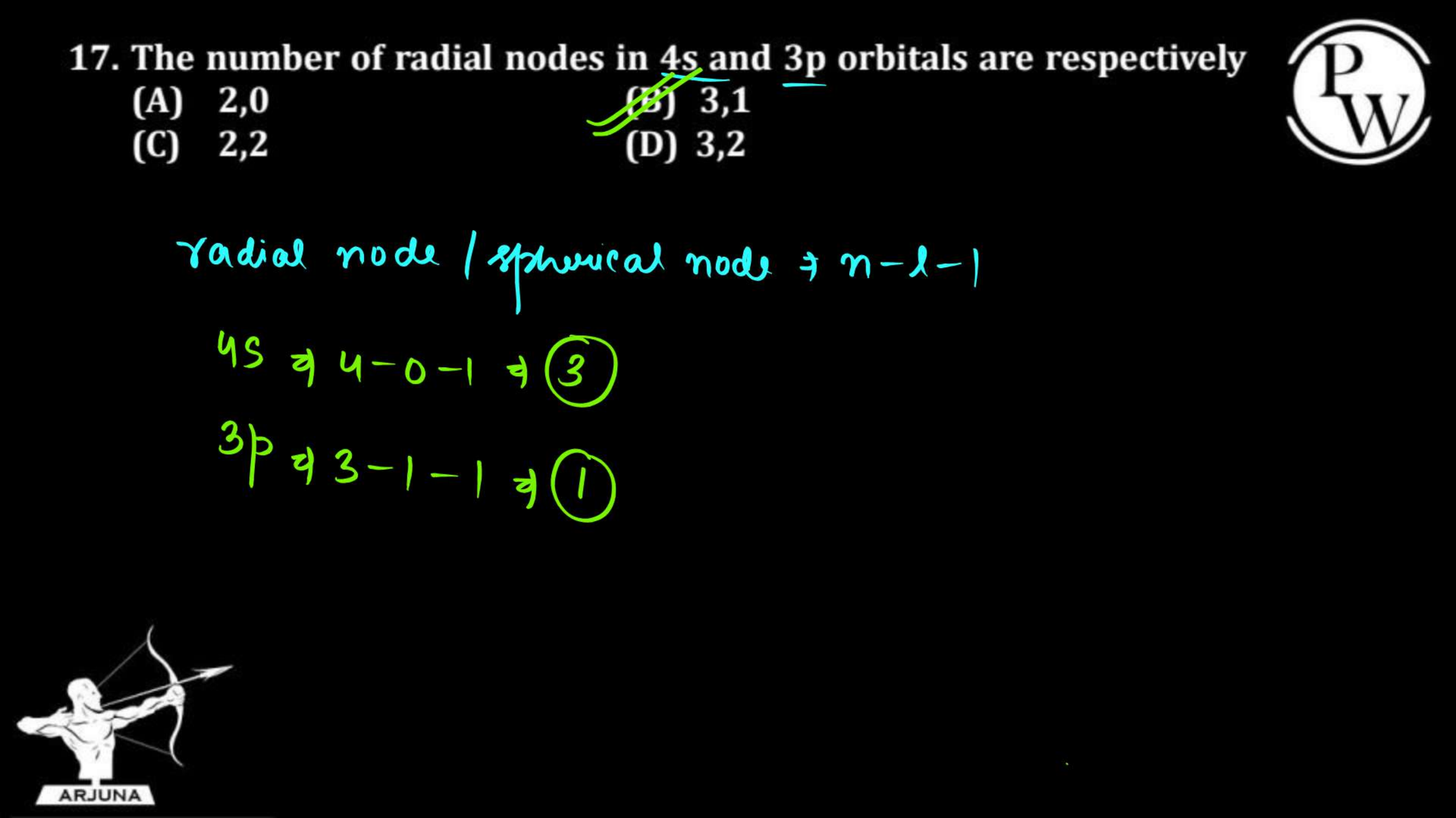


16. A p-orbital can accommodate upto

(A) Four electrons
(B) Six electrons
(C) Two electrons
(D) Eight electrons

17. The number of radial nodes in 4s and 3p orbitals are respectively

(A) 2,0
(B) 3,1
(C) 2,2
(D) 3,2



Radial node / spherical node = $n-l-1$

4s $\Rightarrow 4-0-1 \Rightarrow (3)$

3p $\Rightarrow 3-1-1 \Rightarrow (1)$

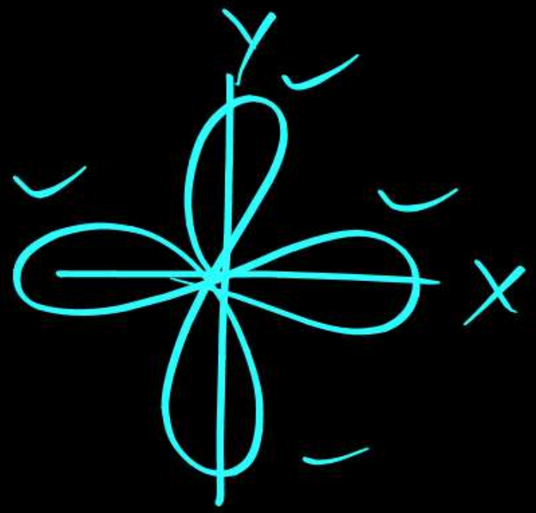
18. Which of the following orbital is with the four lobes present on the axis?

