

SERIES SPECTRALES DE L'ATOME D'HYDROGENE DE BOHR

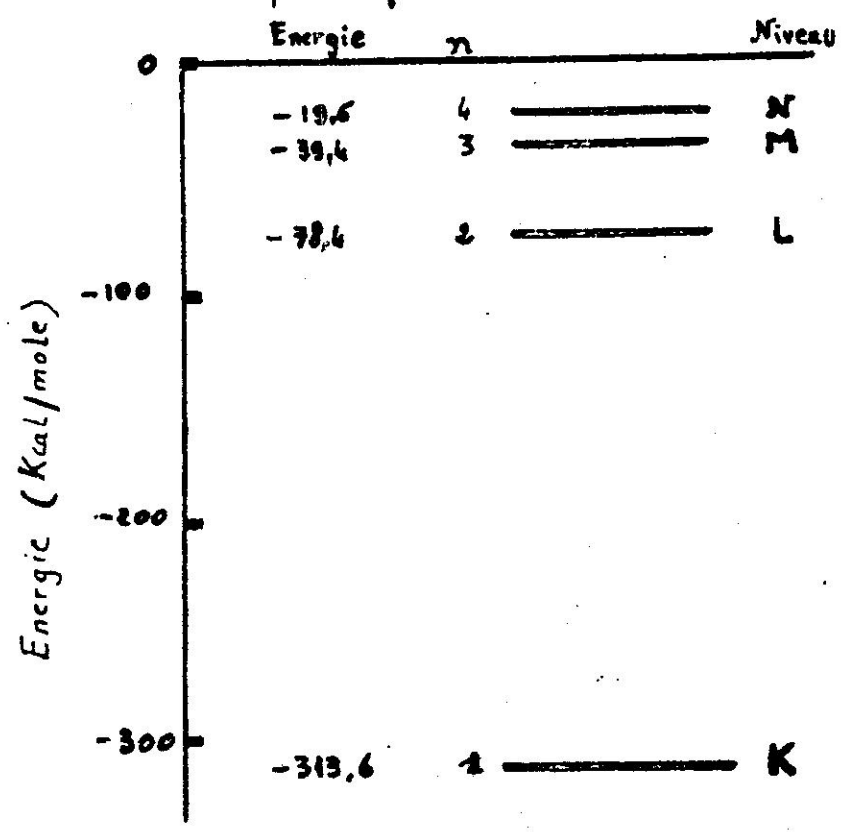
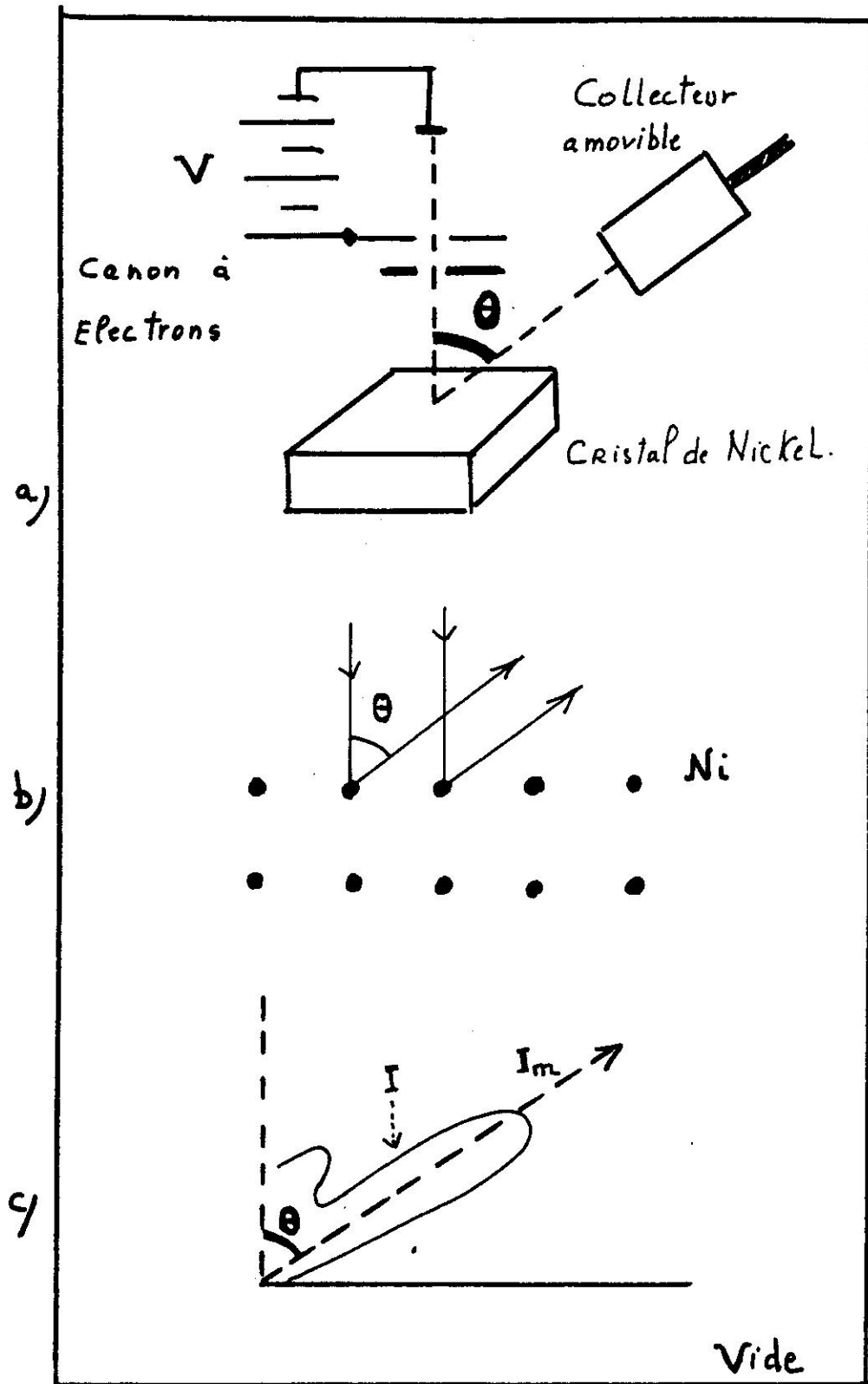


Diagramme des niveaux d'energie de l'atome d'Hydrogene
(23,053 Kcal/mole correspondent à 1eV)



EXPERIENCE de DAVISSON et GERMER

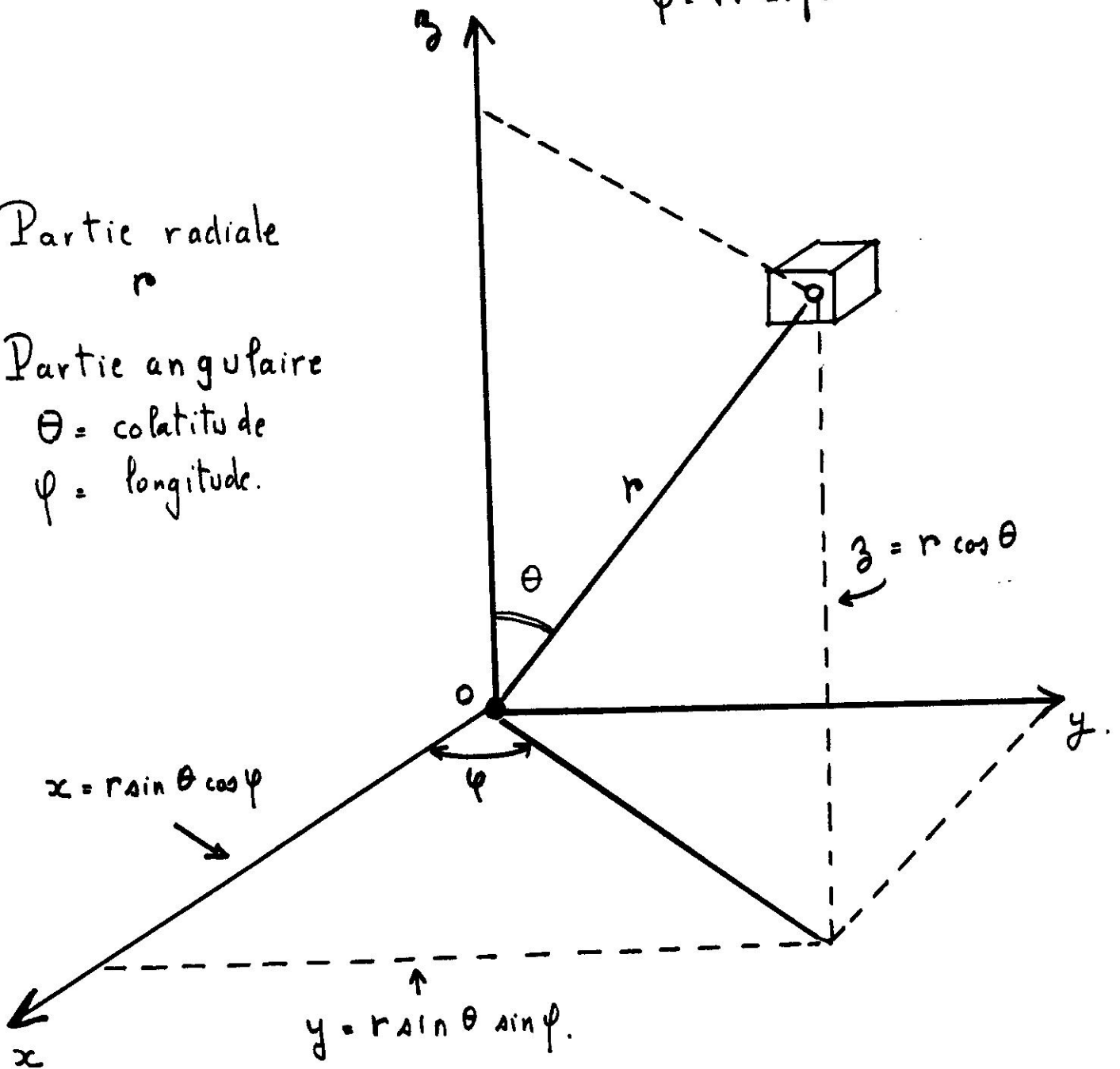
- a) Schema de montage
- b) Diffraction par les atomes du cristal
- c) Variation de l'intensité I des rayons diffractés

GRANDEUR Physique	Expression Classique	Opérateur
Position	x	$\hat{x} = x$
QUANTITE DE MOUVEMENT	$p_x = m v_x$	$\hat{p}_x = \frac{\hbar}{i} \frac{\partial}{\partial x}$
Energie Cinétique	$E_c = \frac{1}{2} m v^2$ $= \frac{1}{2m} (p_x^2 + p_y^2 + p_z^2)$	$\hat{E}_{c_x} = \frac{1}{2m} \frac{\hbar}{i} \frac{\partial}{\partial x} \left(\frac{\hbar}{i} \frac{\partial}{\partial x} \right)$ $= \frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2}$ $\hat{E}_c = -\frac{\hbar^2}{2m} \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} \right)$ $= -\frac{\hbar^2}{2m} \Delta$ <p>Δ, opérateur laplacien</p>
Energie Potentielle	$V(x, y, z)$	$\hat{V} = V$ consequence de la correspondance $\hat{x} = x$

$$\psi = r \cdot \theta \cdot \varphi.$$

Partie radiale
 r

Partie angulaire
 $\theta =$ colatitude
 $\varphi =$ longitude.



Relations entre coordonnées
cartésiennes et coordonnées Sphériques

Ψ_{nlm}

$R_{nl}(r)$

$\Theta_{lm}(\theta)$

$\Phi_m(\varphi)$

Nombres quantiques			Désignation de la fonction d'onde	Partie radiale	Partie angulaire
n	l	m	$\Psi_{n,l,m}$	$R(r)$	$\Phi(\varphi) \Theta(\theta)$
1	0	0	1s $\Psi_{100} =$	$2\left(\frac{Z}{a}\right)^{\frac{3}{2}} e^{-Zr/a}$	$\left(\frac{1}{4\pi}\right)^{\frac{1}{2}}$ ← indépendant de θ et φ
2	0	0	2s $\Psi_{200} =$	$\frac{1}{2\sqrt{2}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(2 - \frac{Zr}{a}\right) e^{-Zr/2a}$	$\left(\frac{1}{4\pi}\right)^{\frac{1}{2}}$
2	1	(-1)	$2p_x$ $\Psi_{21-1} =$	$\frac{1}{2\sqrt{6}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\frac{Zr}{a} e^{-Zr/2a}$	$\left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \sin\theta \cos\varphi$ $\left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \cos\theta$ $\left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \sin\theta \sin\varphi$
2	1	0	$2p_z$ $\Psi_{210} =$	$\frac{1}{2\sqrt{6}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\frac{Zr}{a} e^{-Zr/2a}$ ← idem	
2	1	(1)	$2p_y$ $\Psi_{211} =$	$\frac{1}{2\sqrt{6}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\frac{Zr}{a} e^{-Zr/2a}$	
3	0	0	3s	$\frac{2}{81\sqrt{3}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(27 - 18\frac{Zr}{a} + 2\left(\frac{Zr}{a}\right)^2\right) e^{-Zr/3a}$	$\left(\frac{1}{4\pi}\right)^{\frac{1}{2}}$ ← $\forall \theta \forall \varphi$
3	1	(-1)	$3p_x$	$\frac{4}{81\sqrt{6}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(6 - \frac{Zr}{a}\right) e^{-Zr/3a}$	$\left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \sin\theta \cos\varphi$
3	1	0	$3p_z$	$\frac{4}{81\sqrt{6}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(6 - \frac{Zr}{a}\right) e^{-Zr/3a}$	$\left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \cos\theta$
3	1	(1)	$3p_y$	$\frac{4}{81\sqrt{6}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(6 - \frac{Zr}{a}\right) e^{-Zr/3a}$	$\left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \sin\theta \sin\varphi$
3	2	(-2)	$3d_{xy}$	$\frac{4}{81\sqrt{30}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(\frac{Zr}{a}\right)^2 e^{-Zr/3a}$	$\frac{\sqrt{15}}{4\sqrt{\pi}} \sin^2\theta \sin 2\varphi$
3	2	(-1)	$3d_{yz}$	$\frac{4}{81\sqrt{30}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(\frac{Zr}{a}\right)^2 e^{-Zr/3a}$	$\frac{\sqrt{15}}{2\sqrt{\pi}} \sin\theta \cos\theta \sin\varphi$
3	2	0	$3d_{z^2}$	$\frac{4}{81\sqrt{30}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(\frac{Zr}{a}\right)^2 e^{-Zr/3a}$	$\frac{\sqrt{5}}{4\sqrt{\pi}} (3\cos^2\theta - 1)$
3	2	(1)	$3d_{xz}$	$\frac{4}{81\sqrt{30}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(\frac{Zr}{a}\right)^2 e^{-Zr/3a}$	$\frac{\sqrt{15}}{2\sqrt{\pi}} \sin\theta \cos\theta \cos\varphi$
3	2	(2)	$3d_{x^2-y^2}$	$\frac{4}{81\sqrt{30}}\left(\frac{Z}{a}\right)^{\frac{3}{2}}\left(\frac{Zr}{a}\right)^2 e^{-Zr/3a}$	$\frac{\sqrt{15}}{4\sqrt{\pi}} \sin^2\theta \cos 2\varphi$

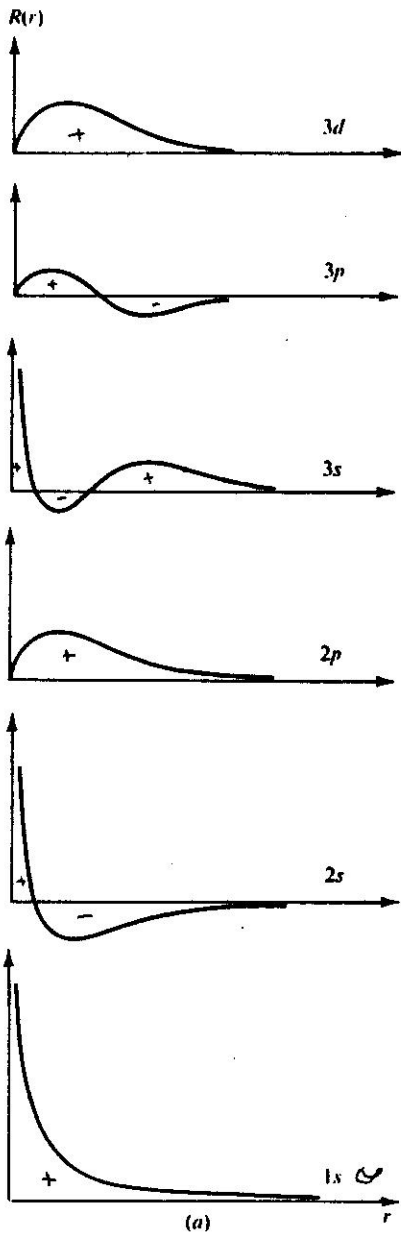
$a = \frac{\hbar^2}{4\pi^2 m e^2} = 0,529 \text{ \AA}$
rayon de Bohr

ORBITALES de L'Atome d'Hydrogene et des Hydrogenoides

Fonctions d'onde Ψ_{nlm}

(Z nombre de charges nucleaires egal a 1 pour L'Hydrogene)

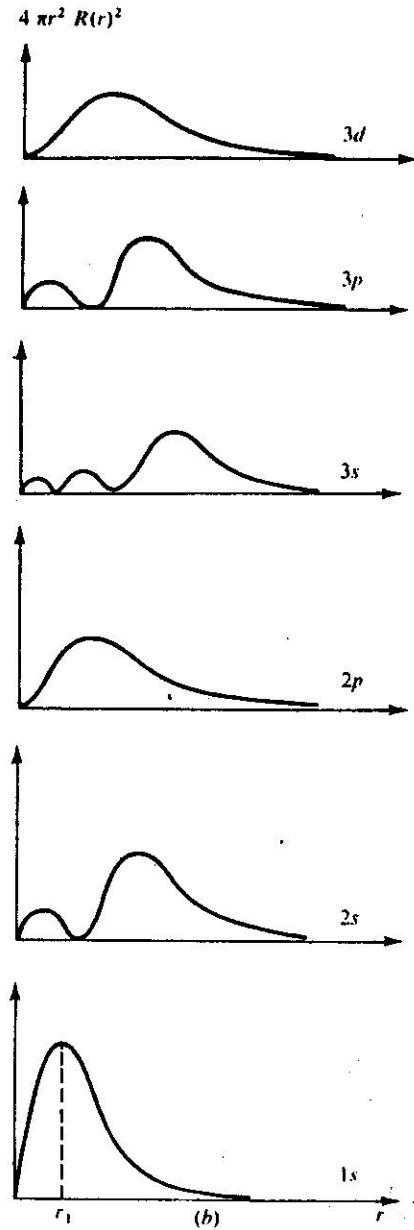
a/



Fonctions de distribution
Radiale

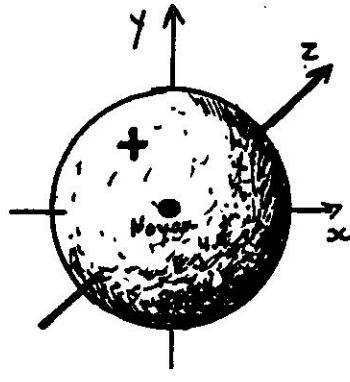
$$R(r) \quad \psi$$

b/ Fiche 5

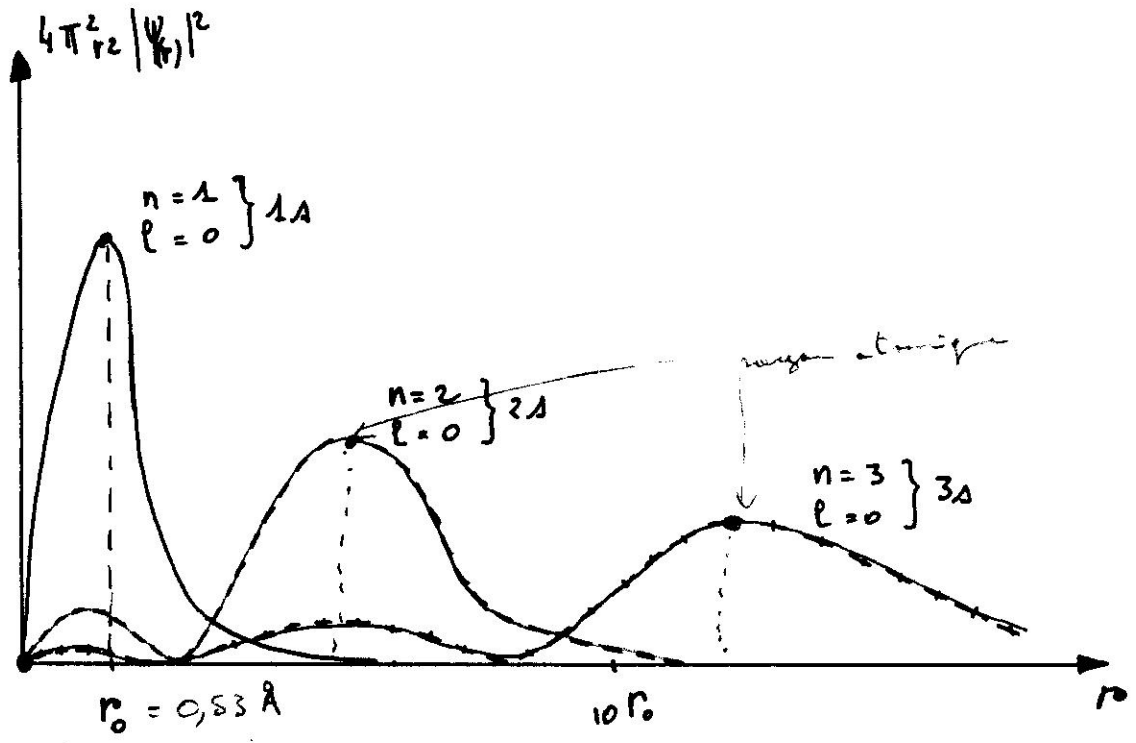
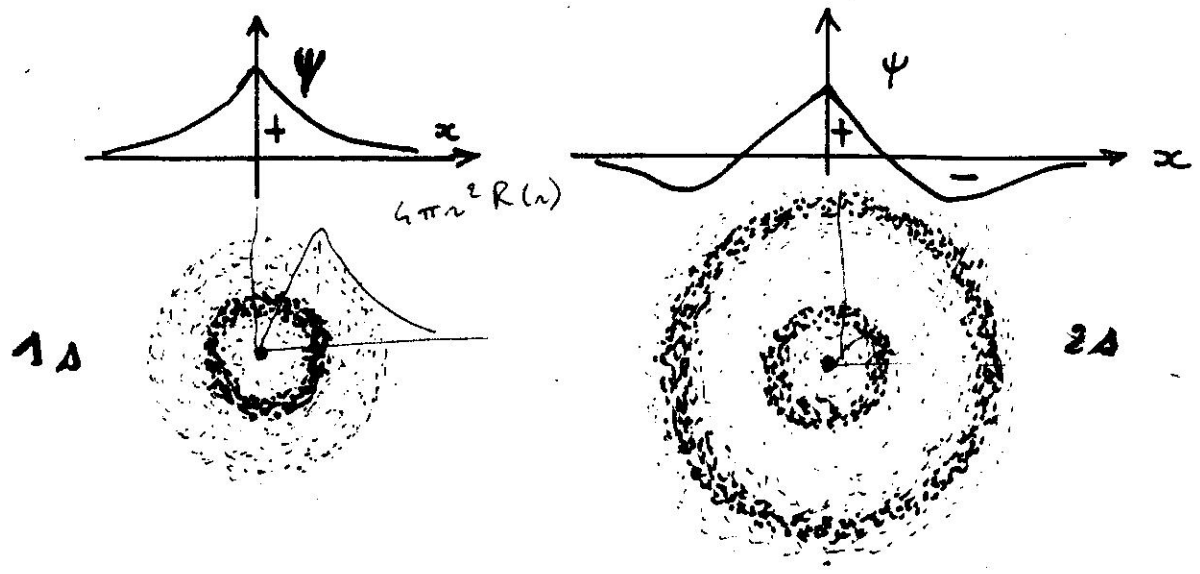


