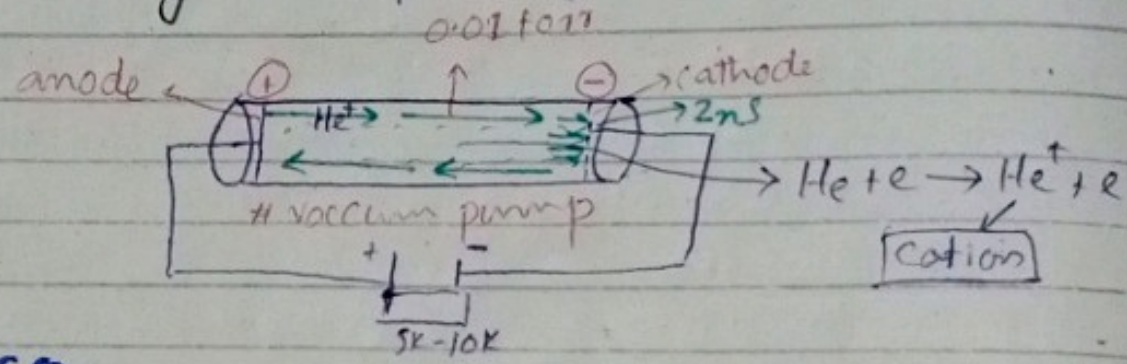
#2

Atomic Structure:

→ Discovery Of Proton:

→ Canal rays
→ Positive rays

Discovery: Goldstein
Naming: Rutherford (proton)



MCQ:

Source of positive rays?
a: Cathode b: Anode
(c) Ionization d: both b & c

∴ positive rays are only produced by ionization of gas.

Properties Of Positive Rays:

→ Travel in straight line
→ Can ionize gas molecules
→ Cause shadow of opaque material
→ Electric field and magnetic field ⇒ deflection
→ Electric field → deflect towards -ve plate.
→ Charge to mass ratio (e/m) depends upon nature of gas.

For H_2:

$e/m = 9.54 \times 10^7$ e/kg (max)

$e/m \propto \frac{1}{\text{mass of gas}}$

MCQ:

a: O_2^{+1} 32g
b: N_2^{+1} 28g
(c) He^{+1} 4g
d: same

greater e/m?

Decreasing order of e/m
e > p > He^{++}

Hunds Rule:

→ Degenrate Orbitals

→ Valency of an atom

$N_2 = 1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^1$ ✓

✗ $3p_x^{\uparrow\downarrow}, 2p_y^1, 2p_z^1$

→ should be same spin ✗ $2p_x^1, 2p_y^1, 2p_z^1$

Phosphorus and Nitrogen's EC can't be justify without hunds rule.

MCQ:

a: [↑↓] [1] [↓] [1]

b: [1] [1] [↓] [1]

c: [↑↓] [↑↑] [1] [1]

In W.O.F Hunds rule is vidated:

a, b, c

In W.O.F Hunds rule and Auf Bau is violated?

b

In W.O.F Pauli and Hunds rule is violated;

c

Electronic Configuration:

$M^{+2} = 24e^- (2e^- 26e^-$

$A = 56$

$n = ?$

$n = A - Z$

$n = 56 - 26 = 30$

$M^{+2} = 18e + 2e^- = 20e^-$

$n = 20$

$A = ?$

$A = P + n$

$= 20 + 20 = 40$

Cathode Rays:

↳ electrons

e/m of C.R = 1.75×10^{11} C kg^{-1}

e/m of C.R = Independant of nature of gas.

MCQ: e/m of C.R depends upon?

a: Nature of electrodes
b: Nature of gas
c: Pressure inside tube
d: Composition of glass.
e: Voltage Used.
f: None of these

→ Planks Quantum Theory:

→ Max Planks (1900)

→ "Radiation from ~~different~~ Hot body under different temperature"

Main Points:

→ Energy → ~~~~ → photon → discontinuous manner

→ Packets → wave packets, pulses of energy or light → photon.

