

الباب الحادي عشر
التراكيب الإلكترونية للذرات والجدول الدوري

$$l = 0, 1, 2, \dots, (n-1) \quad : n-1$$

(l) s,p,d,f,g,...

$$l = 0, 1, 2, 3, 4, \dots$$

$$m_l = -l, \dots, 0, \dots, +l$$

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

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

Spin

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

m_s

() : $n = 1 \ 2 \ 3 \ 4$
 m_s m_l n
 ()
 $\pm \frac{1}{2}$ $\pm \frac{1}{2}$

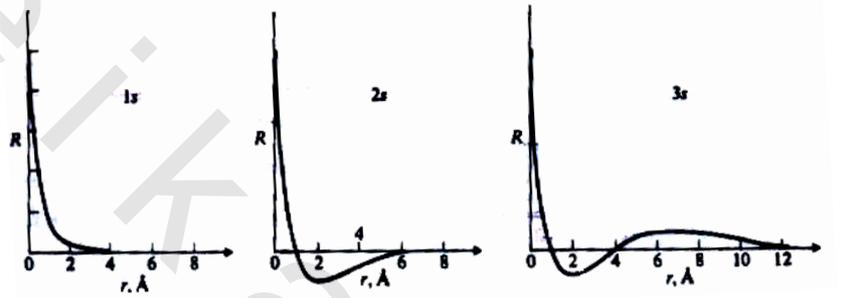
n	l	m_l	m_s	
1	0	0	$\pm \frac{1}{2}$	2
2	0	0	$\pm \frac{1}{2}$	2
2	1	-1, 0, +1	$\pm \frac{1}{2}$	6
3	0	0	$\pm \frac{1}{2}$	2
3	1	-1, 0, +1	$\pm \frac{1}{2}$	6
3	2	-2, -1, 0, +1, +2	$\pm \frac{1}{2}$	10
4	0	0	$\pm \frac{1}{2}$	2
4	1	-1, 0, +1	$\pm \frac{1}{2}$	6
4	2	-2, -1, 0, +1, +2	$\pm \frac{1}{2}$	10
4	3	-3, -2, -1, 0, +1, +2, +3	$\pm \frac{1}{2}$	14

أشكال مدارات وطاقات ذرة الهيدروجين :

r

$\phi \Theta$

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



3s 2s 1s r R

R

$n-1$

$n > 1$
) nodes

R

:

(

R

R^2

R^2

R

R^2

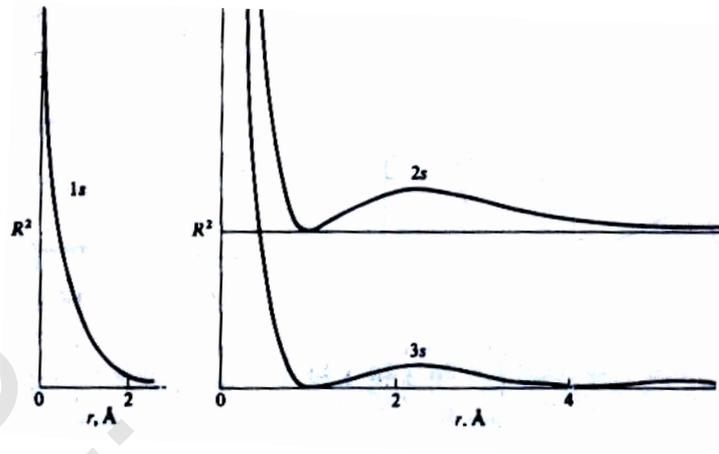
3s

2s

1s

r

. n = 1



3s

2s

1s

r

R^2

R^2

s

ϕ Θ

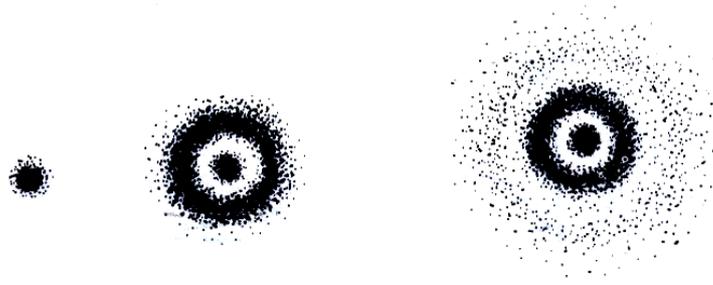
3s

2s

1s

3s

2s



3s 2s 1s

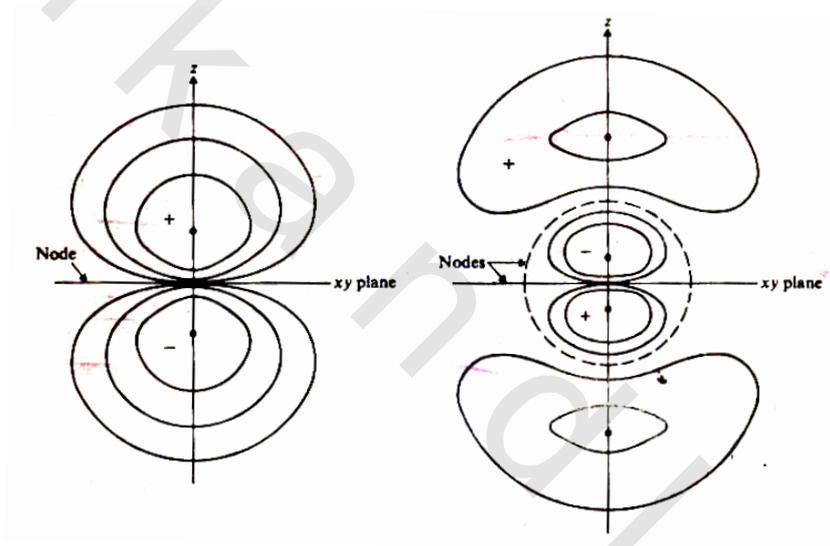
p

. S

Contour maps

:

p3 p2



3p 2p

p

) z

rotating

(

p

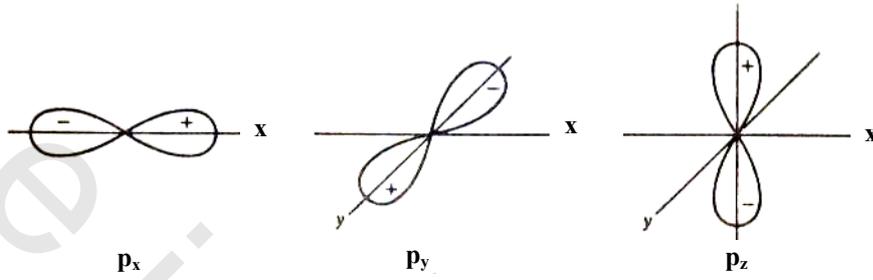
dumbbell

p_z p_y p_x

n

p

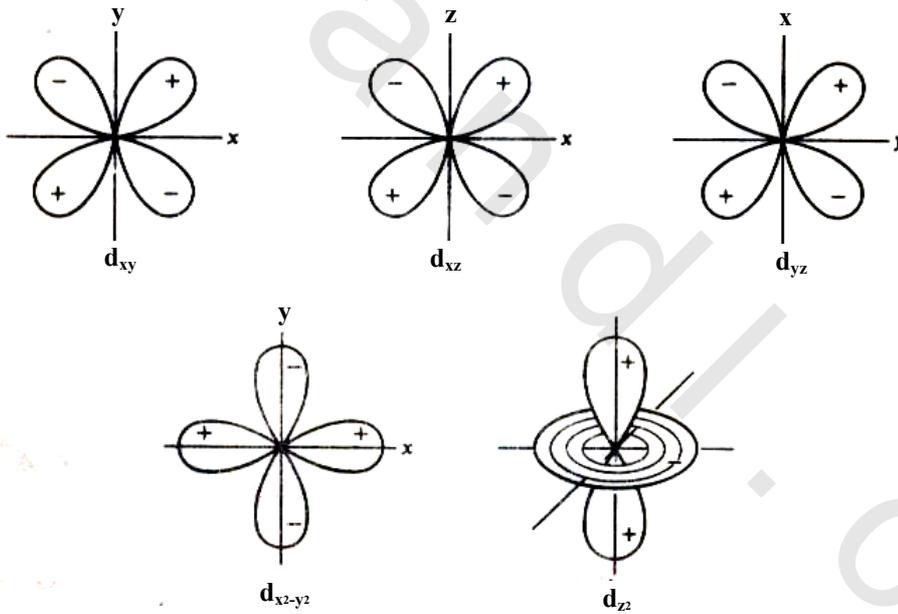
P



3d

d_{yz} d_{xz} d_{xy}

d_{yz} d_{xz} d_{xy}



$d_z^2 - y^2$ $d_z^2 - x^2$ xy $d_x^2 - y^2$ d_z^2 :
 torus xy

3d
 d p n
 ψ $-$ $+$
 $(z - y - x)$ (\quad)
 $)$ gerade ψ
 (even
 (odd $)$ ungerade
 P (gerade) d S
 (ungerade)

$$E = \frac{2\pi^2 m Z^2 e^4}{n^2 h^2} = 13.60 \frac{Z^2}{n^2} \text{ eV}$$

m E
 h e z
 ml l
 n n

$n = 1$ ()
. Is

. n

التشكيلات الإلكترونية للذرات والأيونات :