Fonctions de Probabilité
Radiale

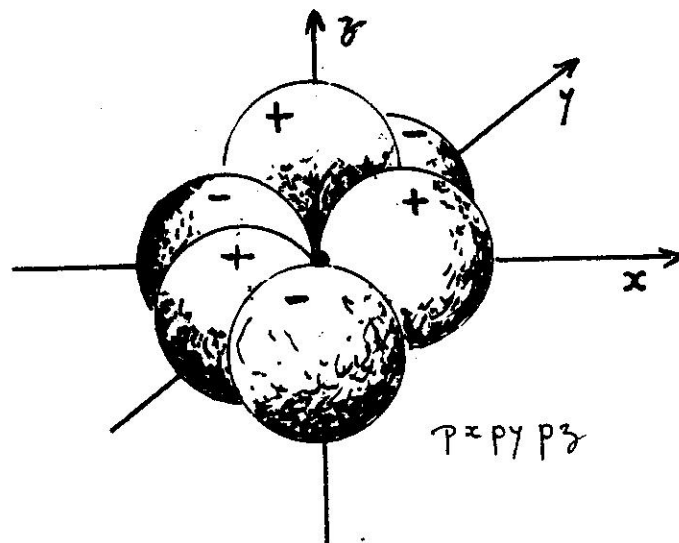
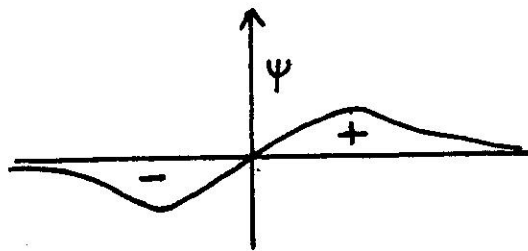
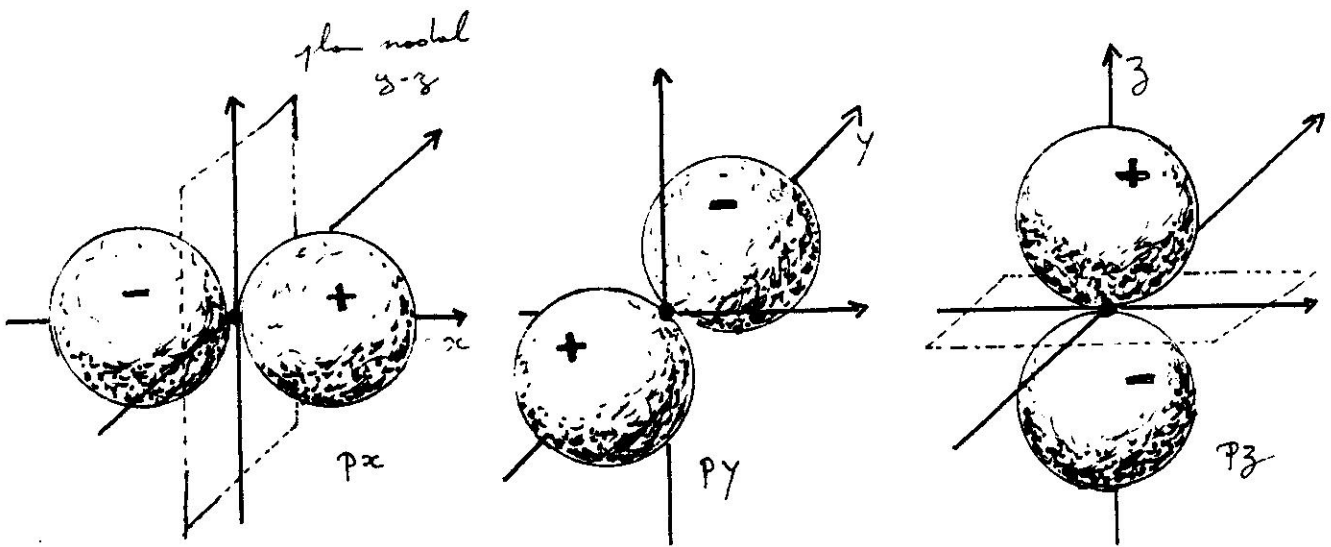
$$4\pi r^2 [R(r)]^2$$



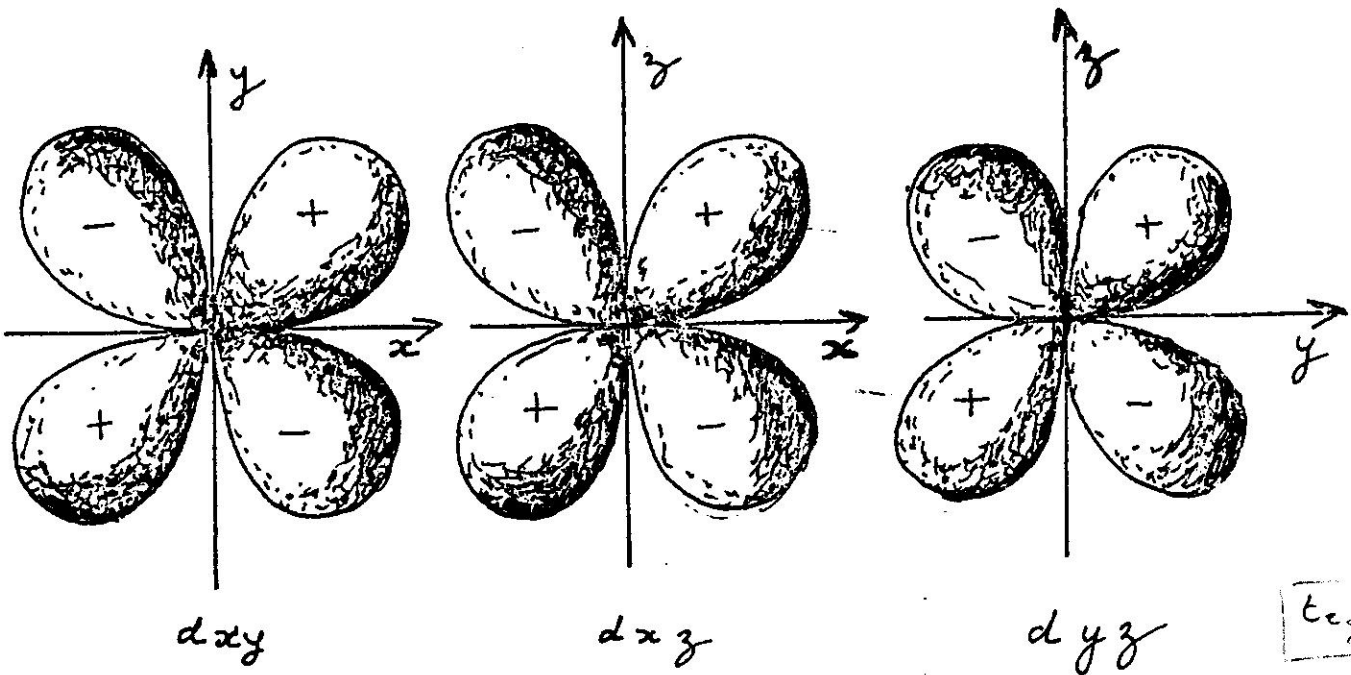
ORBITALE S



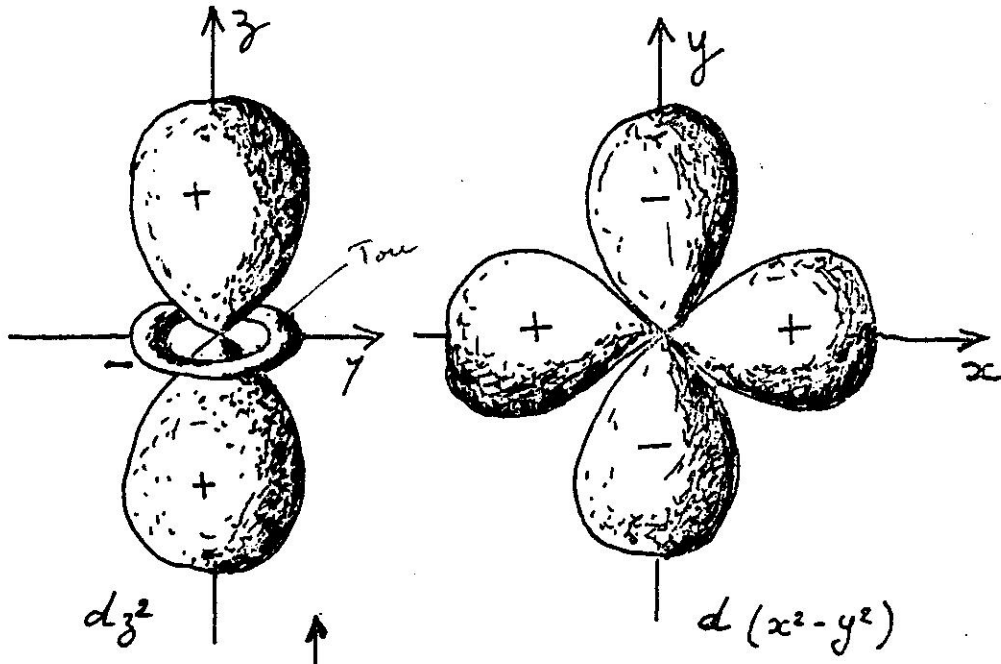
Densite de Probabilite de presence Radiale.