→ Each photon has, Energy, $\nu, \bar{\nu}, \lambda$

$E \propto \nu$ (nu → frequency)

$E = h\nu$ — ①

$\nu \propto \frac{1}{\lambda} \Rightarrow \nu = \frac{c}{\lambda}$ — use in ①

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

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

$\frac{1}{\lambda} = \bar{\nu}$ (nubar)

$\nu \propto \bar{\nu} \propto \frac{1}{\lambda}$

$E = hc\bar{\nu}$

Bohr's Atomic Model:

→ Based upon planks Quantum theory (1913)

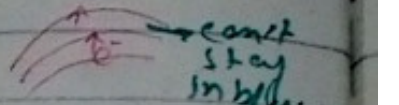
→ Circular paths → orbitals, shells, energy levels
↳ Quantized

→ Same Orbit → Energy of electron remain same

→ Electronic transition → $\Delta E = E_2 - E_1$ (opposite of Rydberg)

Absorption → low to high

Emission → high to low



→ Momentum → Angular: $mvr = \frac{nh}{2\pi}$ (Quantized) n = 1, 2, 3

K shell (1) (2) L-shell

a: $mvr = h/2\pi$ b: $\frac{h}{\pi}$

M shell (3) (5) O shell

c: $mvr = 1.5h/\pi$ d: $2.5h/\pi$

Applications Of Bohr Model

→ applicable on uni electron system.

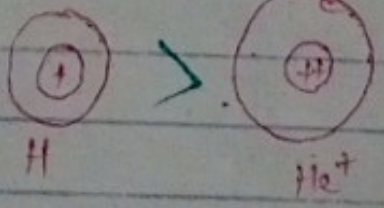
Bohr model can't apply on?

a: $He^{+}(2\bar{e})$ (b) $Li^{+3}(0\bar{e})$

(c): $H(1\bar{e})$ d: $Be^{+3}(1\bar{e})$

Radius Of n^{th} Orbit:

$\downarrow r_n = 0.529 \times \frac{n^2}{Z\uparrow}$ ∴ The more the atomic number (Z) the less is radius.



$r_H > r_{He^+}$ → b/c He^+ has 2 protons so attraction will be greater, hence radius will shrink

Energy Of n^{th} Orbit:

$$E_n = -131236 \times \frac{Z^2}{n^2}$$

$E_n \propto \frac{1}{Z^2}$, $E_n \propto n^2$ ∴ because of -ive sign

Quantum Number:

→ Number that gives complete adress of electron.

OR

→ Set of integer that give complete information of $\bar{e}$

OR

→ solution of schrodinger wave equation that give certain integer called Quantum No:

→ For H_2

Types of Quantum Number:

① Principal (n)] solution of wave equation

② Azimuthal (l)]

③ Magnetic (m)]

④ Spin (s)] independant.

i: Principle Q-N: (shells)

→ 'n'

n = 1, 2, 3, 4 ---

→ shell, Orbital, Energy

Describe:

→ Distance of $\bar{e}$ $\propto n$

→ $r_n \propto n$

→ $E_n \propto n$

→ $mvr \propto n$

- size of atom $\propto n$
- No of $\bar{e}$ in shell $= 2n^2$
- No of sub shell in shell $= n$
- No of orbitals $= n^2$

Shell	n-value	Subshell = n	Orbital = n^2	Electron ($2n^2$)
K	1	1 (1s)	1	$2\bar{e}$
L	2	2 (2s, 2p)	4	$8\bar{e}$
M	3	3 (3s, 3p, 3d)	9	$18\bar{e}$
N	4	4 (4s, 4p, 4d, 4f)	16	$32\bar{e}$

2. Azimuthal Q Num: (subshells)

→ Sub shell, sub energy levels
→ "l"
→ $l = 0, 1, 2, 3 \cdots n-1$
$l \not> n$
$l < 1$

Describe:
→ Shape of subshell
→ No. of orbitals in subshell $= 2l+1$
→ No of $\bar{e}$ in subshell $= 2(2l+1) = 4l+2$

~~shell~~ n
$l = 0 \rightarrow s$
$l = 1 \rightarrow p$
$l = 2 - d$
$l = 3 - f$

Describe:

- Self rotation of ē
- Spinning motion of ē.