(A) d_{x^2}

(B) d_{xy}

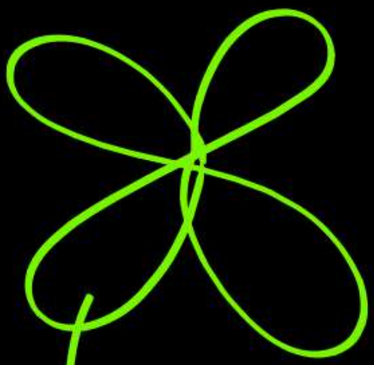
(C) d_{yz}

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



d- 5 degenerate orbitals

$d_{x^2-y^2}$, d_{z^2} → on the axis



1 lobe

d_{xy}, d_{yz}, d_{zx}

→ in blw the axis

19. Which of the following statement concerning the four quantum number is incorrect?

(A) n gives the size of an orbital

(B) *l* gives the shape of an orbital

(C) m gives the energy of the electron in Orbital

(D) s gives the direction of spin of electron in the orbital

20. Which of the following has maximum number of unpaired electrons?

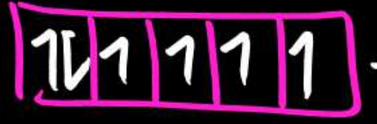
(A) Mg^{2+} (B) Ti^{3+}

(C) Fe^{2+} (D) Mn^{2+}

$_{12}Mg^{+2} \rightarrow 10e^{\ominus} \rightarrow 1s^2, 2s^2, 2p^6, 3s^2$ → 0 unpaired $e^{\ominus}$

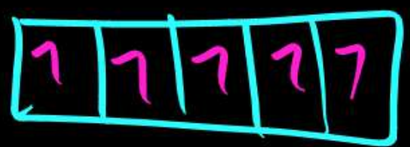
$_{22}Ti^{+3} \rightarrow 19e^{\ominus} \rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^1$ → 1 unpaired $e^{\ominus}$

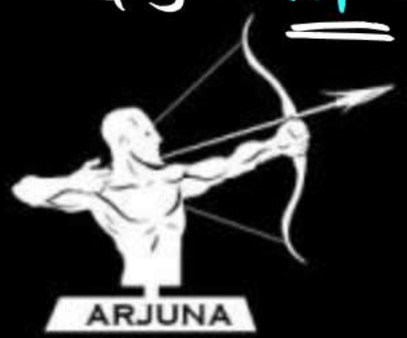
$_{26}Fe^{2+} \rightarrow 24e^{\ominus} \rightarrow 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^6$



→ 4 unpaired $e^{\ominus}$

$_{25}Mn^{+2} \rightarrow 23e^{\ominus} \rightarrow 1s^2 2s^2, 2p^6, 3s^2, 3p^6, 3d^5$ → 5 unpaired $e^{\ominus}$





21. Two electrons in K shall will not have

(A) Same principal quantum number

(B) Same azimuthal quantum number

(C) Same magnetic quantum number

(D) Same spin quantum number

1S | ↑↓

$m = 0$

↑ ↓

$n=1$ $n=1$

$l=0$ $l=0$

$m=0$ $m=0$

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

22. Which of the following electronic configuration is not possible?

(A) $2p^3$

(B) $2d^5$

(C) $4s^1$

(D) $5f^8$

$n=2 \rightarrow 2s, 2p \rightarrow d$ ✗

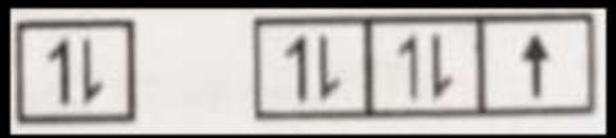
23. The orbital diagram in which both Pauli's exclusion principle and Hund's rule are violated is

(A) 

→ Pauli → ✗
→ Hund ✗

(B) 

(C) 

(D) 

23. The number of waves in the third orbit of Hatom

(A) 1
(B) 2
(C) 4
(D) 3

No. of wavel ⇒ shell no

25. If kinetic energy of a proton is increased nine times, the wavelength of the de-Broglie wave associated with it would become

(A) 3 times
(B) 9 times
(C) 1/3 times
(D) 1/9 times

$\lambda = \frac{1}{\sqrt{K.E.}}$

$\lambda = \frac{1}{\sqrt{9}} \Rightarrow \frac{1}{3}$ becomes

26. The de-Broglie wavelength of an electron travelling with 10% of velocity of light is equal to

(A) 242.4 pm
(B) 24.2 pm
(C) 2.42 pm
(D) 0.2424 pm

$\lambda = ?$

$m_e = 9.1 \times 10^{-31}$ kg

V = 10% of velocity of light

$\rightarrow \frac{10}{100} \times 3 \times 10^{8}$

$\rightarrow 3 \times 10^{7}$ m/s

$\lambda = \frac{h}{mv}$

$\rightarrow \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-31} \times 3 \times 10^{7}}$

$\rightarrow 24.2 \times 10^{-12}$ m

$\rightarrow$ 24.2 pm

1 pm = 10^{-12} m

ARJUNA

Thank You