Li²⁺ He⁺ :

)

(-

4f 2p 1s

n +

n

1

Cu

. d⁹ 4s²3

d¹⁰ 4s3

l

3d 3P 3s

n l n l

s

f d p

p2

p2

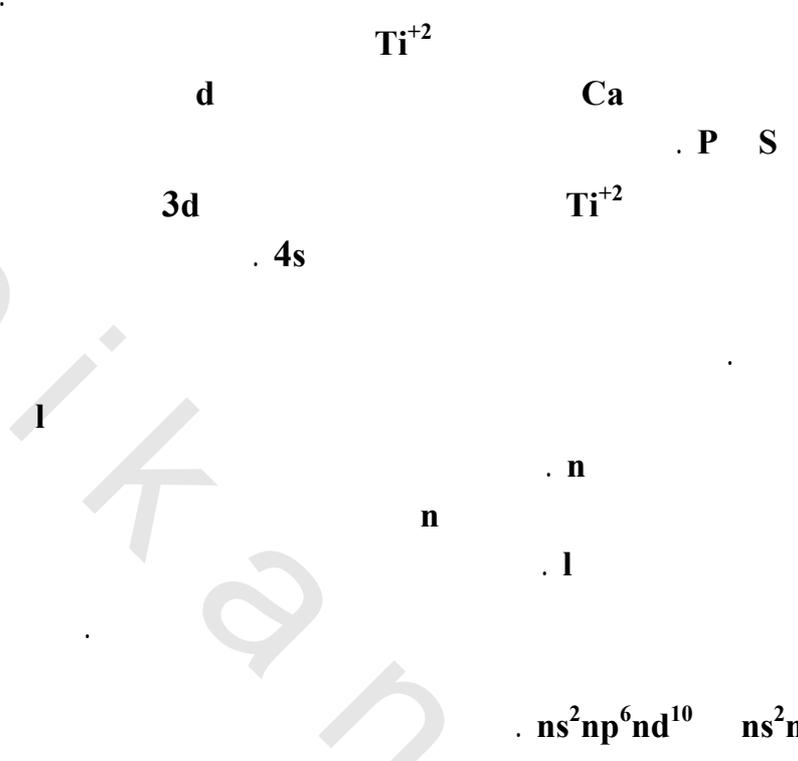
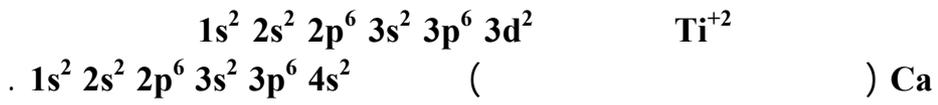


Hund

multiplicity

l,n

exchange energy



$ns^2 np^6 nd^{10}$ $ns^2 np^6$
 الجدول الدوري :

()