MCQ:

Which is correct?

a: $n=4, l=3$ $m=4$ $s=+1/2$
b: $n=4$ $l=4$ $m=4$ $s=-1/2$
c: $n=4$ $l=3$ $m=0$ $s=+1/2$
d: $n=3$ $l=2$ $m=+3$ $s=-1/2$

MCQ:

WOF Quantum no. is corred for last subshell of F?

a: $n=3$ $l=0$
b: $n=2$ $l=1$ $F_9 = 1s^2, 2s^2, 2p^5$
c: $n=3$ $l=2$
d: $n=4$ $l=3$

MCQ: WOF set Quantum numbr represents s-block element?

a: $n=4$ $l=0(s)$ $m=0$ $s=+1/2$
b: $n=3$ $l=1(p)$ $m=+1$ $s=-1/2$
c: $n=3$ $l=2(d)$ $m=+2$ $s=-1/2$
d: $n=4$ $l=3(f)$ $m=+2$ $s=-1/2$

$K_{19} = [Ar]_{18}\ 4s^1$

→ correct set of Q.Nr for last ē of K?

MCQ: Atomic no. of X = 29. NO. of ē in s, p & d?

a: 8, 18, 10
b: 7, 12, 10
c: 12, 7, 10
d: 10, 7, 12

$X = Cu_{29} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^{10}$

MCQ:

Pair of Q-numb being zero value?

a: n, l
b: m, l
c: n, s
d: s, m

shell	n	total l value	Max l value	2l+1 Orbital	2(2l+1) electron
K	1	(0) s	0(s)	1	2e⁻
L	2	(0,1) s p	1(p)	3	6e⁻
M	3	(0,1,2) s p d	2(d)	5	10e⁻
N	4	(0,1,2,3) s p d f	3(f)	7	14e⁻

3: Magnetic Q-Num:

→ Orbital $m = l$ ✓
→ "m" $m < l$ ✓
→ $m = +l, 0, -l$ $m > l$ ✗

Describe:
→ Orientation of orbital
→ Magnetic properties of ē
→ Zeeman effect
→ Degenracy of orbitals

Total no of m-value = $2l + 1$

$l = 0$ s $m = 1$
$l = 1$ p $m = 3$
$l = 2$ d $m = 5$
$l = 3$ f $m = 7$

4: Spin Q-Num:

→ s
→ $s = +\frac{1}{2}, -\frac{1}{2}$

Shape of subshell:

→ s-subshell:
- Non directional
- Spherical
- n↑ size↑ E↑ : shape → same

1s 2s 3s 4s

size↑ E↑ n↑ : shape → same.

→ P-subshell: → Node plane

2p 3p 4p

n↑ size↑ E↑ : shape - same

- Dumbell
- Directiond
- Determine geometary of molecule.

→ Total loops = 6

- 2px 2py 2pz

→ n+l = same, shape = same, E = same, Orientation = diff.

- 2px 3py 4pz

→ n+l = diff, E = diff, size = diff, orient + shape = same.

→ d-subshell:
- → double dumbell or sausage
- → directional

dxy dyz dzx

planes

dx²-y² dz² (collar with dropes)

on axis

→ Total loops in d-subshell → 18

→ Total loops in dxy orbital → 4

Rules Of Electronic Config:

$1s^2$
$2s^2\ 2p^6$
$3s^2\ 3p^6\ 3d^{10}$
$4s^2\ 4p^6\ 4d^{10}\ 4f^{14}$
$5s^2\ 5p^6\ 5d^{10}\ 5f^{14}$

Auf-Bau Principle: $(n+l)$

→ Electron are filled from low E orbital to high energy orbital.

Energy of orbital $\propto n+l$

$n+l$

Sum = same (look at n)
4s 4+0 = 4
3p 3+1 = 4
3p < 4s

Sum = different
1s : 1+0 = 1
2s : 2+0 = 2
1s < 2s

$Cr_{24} = [Ar_{18}]_{+3}, 4s^2, 3d^5$
$Cu_{29} = [Ar]_{+2}, 4s^1, 3d^{10}$
] violates Auf Bau principle $(n+l)$ ✗

$C_6 = 1s^2, 2s^2, 2p^2$ (G.S)
$C_6 = 1s^2, 2s^1, 2p_x^1, 2p_y^1, 2p_z^1$ (E.S)

∴ n+l rule violates in excited state e.c

Pauli Exclusion Principle:

→ No two es in same orbital can have same value of four Quantum Numbers.

always 2 es (2px or 3dxy)

$He = 1s^2$

1st e: n=1, l=0, m=0, s = +1/2
2nd e: n=1, l=0, m=0, s = −1/2