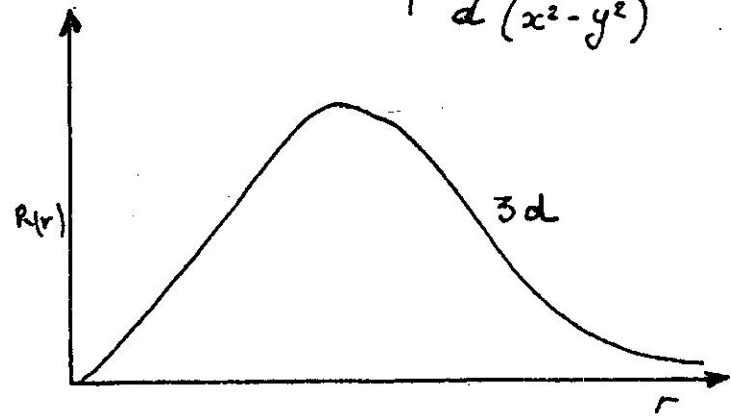
ORBITALES **P**



e_g



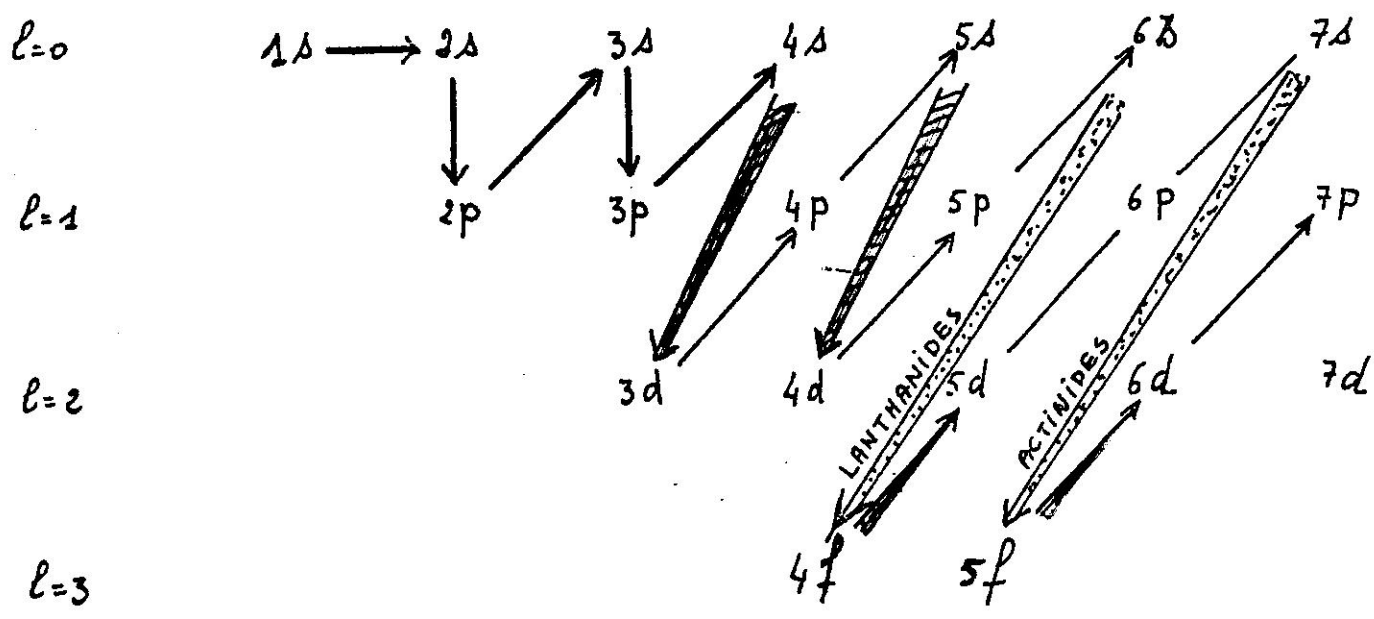
e_g



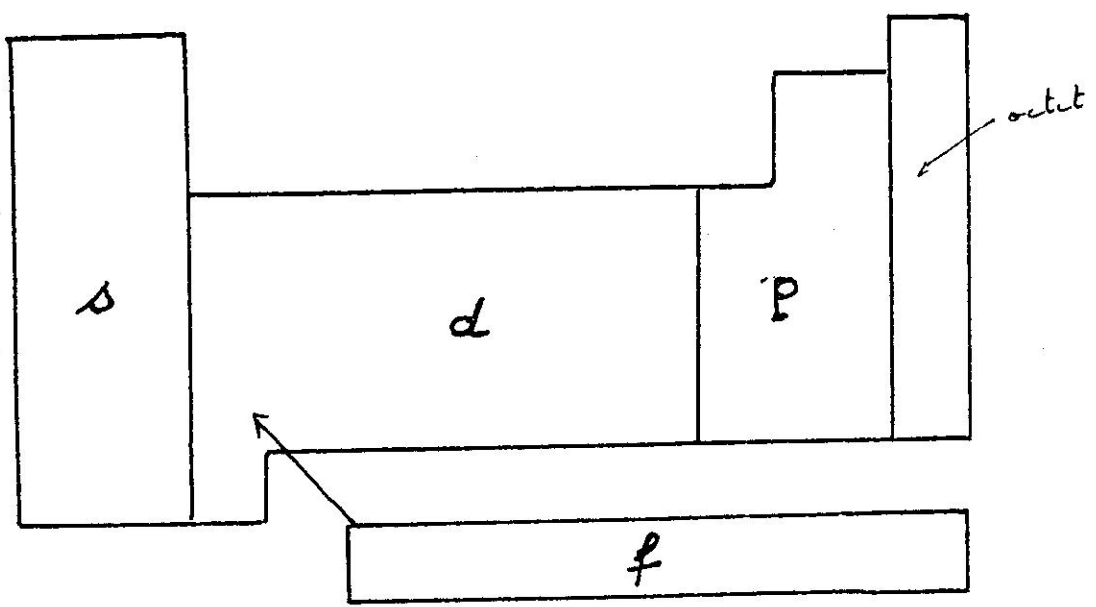
ORBITALES D

FONCTION RADIALE pour ORBITALE $3d$

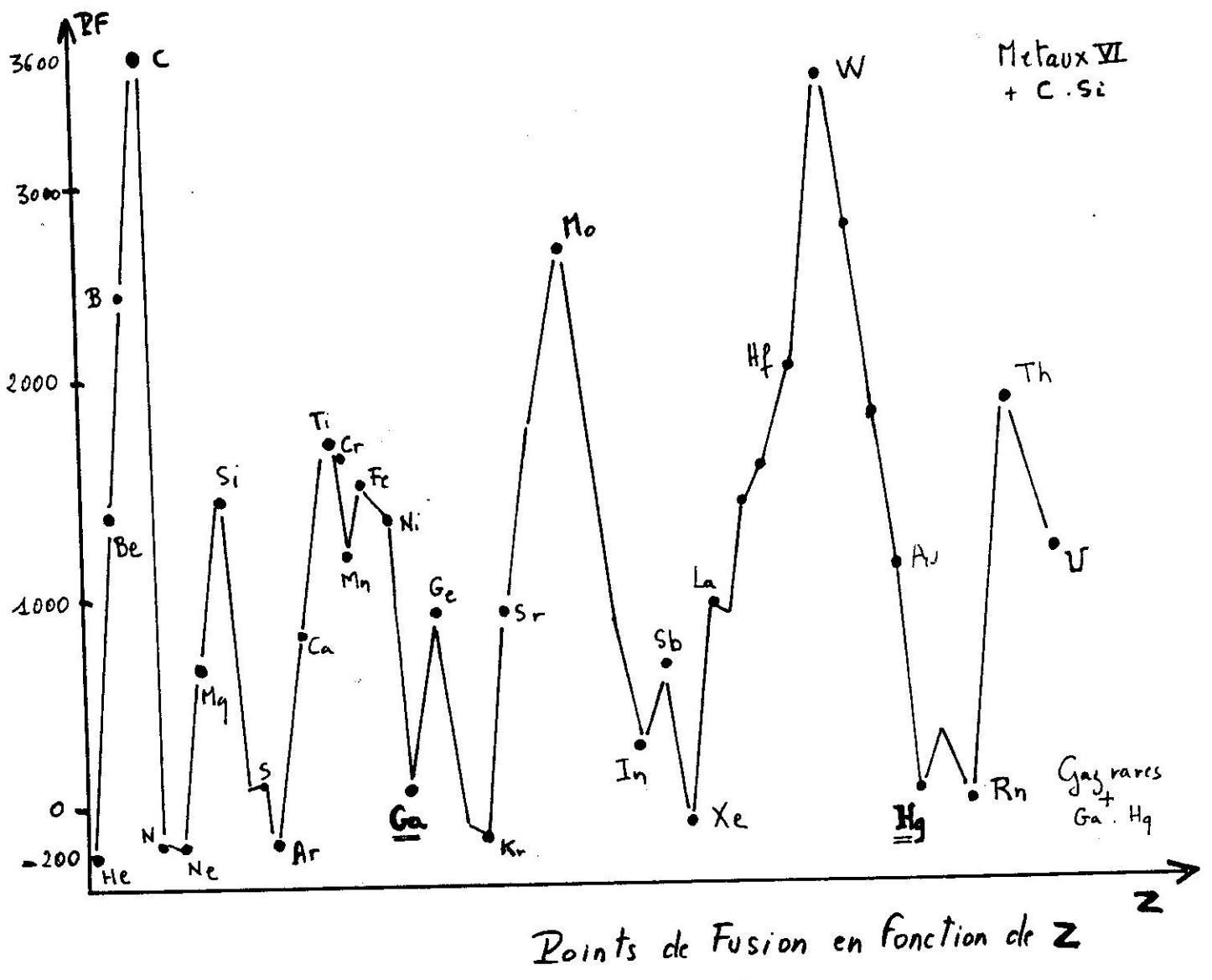
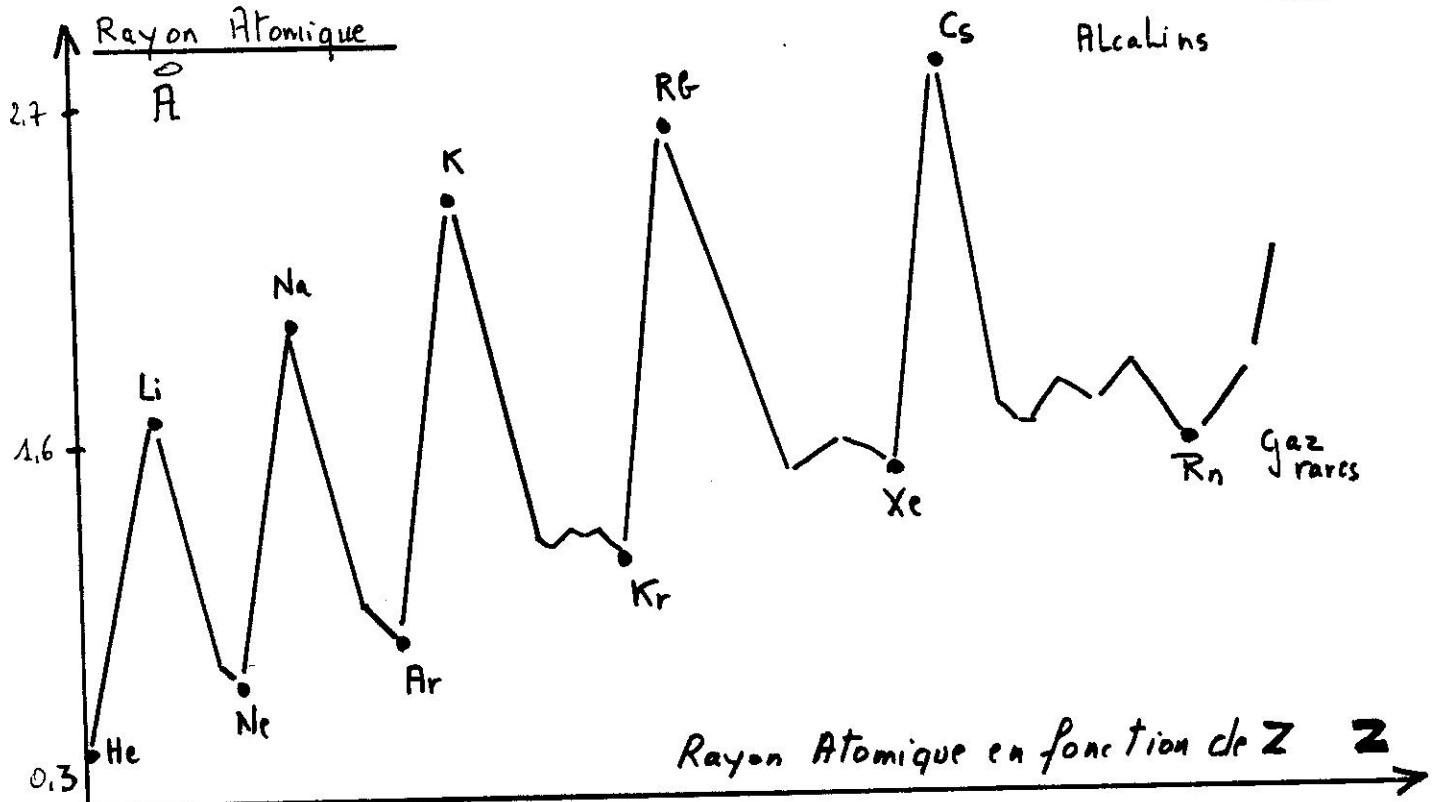
	K	L	M	N	O	P	Q
n	1	2	3	4	5	6	7

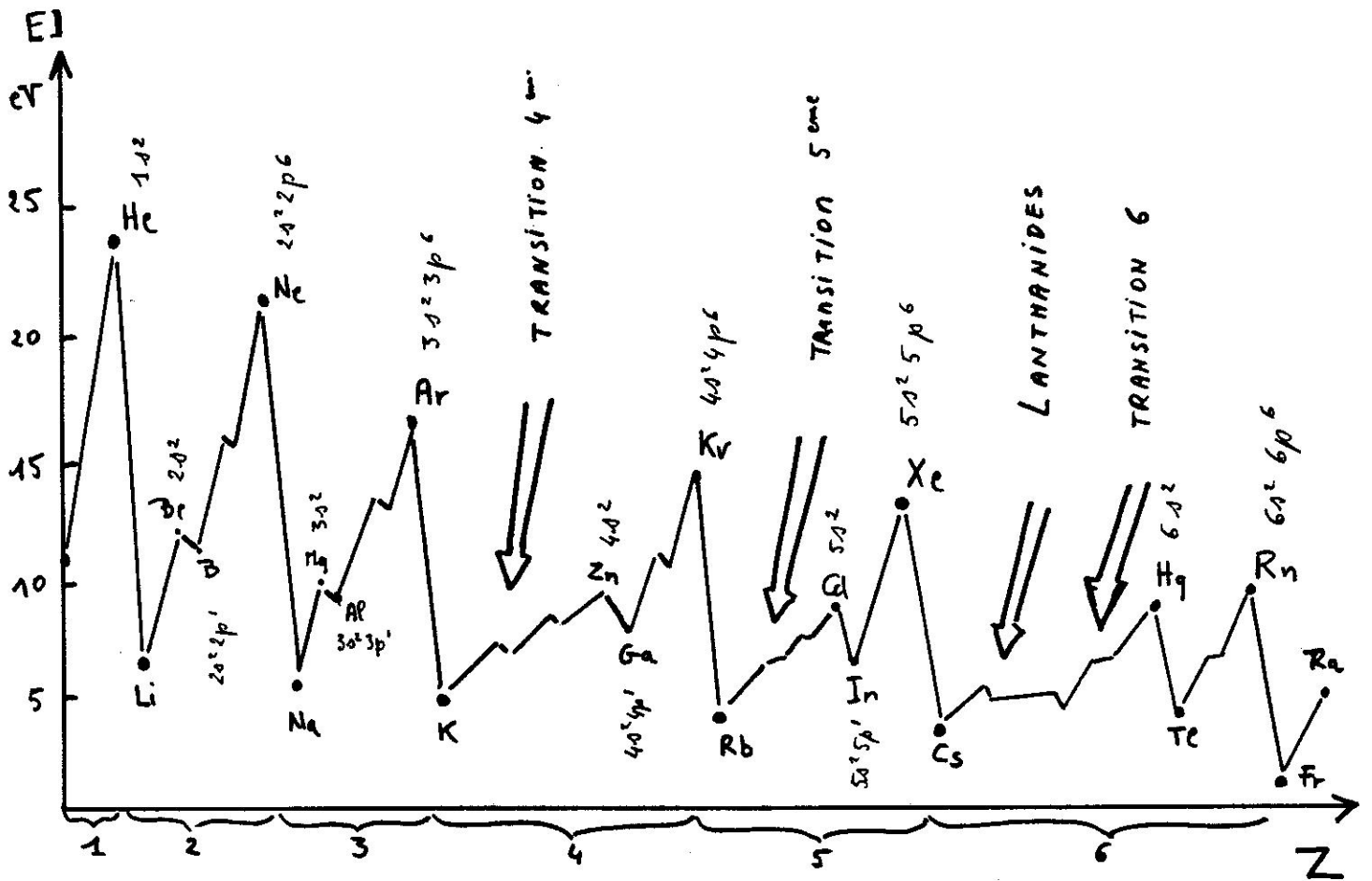


———→ REPRESENTATIFS
 ▨▨▨▨→ DE TRANSITIONS PROFONDES
 ▤▤▤▤→ DE TRANSITIONS PROFONDES
 - REGLE DE KLECHKOWSKI

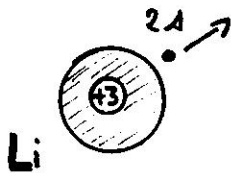


- TABLEAU PERIODIQUE ET NATURE DES ORBITALES remplies

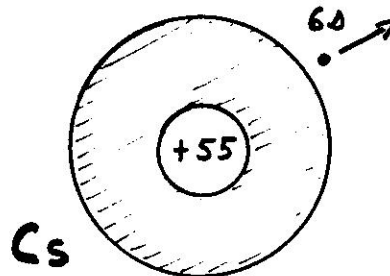




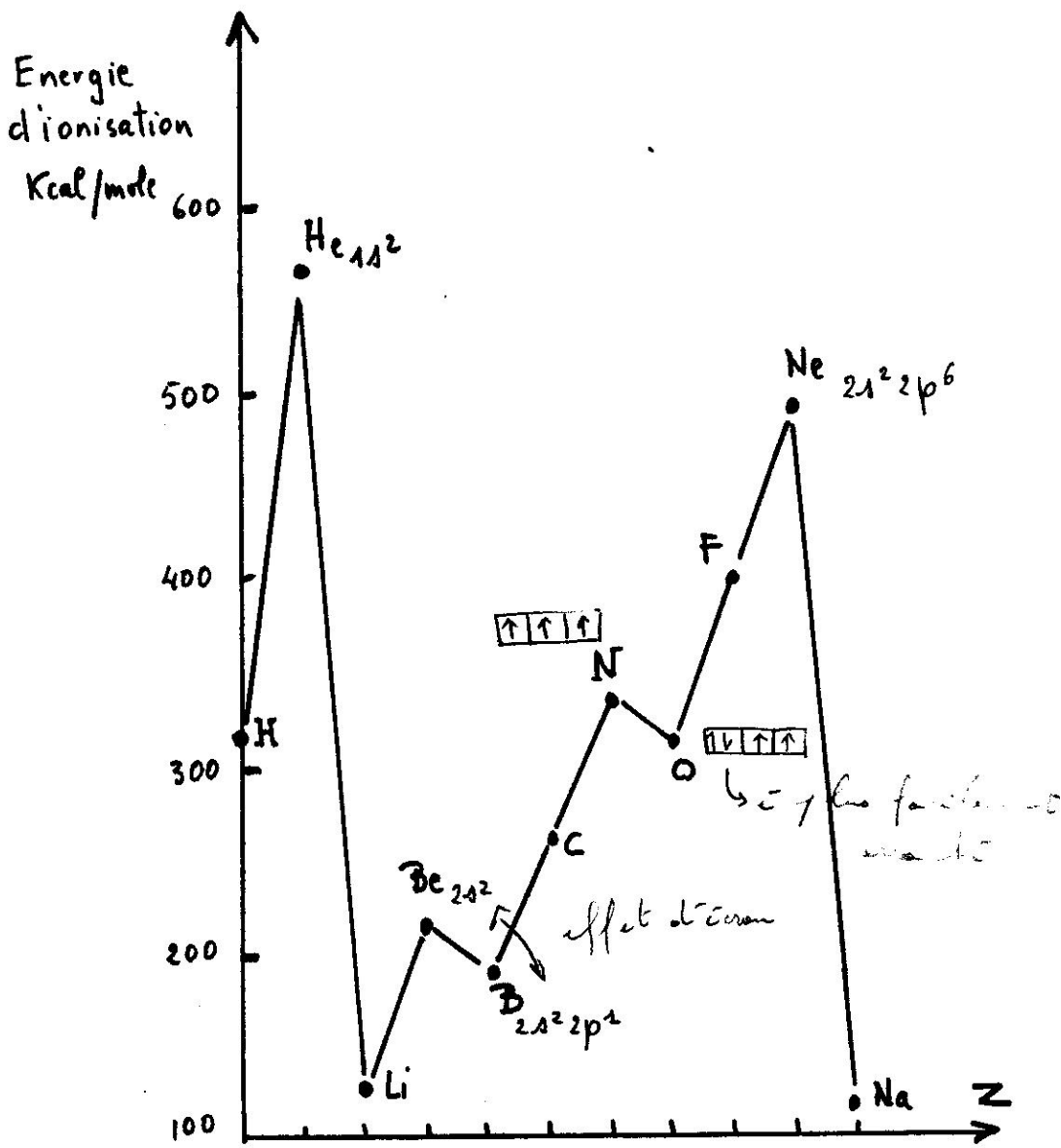
POTENTIEL de 1^{er} IONISATION



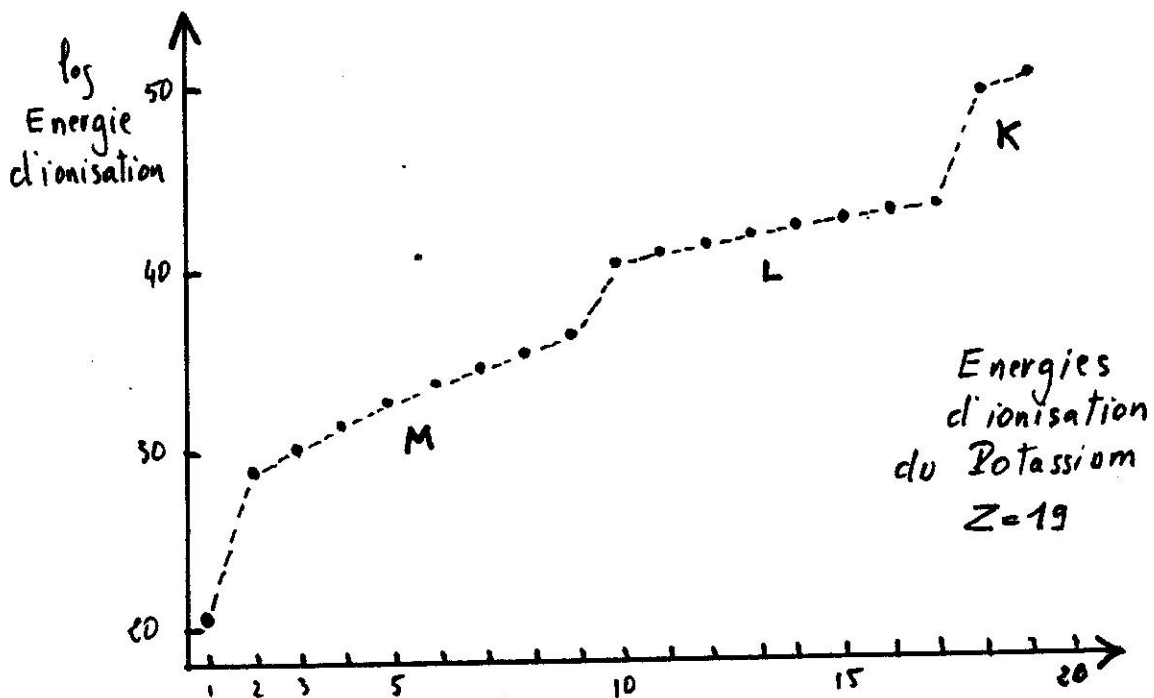
Effet d'écran des électrons
1s²



Effet d'écran des électrons
1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁶ 5s² 4d¹⁰ 5p⁶