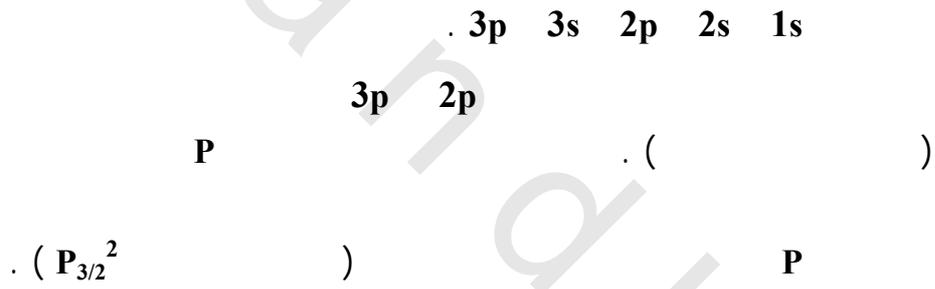
d

f

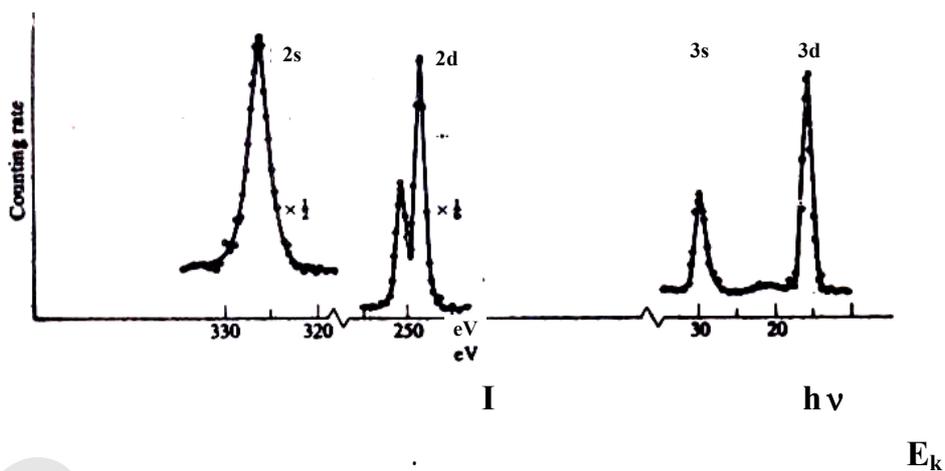
.()

() ()

اتجاهات جهد التأين :



$$h\nu = I + E_k \quad :$$



Level	I, eV
3p _{3/2}	15.759
3p _{1/2}	15.937
3s	29.24
2p _{3/2}	248.52
2p _{1/2}	250.55
2s	326.3
1s	3205.9



:



() ()

$$S = \sum_{n=1}^{\infty} \sum_{l=0}^{n-1} \sum_{m=-l}^l \frac{Z - S}{n^3} (Z - S)^2 n^2$$

$$S = \sum_{n=1}^{\infty} \sum_{l=0}^{n-1} \sum_{m=-l}^l \frac{Z - S}{n^3} (Z - S)^2 n^2$$

$$S = \sum_{n=1}^{\infty} \sum_{l=0}^{n-1} \sum_{m=-l}^l \frac{Z - S}{n^3} (Z - S)^2 n^2$$

$$S = \sum_{n=1}^{\infty} \sum_{l=0}^{n-1} \sum_{m=-l}^l \frac{Z - S}{n^3} (Z - S)^2 n^2$$

$$(1s^2 2s^2 2p^6 3s^2 3p), S = 2 \times 100 + 8 \times 0.85 + 2 \times 0.35 = 9.5$$

$$, Z - S = 13 - 9.5 = 3.5.$$

z-s

$$18 - 11.25 = 6.75$$

:

$$. 19 - 16.8 = 2.2 :$$

$$2 \times 1.0 + 8 \times 1.0 + 8 \times 0.85 = 16.8$$

)

(

. P

Mg Be

d

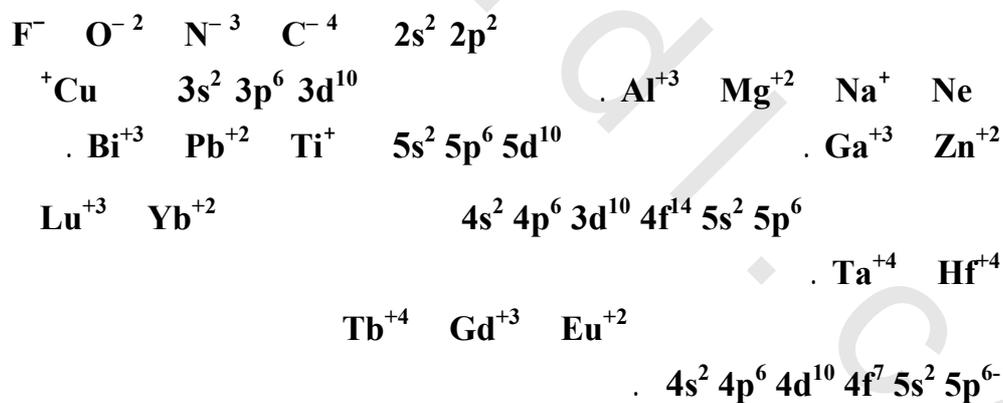
Cd Zn

s

P

np⁴

f d P



F⁻

F

()

:

l n

()

()

La

Hf

4f

Lu

. Pt

. Pd Zr

Rh Ru

Pt Ir Os Pd

* * *

"الأسئلة"

r -1

. r = 0.529 Å

. 3P -2

-3

-4

Dy⁺³ Ir⁺³ ³Cr⁺³ Sc⁺ S Al :

4d +2 -5

-6

-7

+2

-8

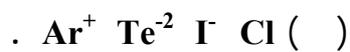
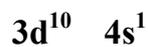
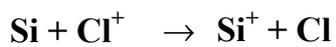
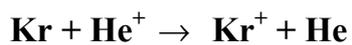
-9

. 1s² 2s² 2p⁶ 3p⁶ 3d¹⁰ 4s² 4p⁶ 4d⁴ 5s¹

-10

25

-11



*** * ***