Première energie d'ionisation d'atomes légers



Energies d'ionisation du Potassium $Z=19$

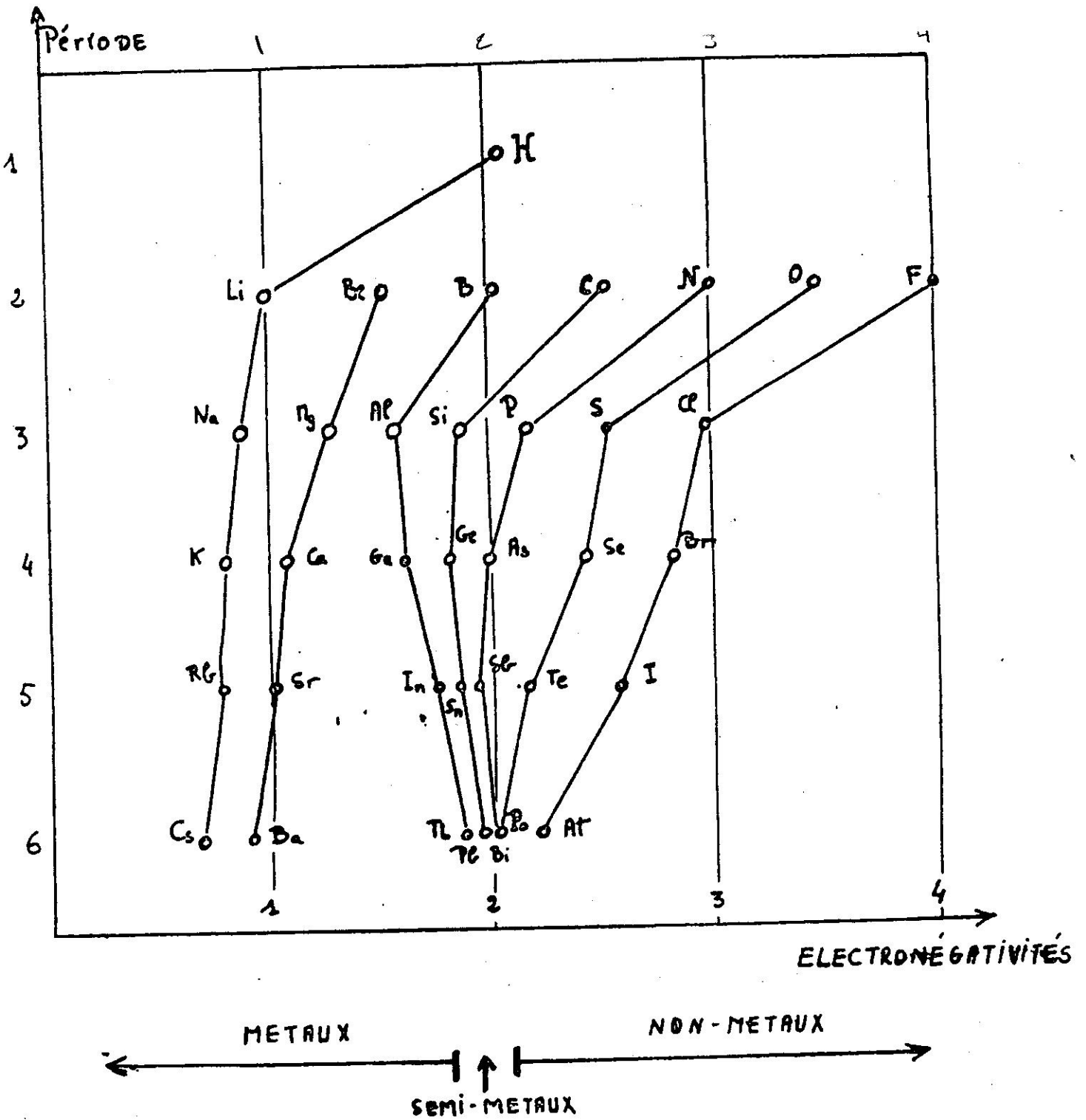


TABLEAU DES ELECTRONEGATIVITÉS

TABLEAU 1

Tableau périodique des éléments

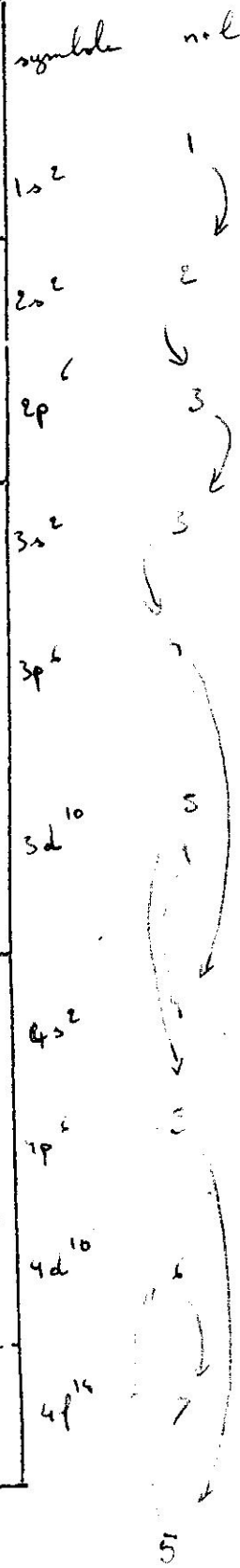
VIII B																	
0																	
2 He $1s^2$																	
10 Ne $2s^2 2p^6$																	
18 Ar $3s^2 3p^6$																	
36 Kr $4s^2 4p^6$																	
54 Xe $5s^2 5p^6$																	
86 Rn $6s^2 6p^6$																	
Non-métaux : à droite du trait plein « escalier ».																	
VIII B VII B VI B V B IV B III B																	
5 B $2s^2 2p^1$ 6 C $2s^2 2p^2$ 7 N $2s^2 2p^3$ 8 O $2s^2 2p^4$ 9 F $2s^2 2p^5$ 10 Ne $2s^2 2p^6$																	
13 Al $3s^2 3p^1$ 14 Si $3s^2 3p^2$ 15 P $3s^2 3p^3$ 16 S $3s^2 3p^4$ 17 Cl $3s^2 3p^5$ 18 Ar $3s^2 3p^6$																	
31 Ga $4s^2 4p^1$ 32 Ge $4s^2 4p^2$ 33 As $4s^2 4p^3$ 34 Se $4s^2 4p^4$ 35 Br $4s^2 4p^5$ 36 Kr $4s^2 4p^6$																	
49 In $5s^2 5p^1$ 50 Sn $5s^2 5p^2$ 51 Sb $5s^2 5p^3$ 52 Te $5s^2 5p^4$ 53 I $5s^2 5p^5$ 54 Xe $5s^2 5p^6$																	
67 Ho $4f^{14} 6s^2$ 68 Er $4f^{14} 6s^2$ 69 Tm $4f^{14} 6s^2$ 70 Yb $4f^{14} 6s^2$ 71 Lu $4f^{14} 5d^1 6s^2$																	
81 Tl $6s^2 6p^1$ 82 Pb $6s^2 6p^2$ 83 Bi $6s^2 6p^3$ 84 Po $6s^2 6p^4$ 85 At $6s^2 6p^5$ 86 Rn $6s^2 6p^6$																	
99 Es $5f^{14} 7s^2$ 100 Fm $5f^{14} 7s^2$ 101 Md $5f^{14} 7s^2$ 102 No $5f^{14} 7s^2$ 103 Lw $5f^{14} 6d^1 7s^2$																	
Éléments de transition																	
VIII IB IIB																	
26 Fe $3d^6 4s^2$ 27 Co $3d^7 4s^2$ 28 Ni $3d^8 4s^2$ 29 Cu $3d^{10} 4s^1$ 30 Zn $3d^{10} 4s^2$																	
44 Ru $4d^8 5s^1$ 45 Rh $4d^9 5s^1$ 46 Pd $(4d^{10})$ 47 Ag $4d^{10} 5s^1$ 48 Cd $4d^{10} 5s^2$																	
62 Sm $4f^6 6s^2$ 63 Eu $4f^7 6s^2$ 64 Gd $4f^7 5d^1 6s^2$ 65 Tb $4f^9 6s^2$ 66 Dy $4f^{10} 6s^2$																	
76 Os $5d^6 6s^2$ 77 Ir $5d^7 6s^1$ 78 Pt $5d^9 6s^1$ 79 Au $5d^{10} 6s^1$ 80 Hg $5d^{10} 6s^2$																	
94 Pu $5f^6 7s^2$ 95 Am $5f^7 7s^2$ 96 Cm $5f^7 6d^1 7s^2$ 97 Bk $5f^9 6d^1 7s^2$ 98 Cf $5f^{10} 7s^2$																	
VIII A VII A VI A V A IV A III A																	
12 Mg $3s^2$ 19 K $4s^1$ 20 Ca $4s^2$ 21 Sc $3d^1 4s^2$ 22 Ti $3d^2 4s^2$ 23 V $3d^3 4s^2$ 24 Cr $3d^5 4s^1$ 25 Mn $3d^5 4s^2$ 26 Fe $3d^6 4s^2$ 27 Co $3d^7 4s^2$ 28 Ni $3d^8 4s^2$ 29 Cu $3d^{10} 4s^1$ 30 Zn $3d^{10} 4s^2$																	
38 Sr $5s^2$ 39 Y $4d^1 5s^2$ 40 Zr $4d^2 5s^2$ 41 Nb $4d^4 5s^1$ 42 Mo $4d^5 5s^1$ 43 Tc $4d^5 5s^2$ 44 Ru $4d^7 5s^1$ 45 Rh $4d^8 5s^1$ 46 Pd $(4d^{10})$ 47 Ag $4d^{10} 5s^1$ 48 Cd $4d^{10} 5s^2$																	
56 Ba $6s^2$ 57 La $5d^1 6s^2$ 58 Ce $4f^1 6s^2$ 59 Pr $4f^3 6s^2$ 60 Nd $4f^4 6s^2$ 61 Pm $4f^5 6s^2$ 62 Sm $4f^6 6s^2$ 63 Eu $4f^7 6s^2$ 64 Gd $4f^7 5d^1 6s^2$ 65 Tb $4f^9 6s^2$ 66 Dy $4f^{10} 6s^2$																	
88 Ra $7s^2$ 89 Ac $6d^1 7s^2$ 90 Th $6d^2 7s^2$ 91 Pa $5f^2 6d^1 7s^2$ 92 U $5f^3 6d^1 7s^2$ 93 Np $5f^4 7s^2$ 94 Pu $5f^6 7s^2$ 95 Am $5f^7 7s^2$ 96 Cm $5f^7 6d^1 7s^2$ 97 Bk $5f^9 6d^1 7s^2$ 98 Cf $5f^{10} 7s^2$																	
87 Fr $7s^1$ 88 Ra $7s^2$ 89 Ac $6d^1 7s^2$ 90 Th $6d^2 7s^2$ 91 Pa $5f^2 6d^1 7s^2$ 92 U $5f^3 6d^1 7s^2$ 93 Np $5f^4 7s^2$ 94 Pu $5f^6 7s^2$ 95 Am $5f^7 7s^2$ 96 Cm $5f^7 6d^1 7s^2$ 97 Bk $5f^9 6d^1 7s^2$ 98 Cf $5f^{10} 7s^2$																	

(1) Symboles: Zn : solide, He : gaz, Fr : liquide, * blanc * obtenu par synthèse (Ex : Tc).

Elément	Symbole	Z	1s	2s2p	3s3p3d	4s4p4d4f	5s5p5d5f	6s6p6d	7s
Tellure	Te	52	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Iode	I	53	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Xénon	Xe	54	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Césium	Cs	55	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Baryum	Ba	56	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Lanthan	La	57	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Cérium	Ce	58	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Praseodyme	Pr	59	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Neodyme	Nd	60	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Protactinium	Pa	61	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Uranium	U	62	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Néptunium	Np	63	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Plutonium	Pu	64	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Américium	Am	65	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Curium	Cm	66	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Berkélium	Bk	67	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Californium	Cf	68	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Einsteinium	Ei	69	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Fermium	Fm	70	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Mendelev	Md	71	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Ununbium	Uu	72	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Nobelium	Nm	73	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Thallium	Tl	81	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Plomb	Pb	82	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Bismuth	Bi	83	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Polonium	Po	84	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Astato	At	85	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Radon	Rn	86	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Francium	Fr	87	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Radium	Ra	88	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Actinium	Ac	89	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Thorium	Th	90	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Protoactinium	Pa	91	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Uranium	U	92	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Néptunium	Np	93	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Plutonium	Pu	94	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Américium	Am	95	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Curium	Cm	96	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Berkélium	Bk	97	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Californium	Cf	98	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Einsteinium	Ei	99	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Fermium	Fm	100	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Mendelev	Md	101	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Ununbium	Uu	102	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2
Nobelium	Nm	103	2	2,6	2,6,10	2,6,10	2,6,10	2,6,10	2

Elément	Symbole	Z	1s	2s2p	3s3p3d	4s4p4d4f	5s5p5d5f	6s6p6d	7s
Hydrogène	H	1	1						
Hélium	He	2	2						
Lithium	Li	3	2	1					
Béryllium	Be	4	2	2					
Bore	B	5	2	2,1					
Carbone	C	6	2	2,2					
Azote	N	7	2	2,3					
Oxygène	O	8	2	2,4					
Fluore	F	9	2	2,5					
Néon	Ne	10	2	2,6					
Sodium	Na	11	2	2,6	1				
Magnésium	Mg	12	2	2,6	2				
Aluminium	Al	13	2	2,6	2,1				
Silicium	Si	14	2	2,6	2,2				
Phosphore	P	15	2	2,6	2,3				
Soufre	S	16	2	2,6	2,4				
Chlore	Cl	17	2	2,6	2,5				
Argon	A	18	2	2,6	2,6				
Potassium	K	19	2	2,6	2,6	1			
Calcium	Ca	20	2	2,6	2,6	2			
Scandium	Sc	21	2	2,6	2,6,1	2			
Titane	Ti	22	2	2,6	2,6,2	2			
Vanadium	V	23	2	2,6	2,6,3	2			
Chrome	Cr	24	2	2,6	2,6,5	1			
Manganèse	Mn	25	2	2,6	2,6,5	2			
Fer	Fe	26	2	2,6	2,6,6	2			
Cobalt	Co	27	2	2,6	2,6,7	2			
Nickel	Ni	28	2	2,6	2,6,8	2			
Cuivre	Cu	29	2	2,6	2,6,10	1			
Zinc	Zn	30	2	2,6	2,6,10	2			
Gallium	Ga	31	2	2,6	2,6,10	2,1			
Germanium	Ge	32	2	2,6	2,6,10	2,2			
Arsenic	As	33	2	2,6	2,6,10	2,3			
Sélénium	Se	34	2	2,6	2,6,10	2,4			
Brome	Br	35	2	2,6	2,6,10	2,5			
Krypton	Kr	36	2	2,6	2,6,10	2,6			
Rubidium	Rb	37	2	2,6	2,6,10	2,6	1		
Strontium	Sr	38	2	2,6	2,6,10	2,6	2		
Yttrium	Y	39	2	2,6	2,6,10	2,6,1	2		
Zirconium	Zr	40	2	2,6	2,6,10	2,6,2	2		
Niobium	Nb	41	2	2,6	2,6,10	2,6,4	1		
Molibdène	Mo	42	2	2,6	2,6,10	2,6,5	1		
Technétium	Tc	43	2	2,6	2,6,10	2,6,5	2		
Ruthénium	Ru	44	2	2,6	2,6,10	2,6,7	1		
Rhodium	Rh	45	2	2,6	2,6,10	2,6,8	1		
Palladium	Pd	46	2	2,6	2,6,10	2,6,10	1		
Argent	Ag	47	2	2,6	2,6,10	2,6,10	1		
Cadmium	Cd	48	2	2,6	2,6,10	2,6,10	2		
Rodium	Ru	59	2	2,6	2,6,10	2,6,10	2,1		
Fluor	F	30	2	2,6	2,6,10	2,6,10	2,2		
Antimoine	Sb	51	2	2,6	2,6,10	2,6,10	2,3		

n	l (n-1)	m (2l+1 valeurs)	s	MAXIMUM d'électrons $2n^2$
K 1	0	0	$\pm 1/2$	2
L 2	0	0	»	2
	1	1	»	6
		0 -1	» »	
M 3	0	0	»	2
	1	1	»	6
		0	»	
		-1	»	
	2	2	»	10
		1	»	
0 -1 -2		» » »		
N 4	0	0	»	2
	1	0 ± 1	» » »	6
		2	0, $\pm 1, \pm 2$	» » » » »
	3	0, $\pm 1, \pm 2, \pm 3$	» » » » » » »	14



DISTRIBUTION DES ELECTRONS DANS LES NIVEAUX D'ENERGIE D'APRES LE PRINCIPE DE PAULI

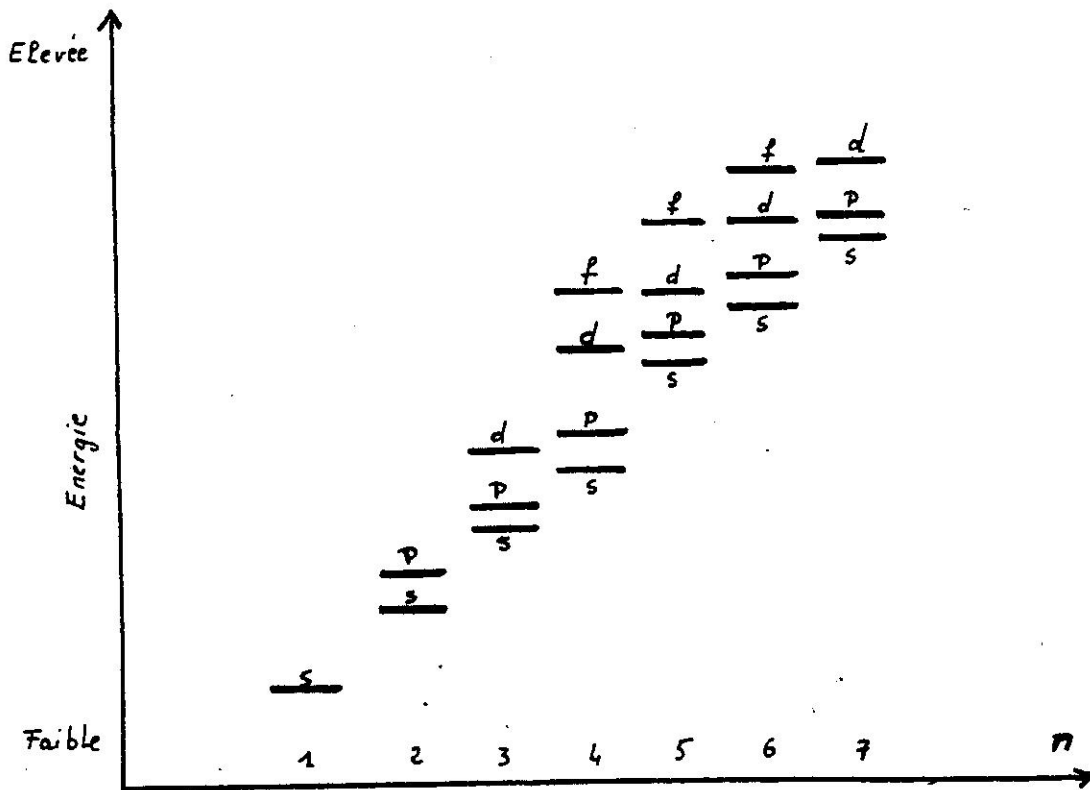
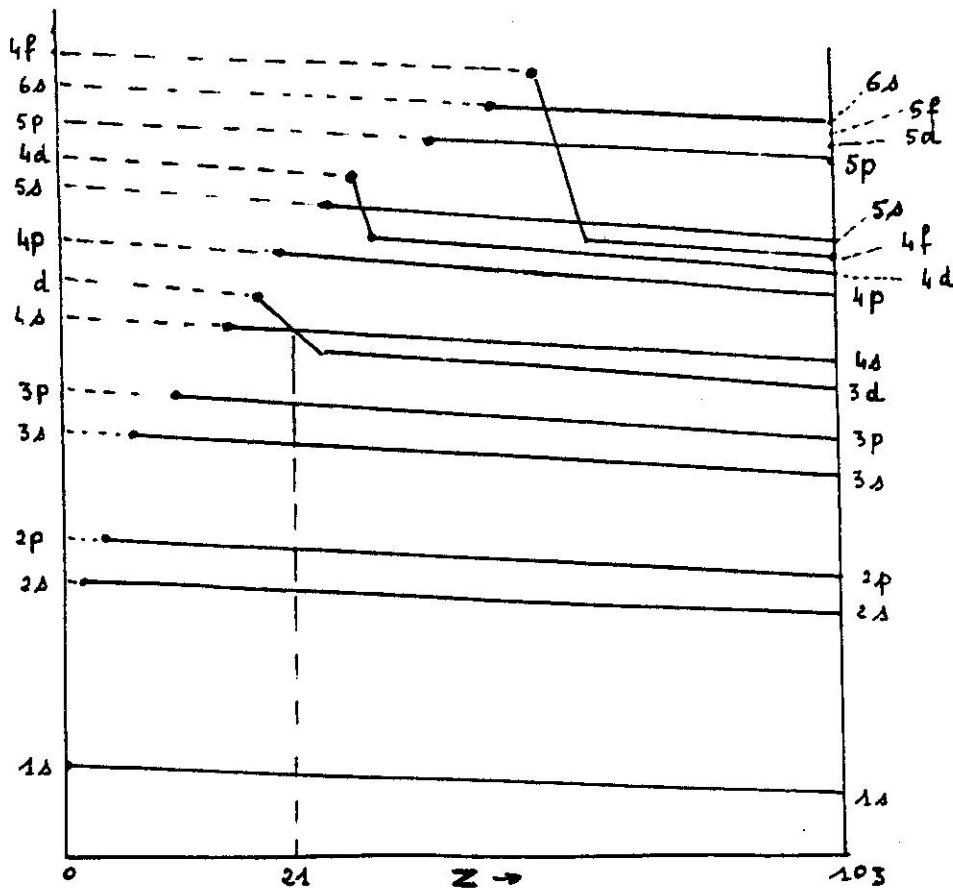
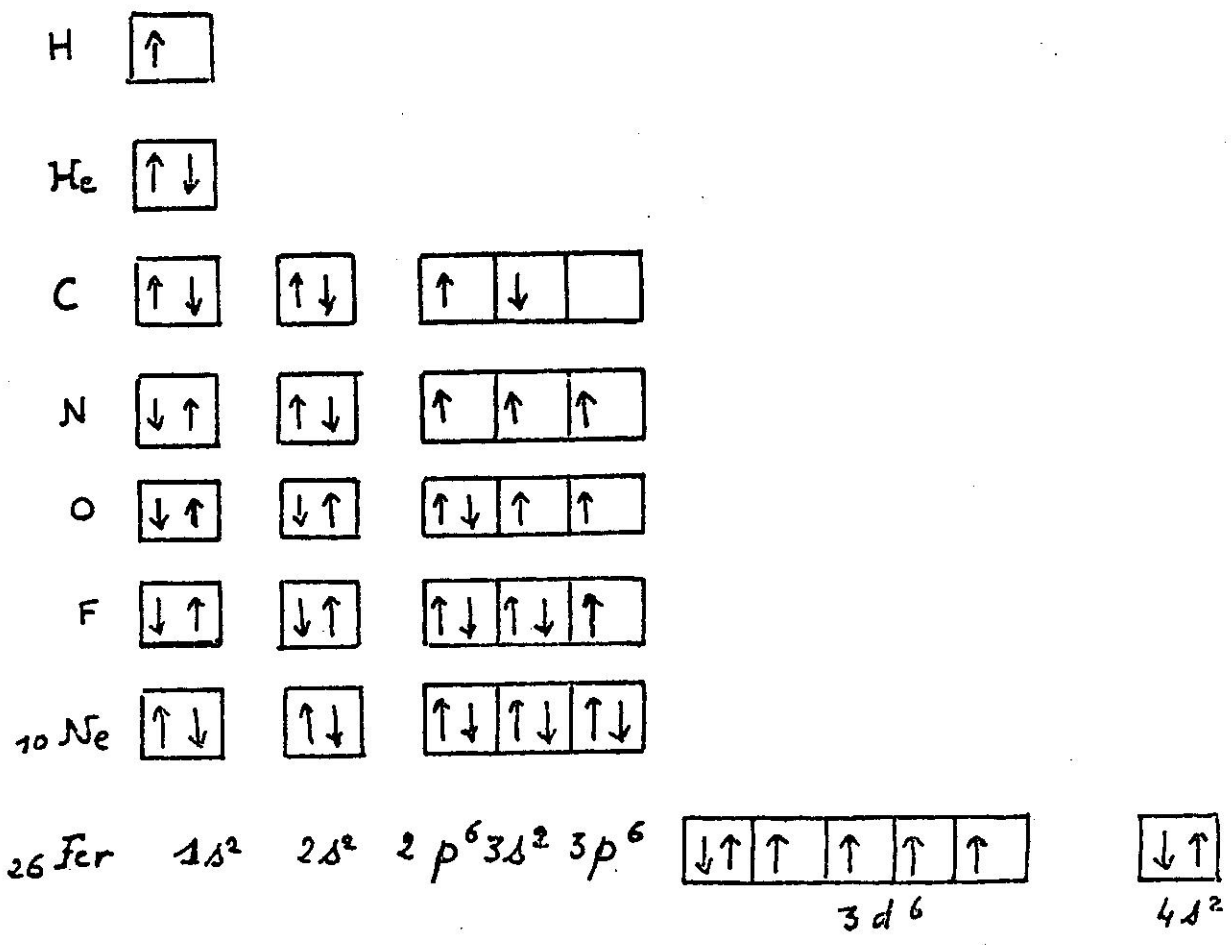
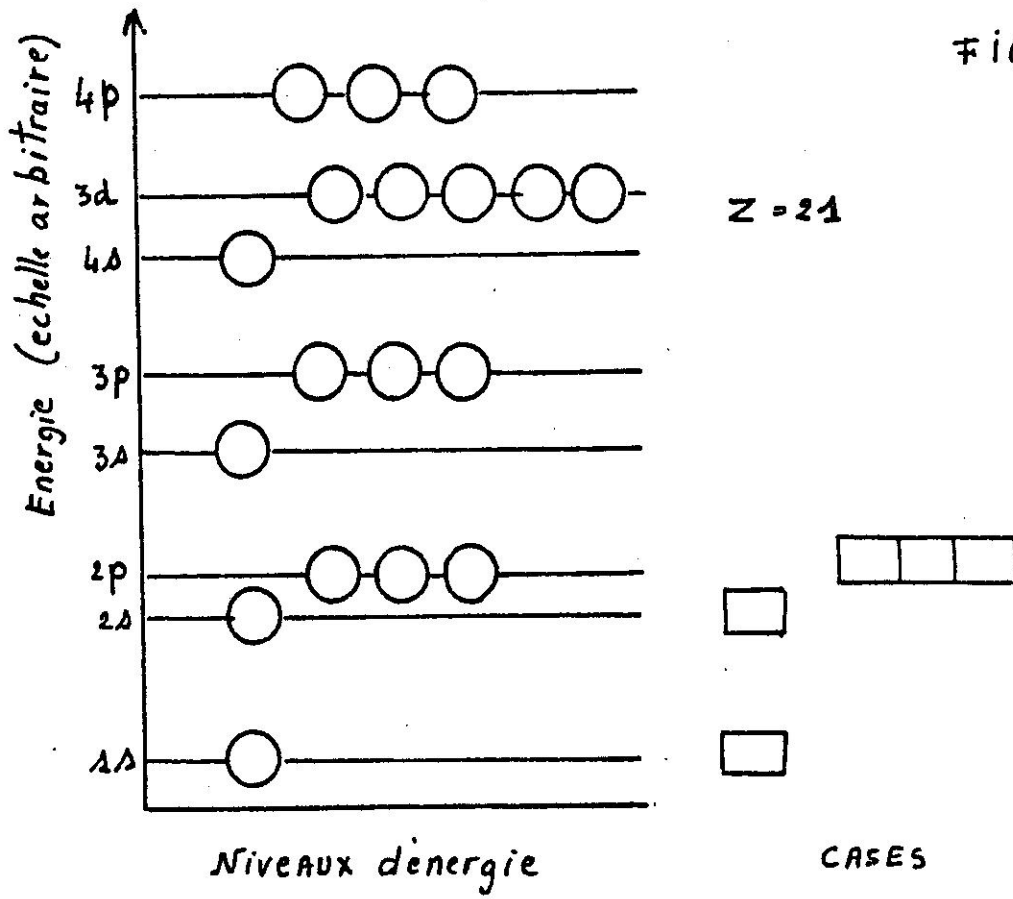


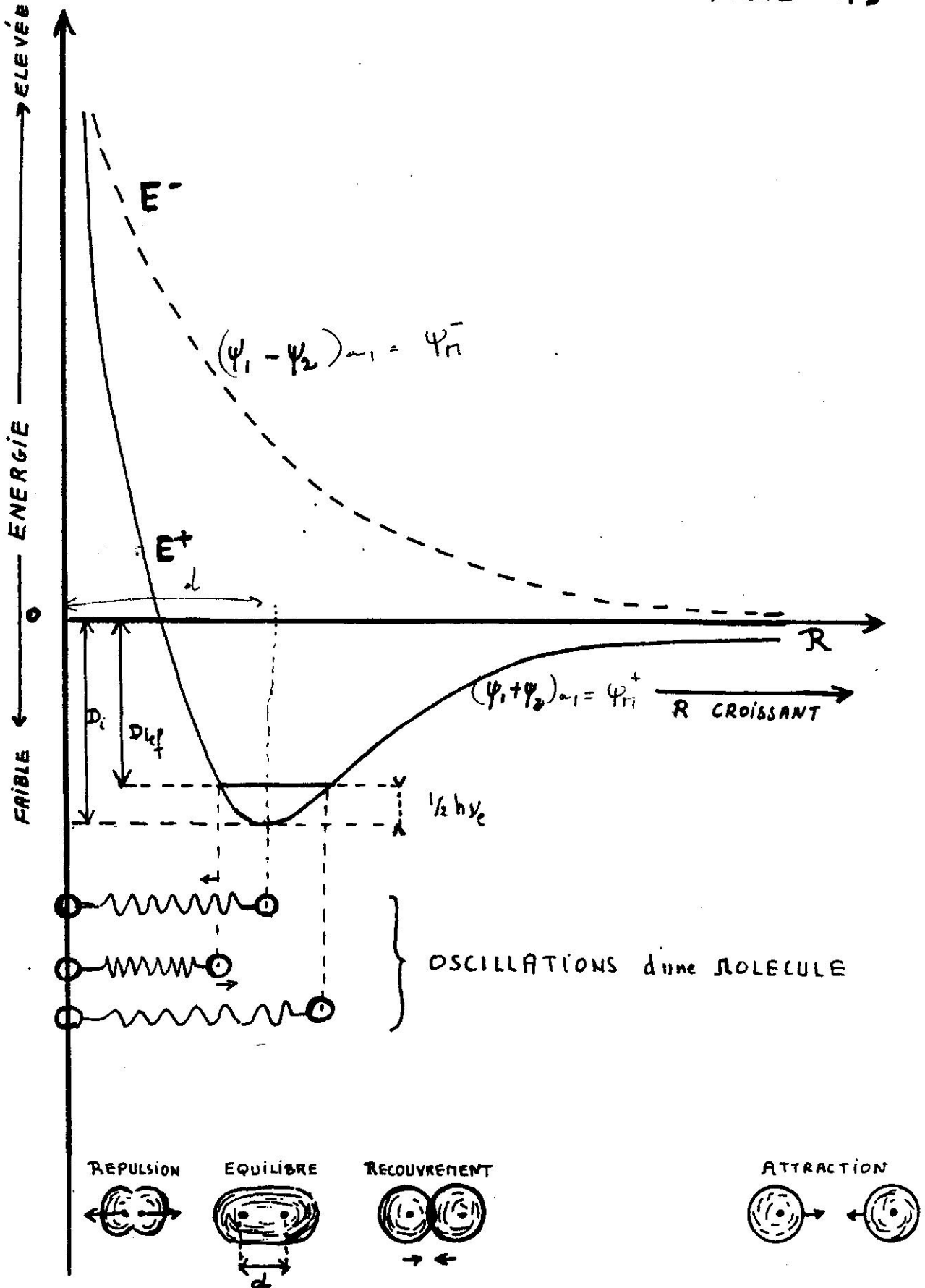
Diagramme (relatif) des energies des orbitales des atomes neutres



Chevauchement des niveaux orbitaux en fonction de Z

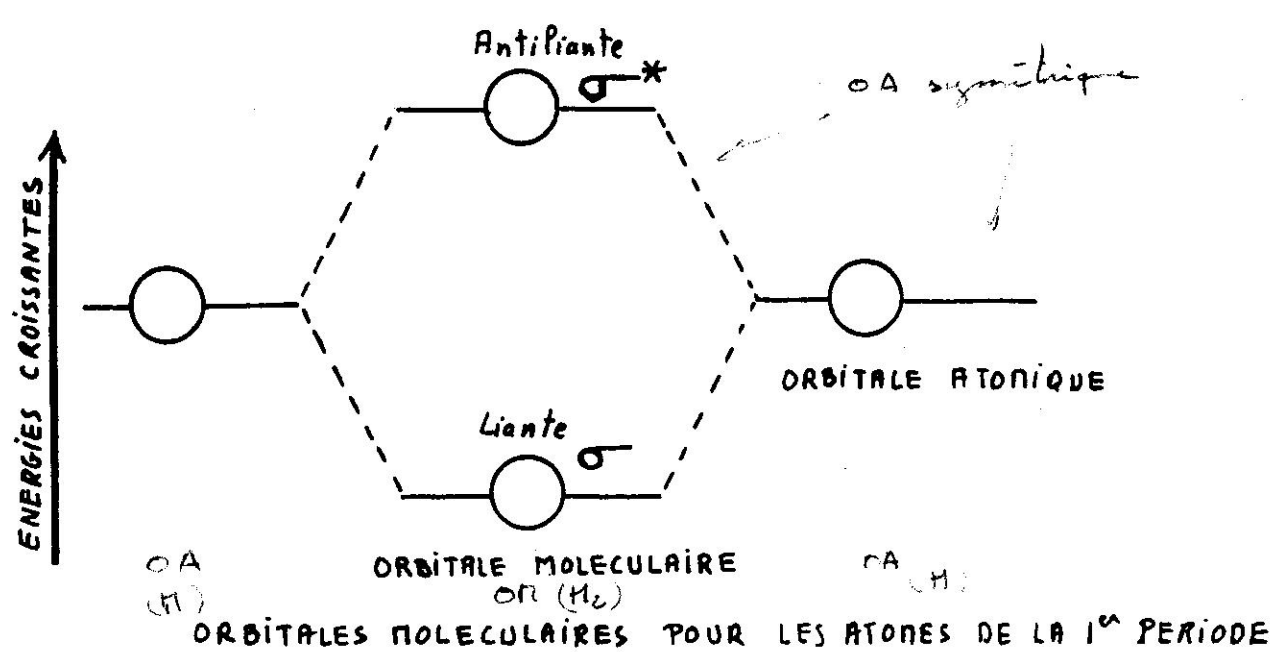
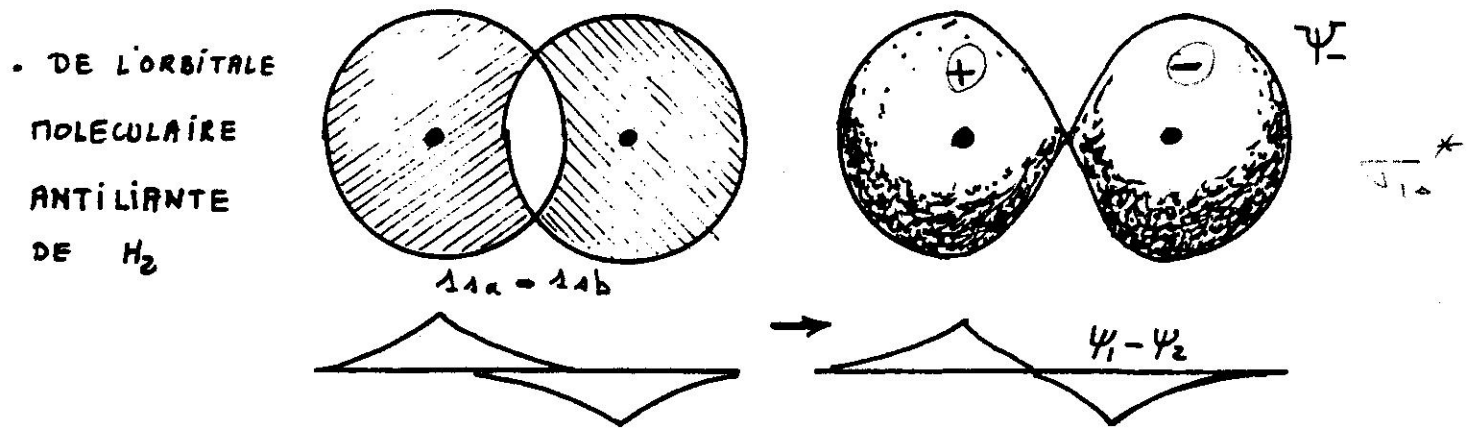
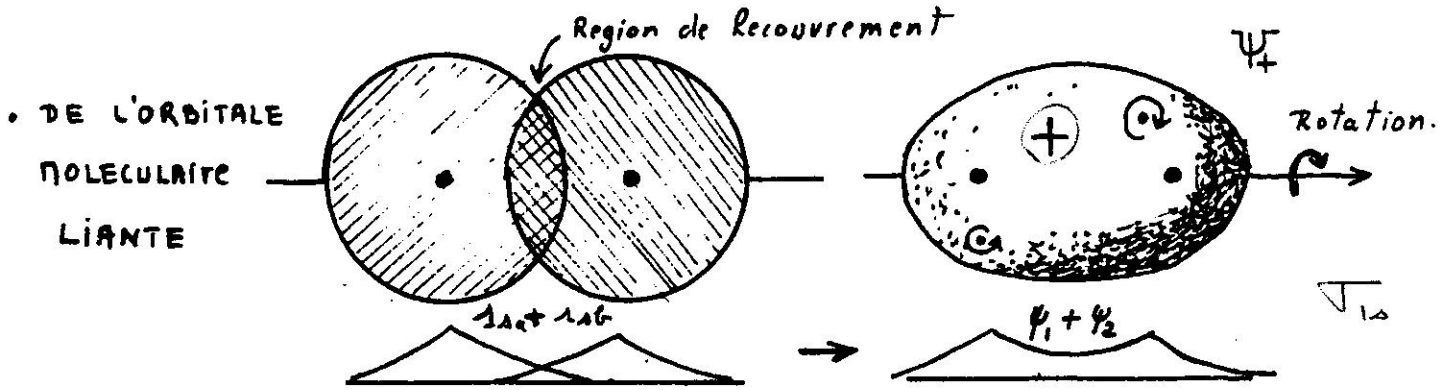
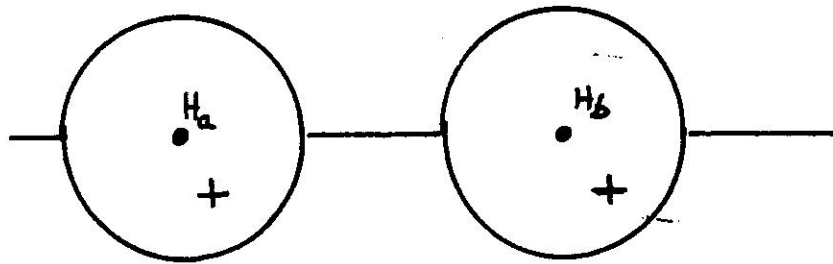


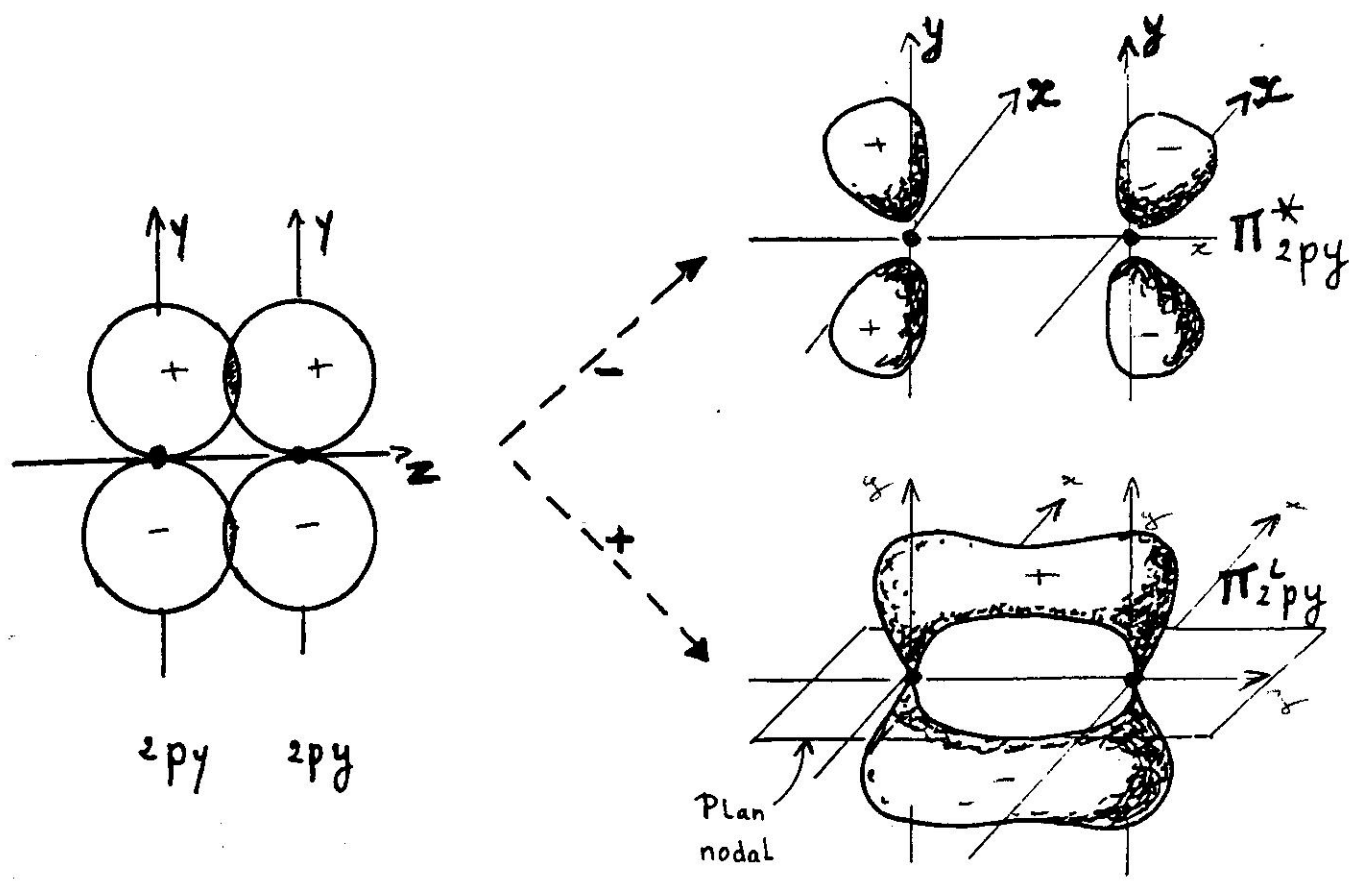
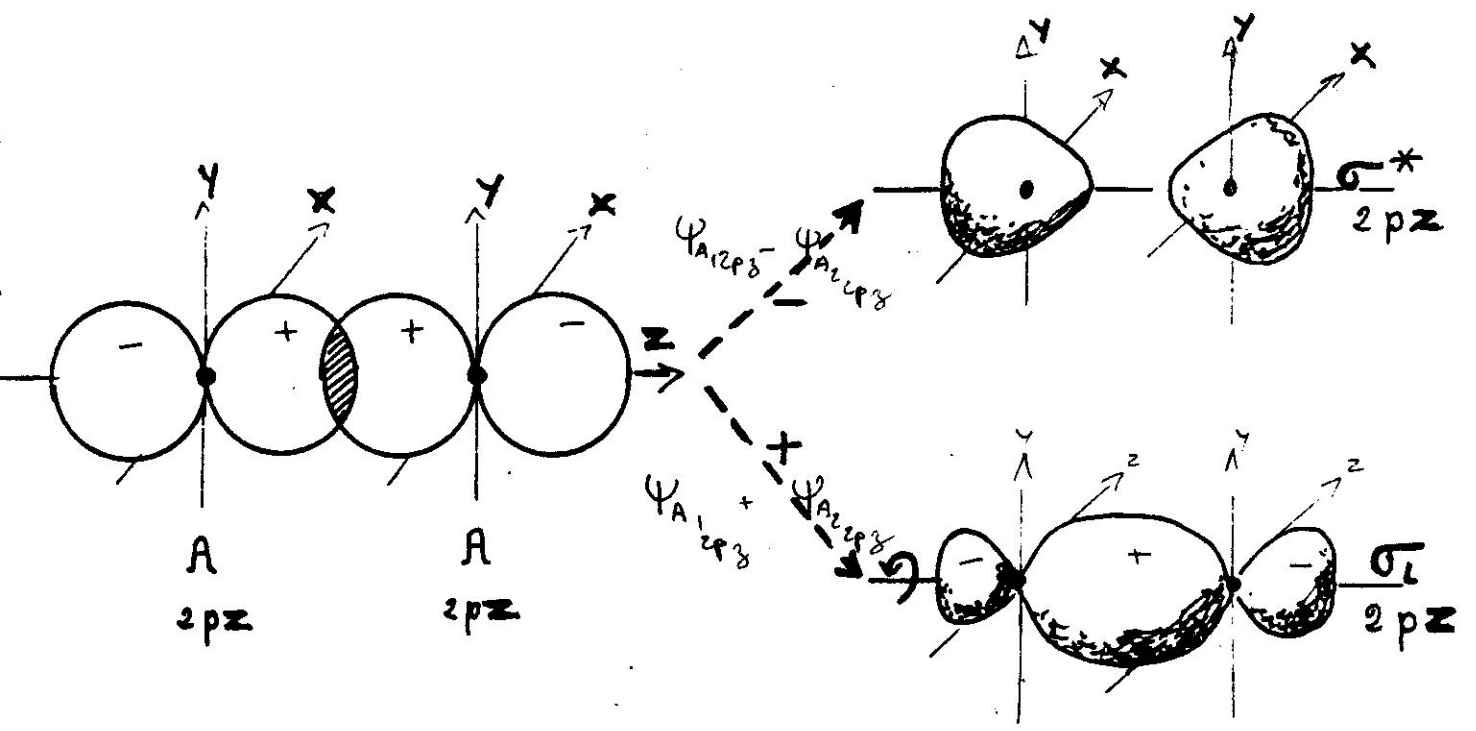
QUELQUES EXEMPLES DE CONFIGURATIONS ELECTRONIQUES



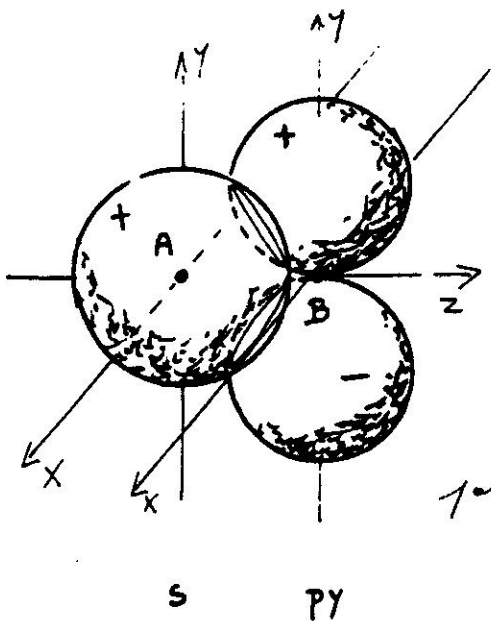
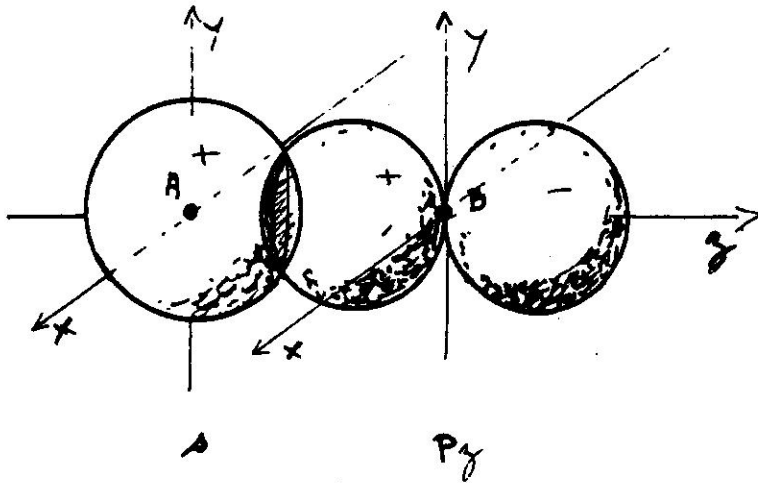
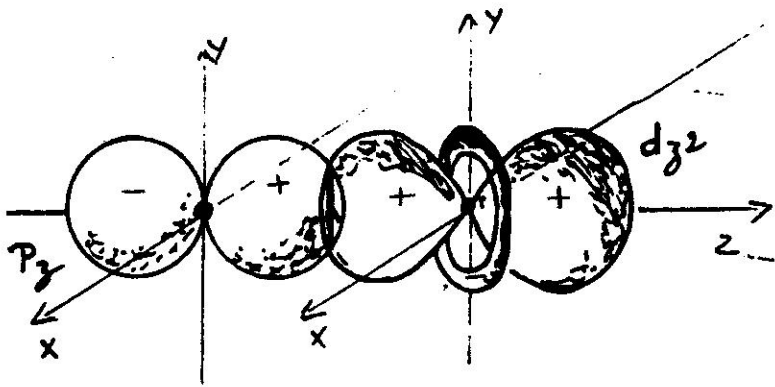
ENERGIE DU SYSTEME DE DEUX ATOMES D'HYDROGENE
 EN FONCTION DE LA DISTANCE INTERNUCLEAIRE

REPRESENTATION SCHEMATIQUE DE LA FORMATION



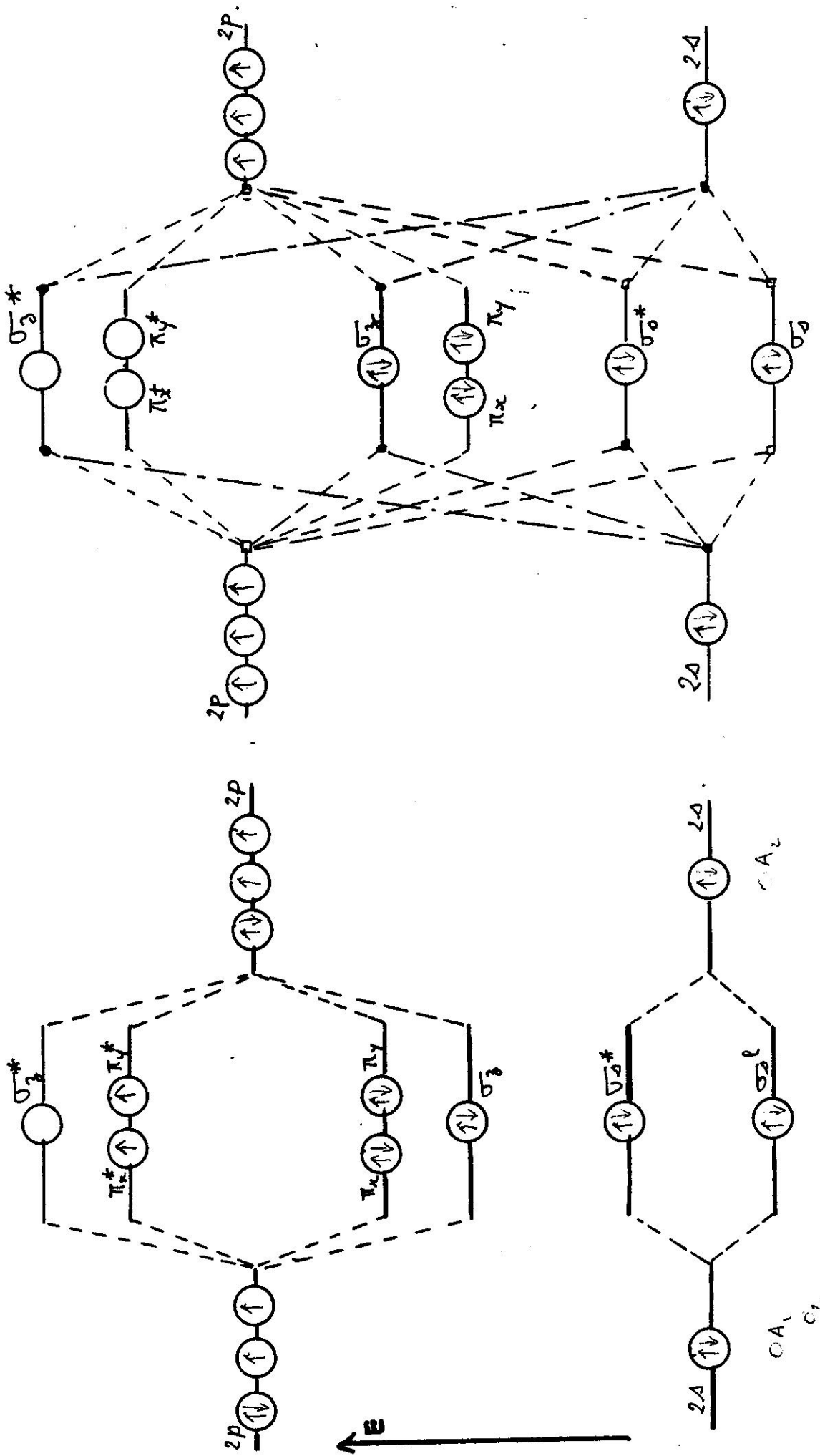


LES ORBITALES MOLECULAIRES LIANTES et ANTILIANTES σ et π



RECouvreMENT
d'O.A. conduisant
à une liaison

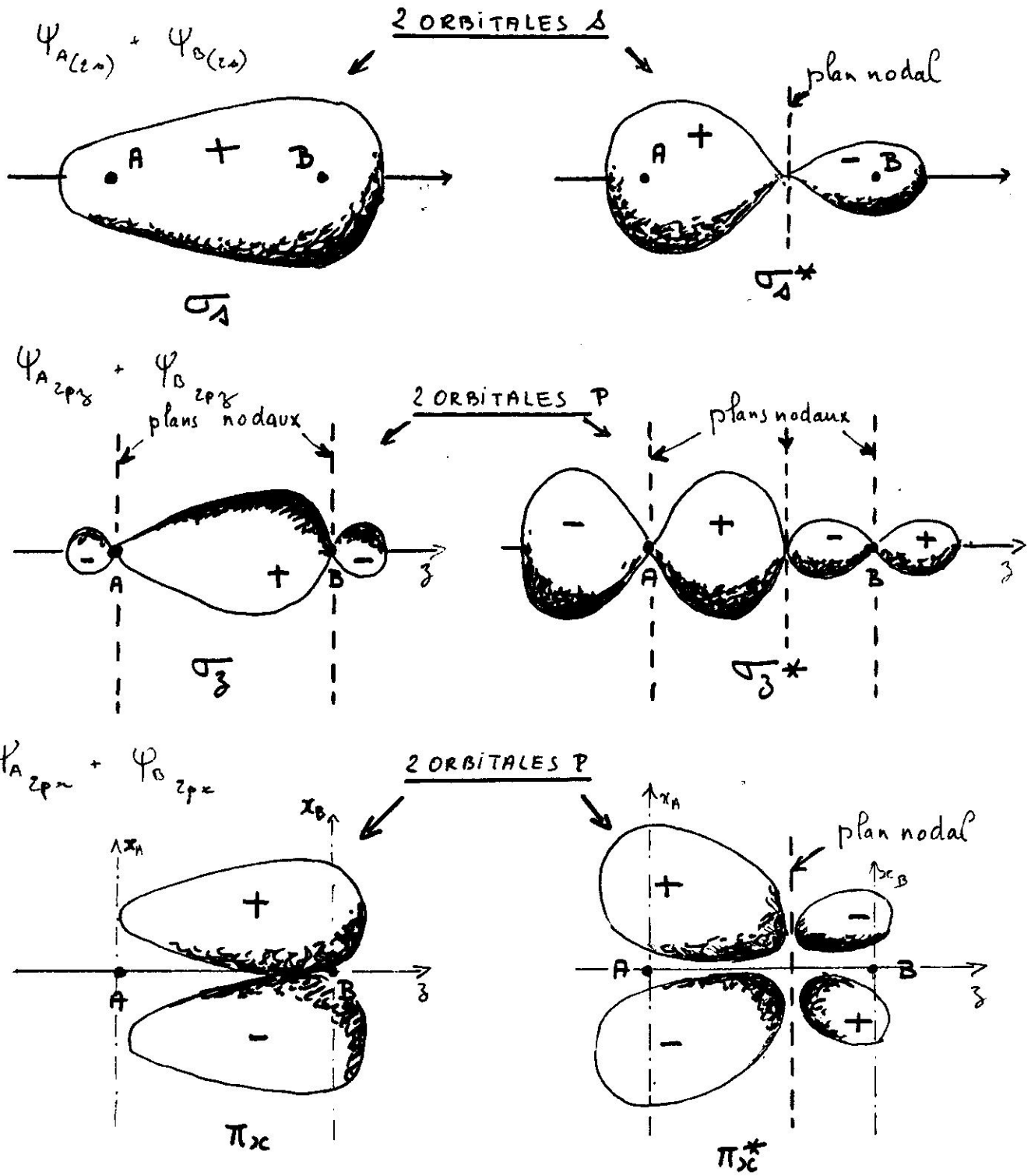
Recouvrement d'O.A.
ne donnant pas d'O.M.
pas de liaison possible



Avec Interaction $\sigma_s - \sigma_s$.

Sans Interaction $\sigma_s - \sigma_s$.

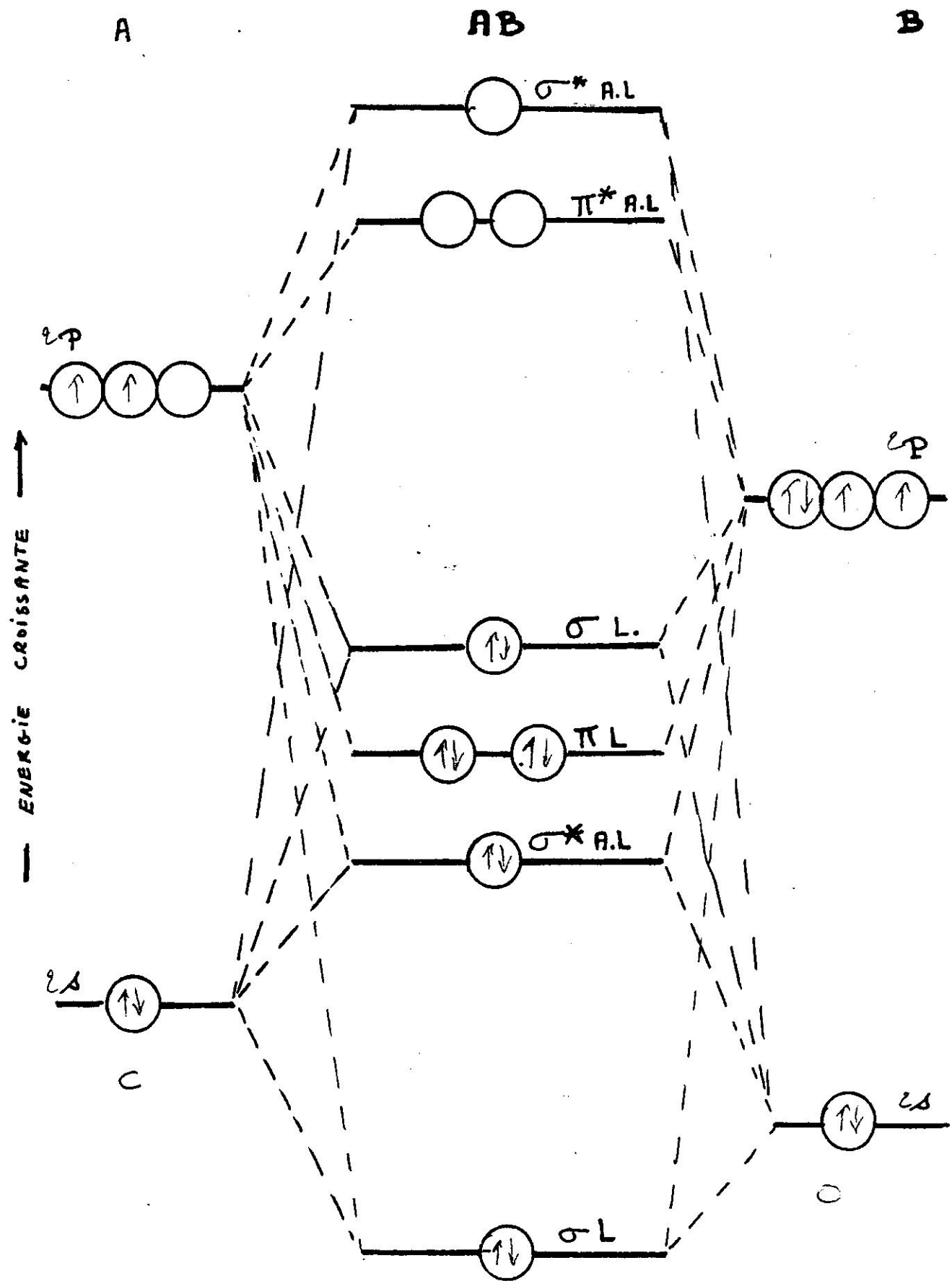
DIAGRAMME DES NIVEAUX D'ENERGIE DES ORBITALES MOLECULAIRES
 D'UNE MOLECULE DIATOMIQUE HOMONUCLEAIRE
(O₂ FL (2^e période))
 N₂ et les autres



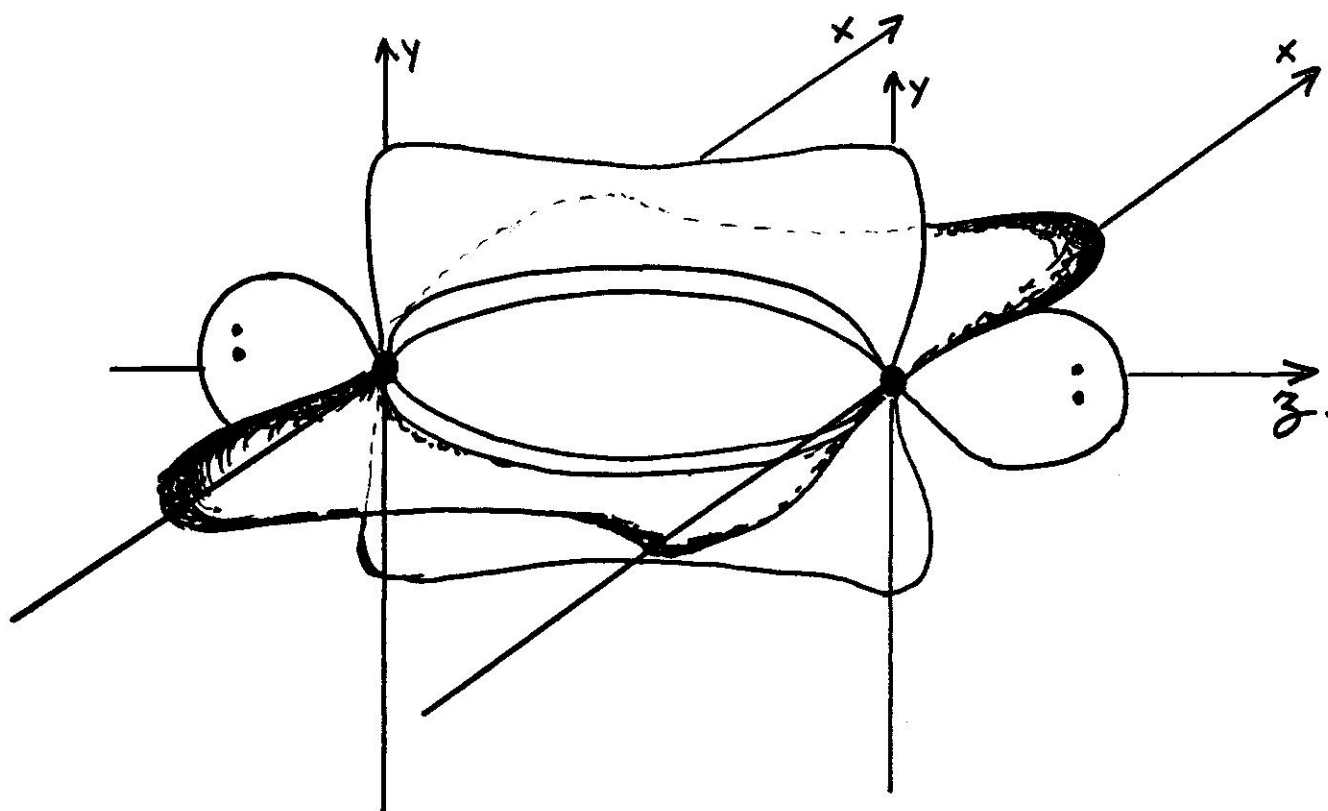
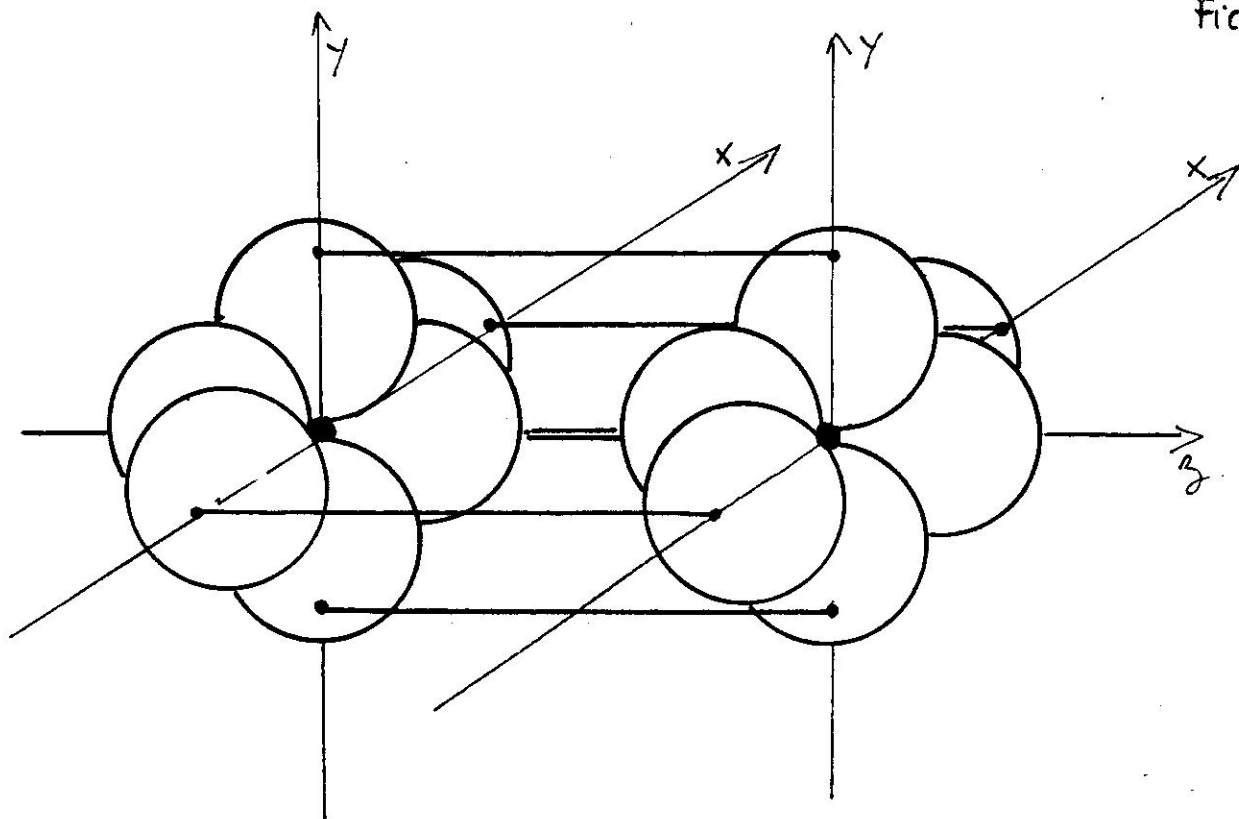
ORBITALES MOLECULAIRES (partie angulaire).

d'une MOLECULE HETERONUCLEAIRE AB

B PLUS ELECTRONEGATIF QUE A



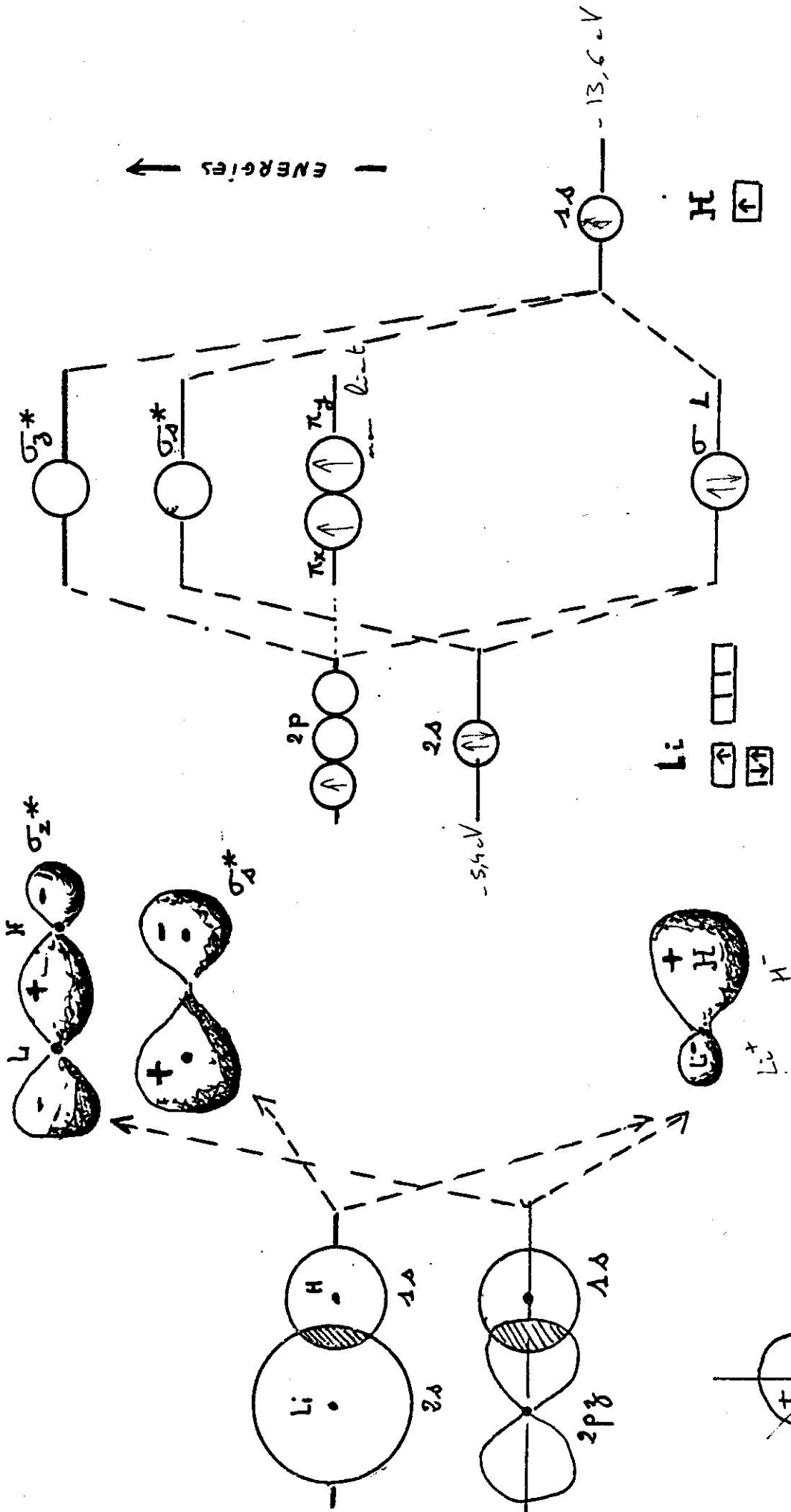
ORBITALES D'UNE MOLECULE **AB** - **B** plus ELECTRONEGATIF QUE **A**
(exemple CO)



REPRESENTATION de la MOLECULE N₂

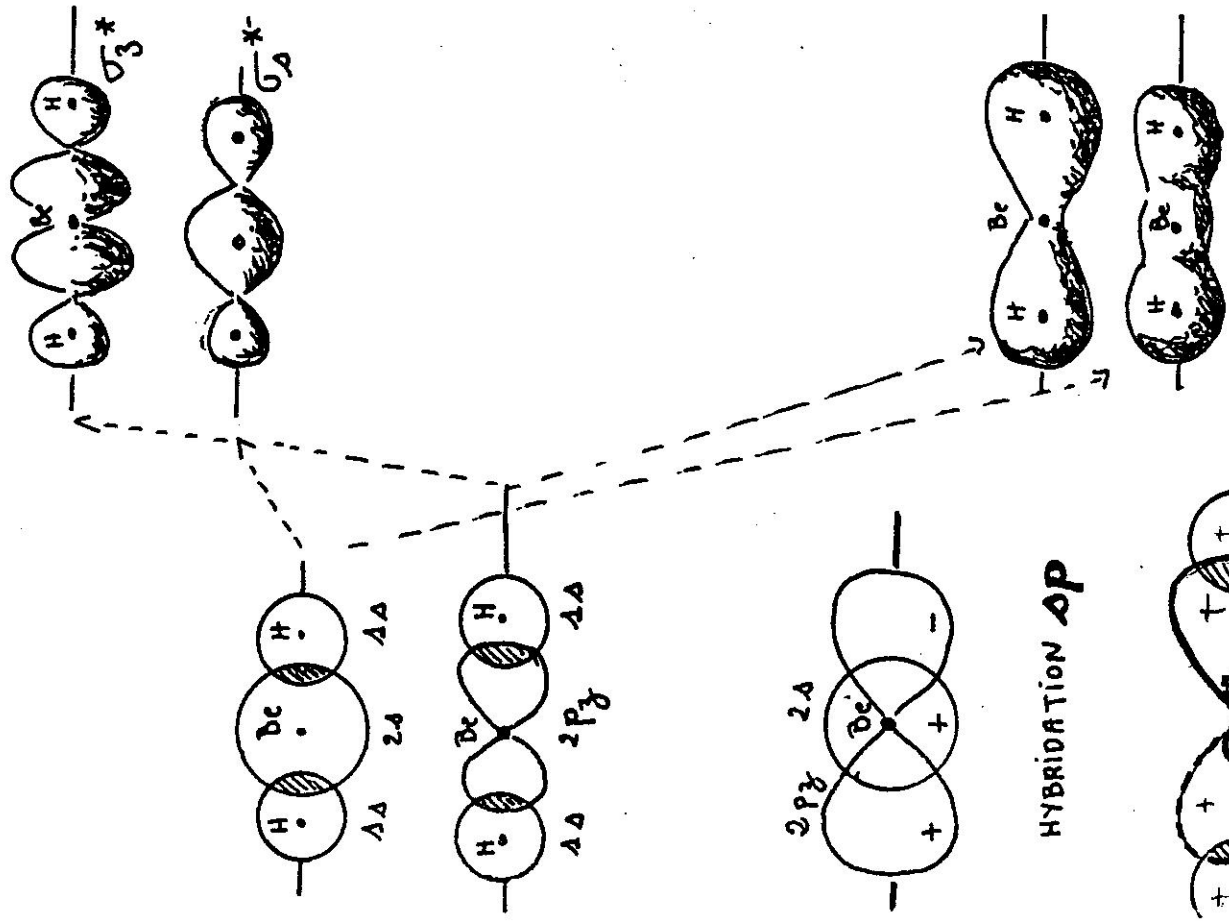
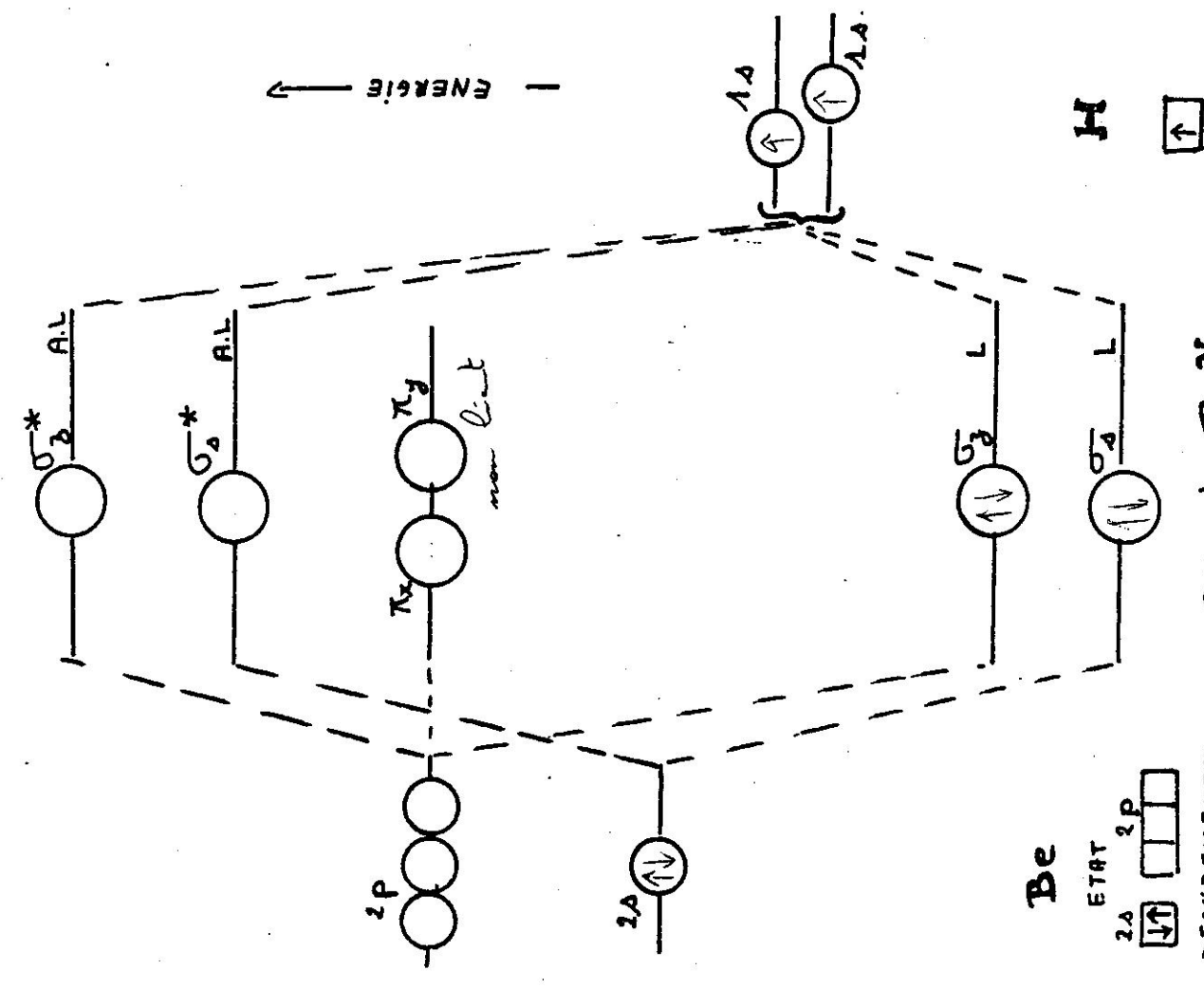
O.M de LiH

LiH

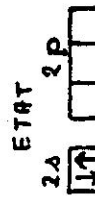


↑ ENERGIES

2px on 2py



Be

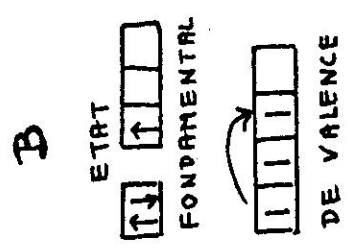
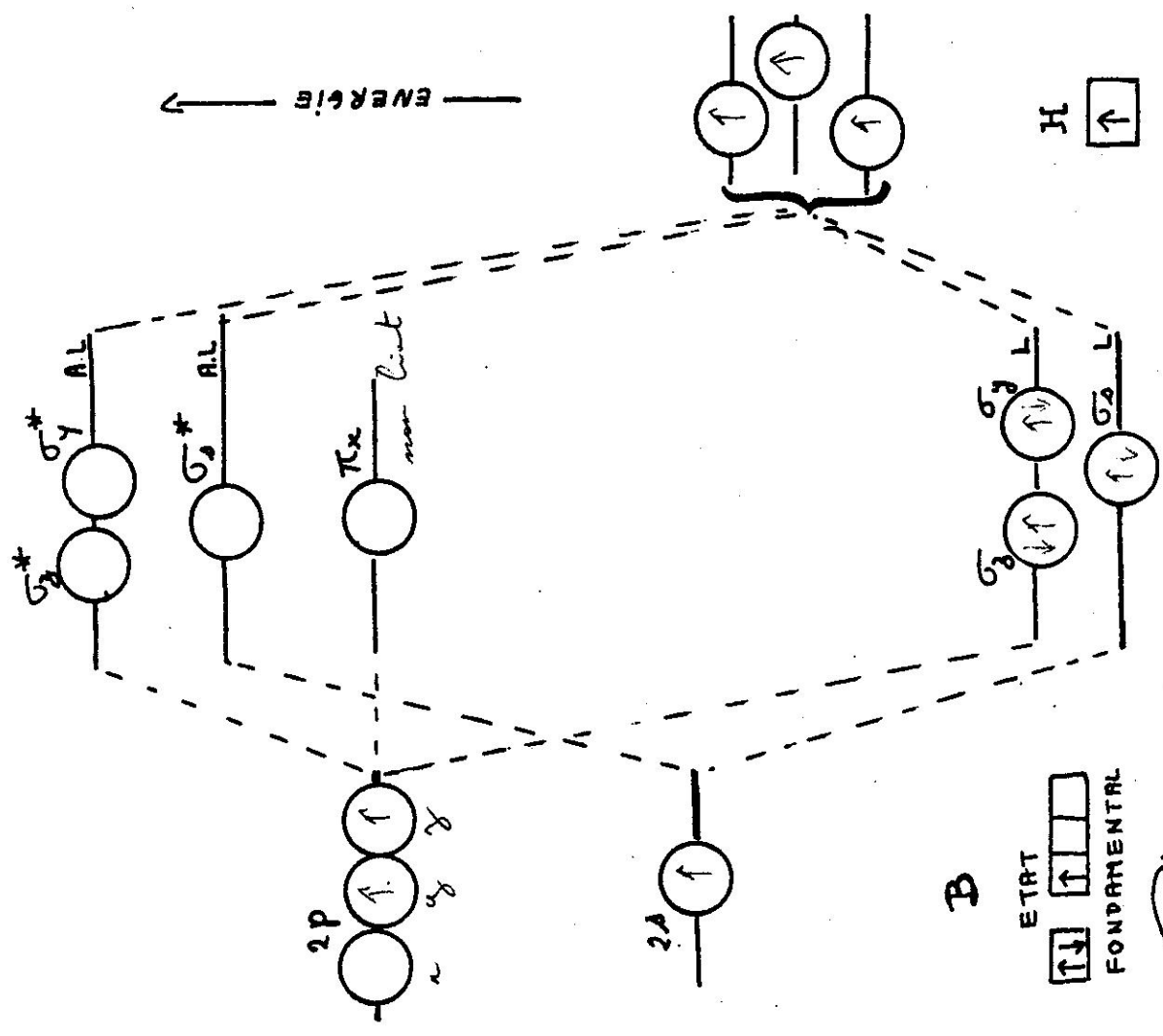


→ FONDAMENTAL

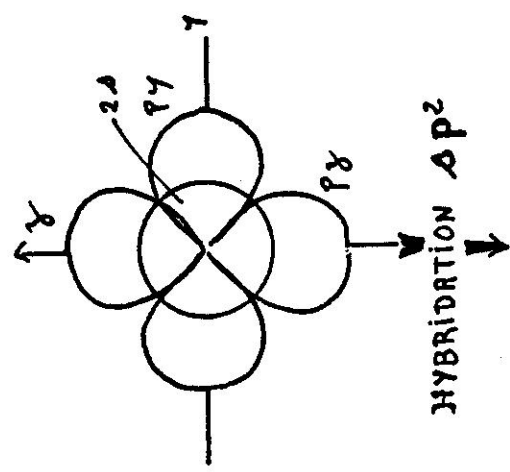
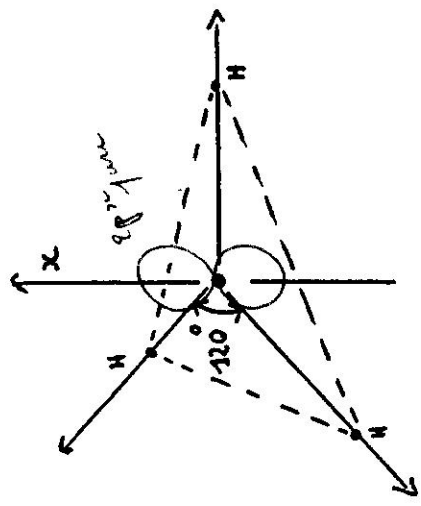


→ DEVALENCE (sp)

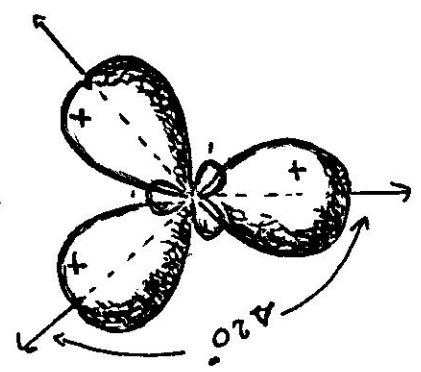
O.M. de BeH_2

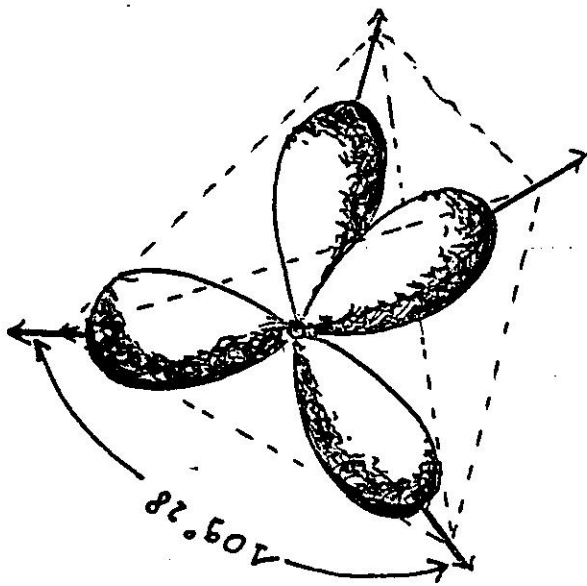
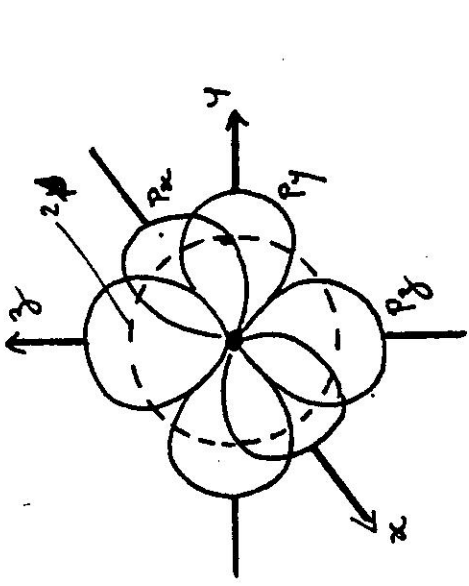


O.M DE BH_3
 Augmente de la force
 motrice de C. = 3

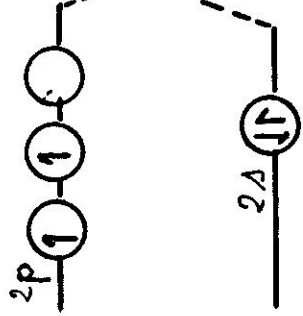


HYBRIDATION sp^2

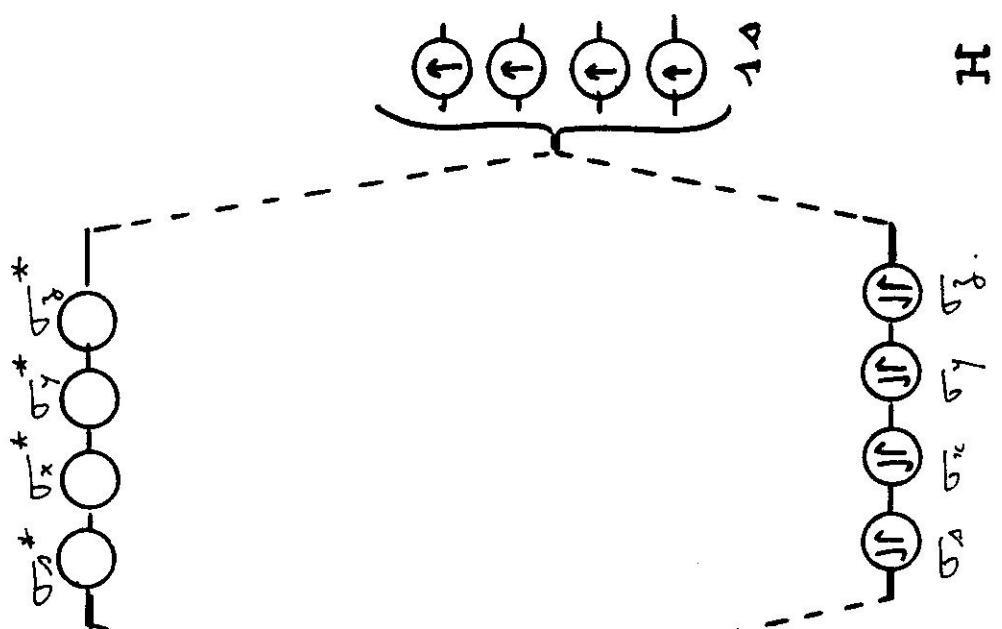
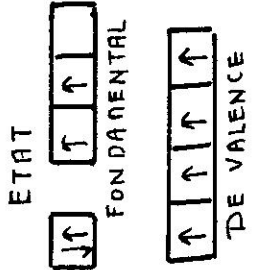




HYBRIDATION sp^3



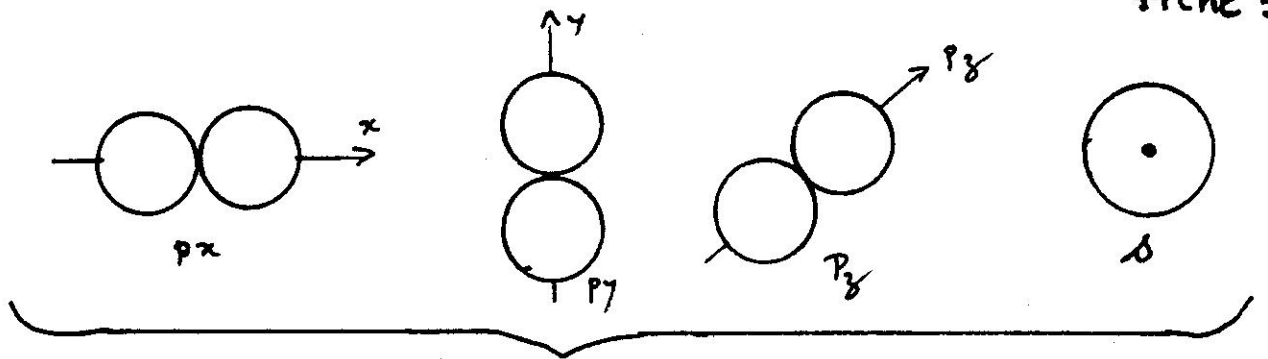
C



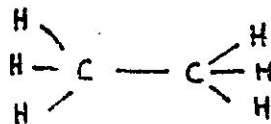
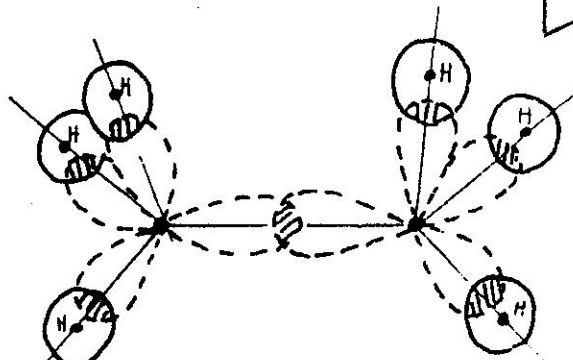
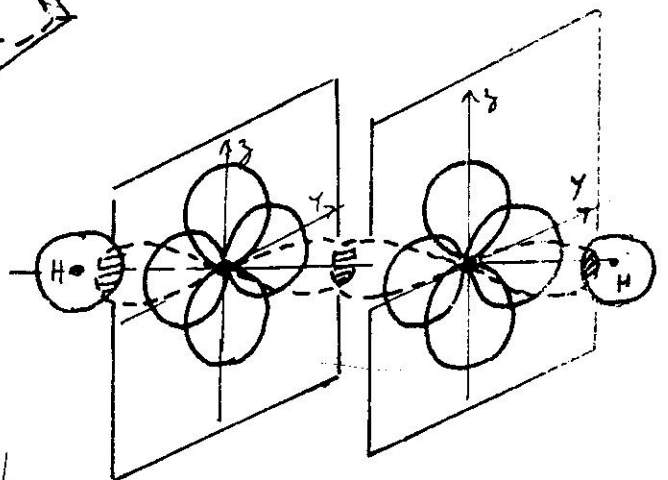
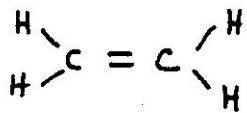
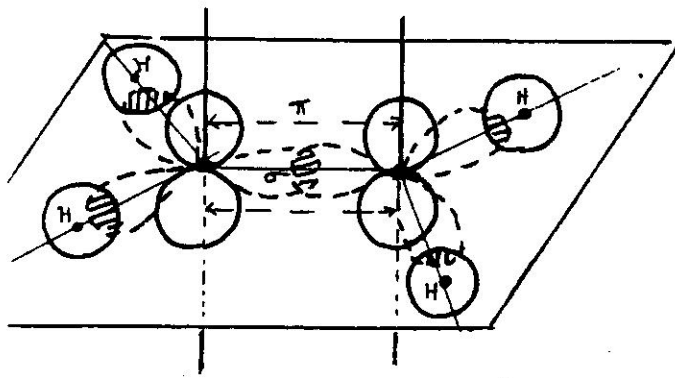
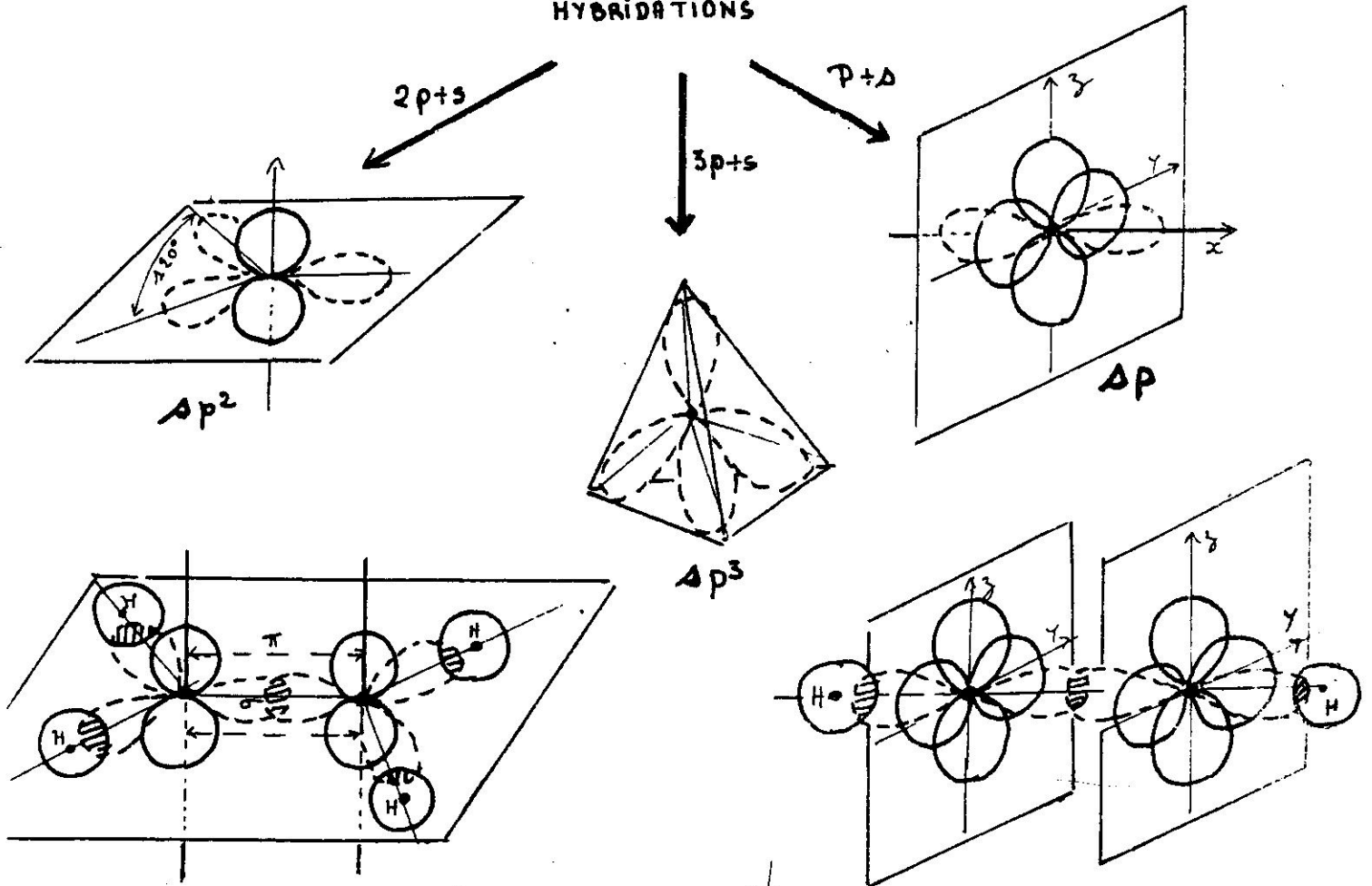
OM de CH_4

C

H

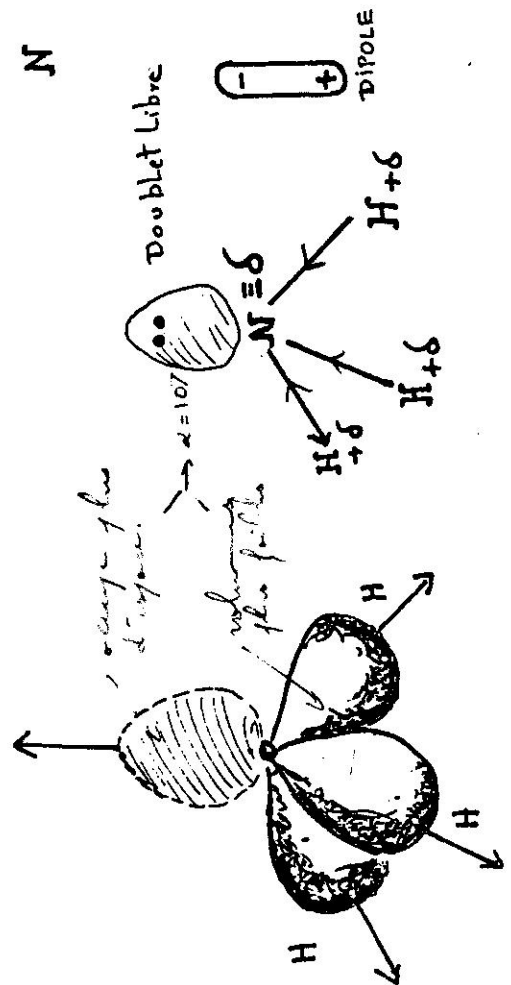
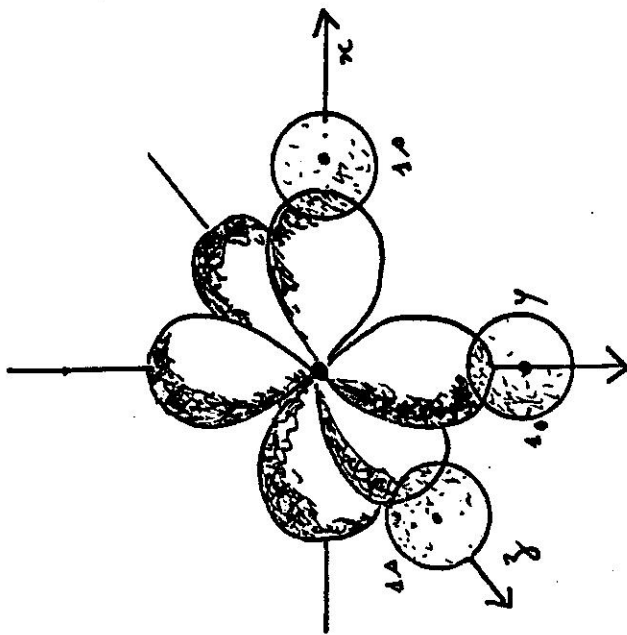
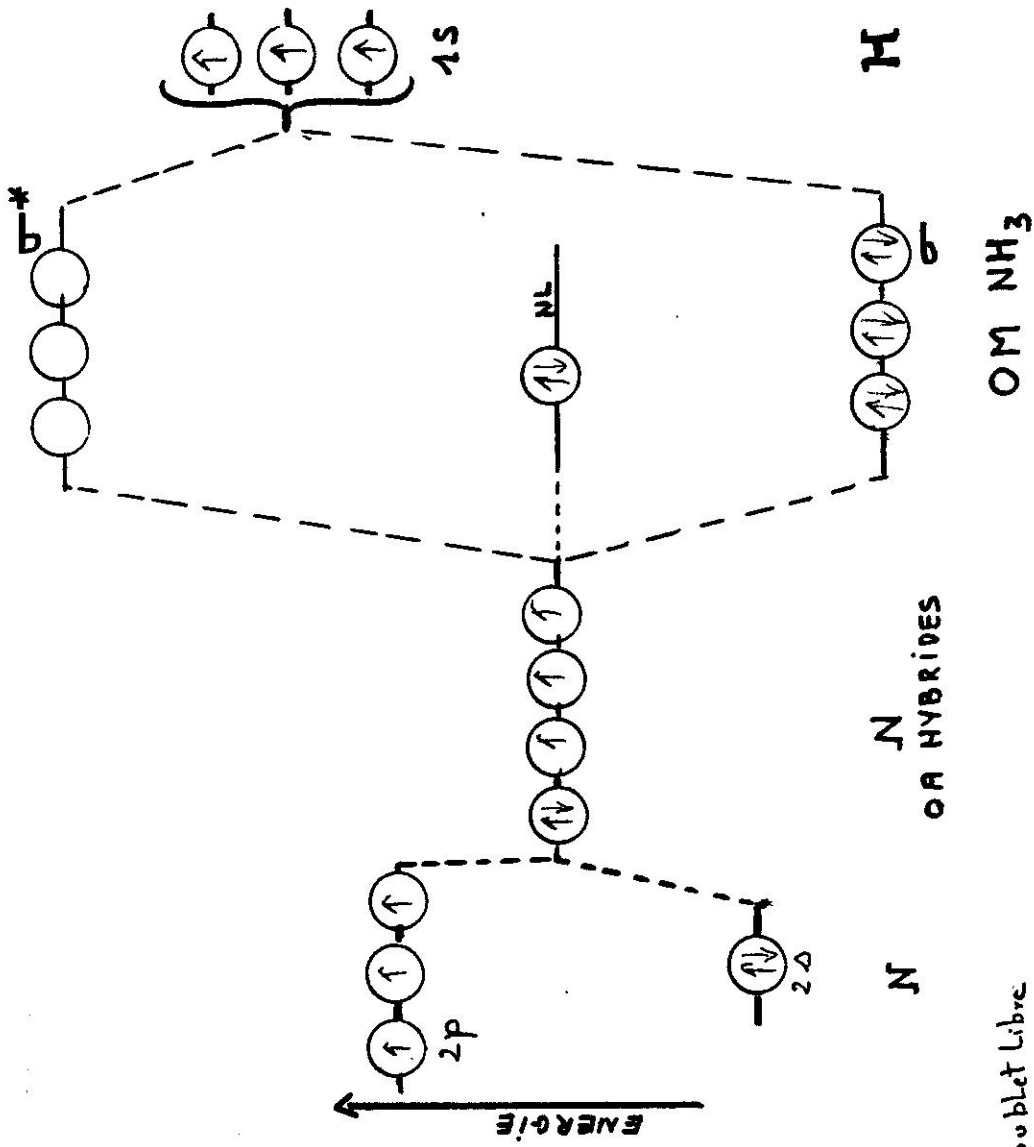


HYBRIDATIONS



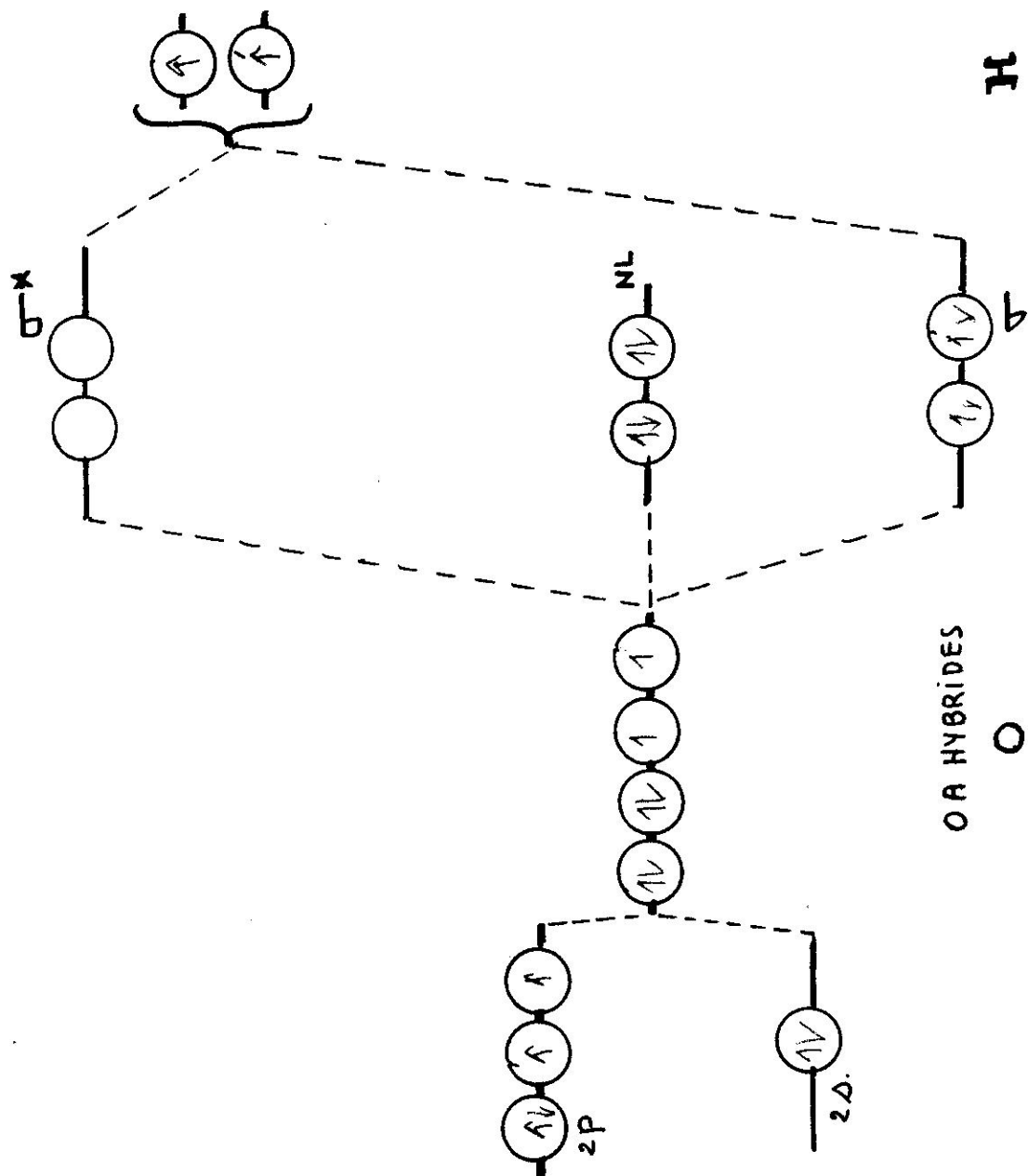
ORBITALES
 ——— PURES
 - - - - - HYBRIDES

CARBONE - LIAISONS - SIMPLES DOUBLES, TRIPLES



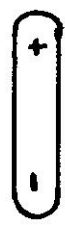
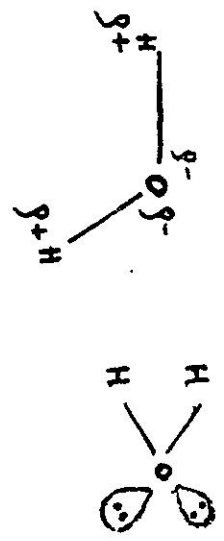
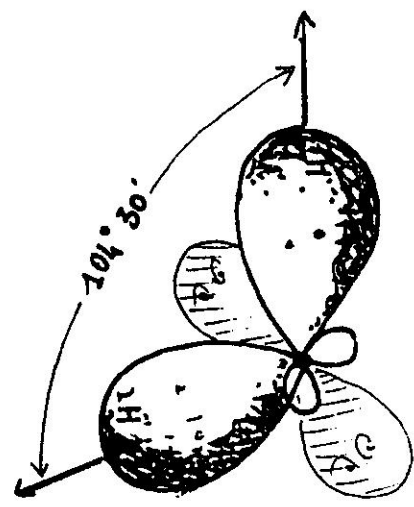
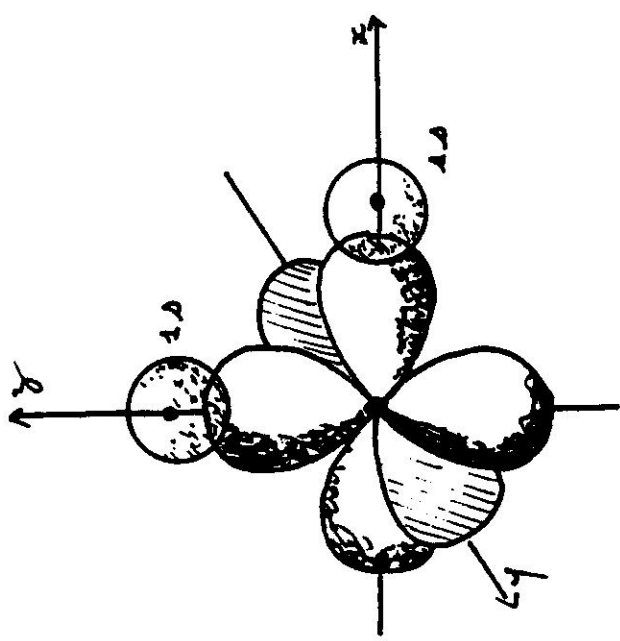
N
OR HYBRIDES

LA MOLECULE NH₃

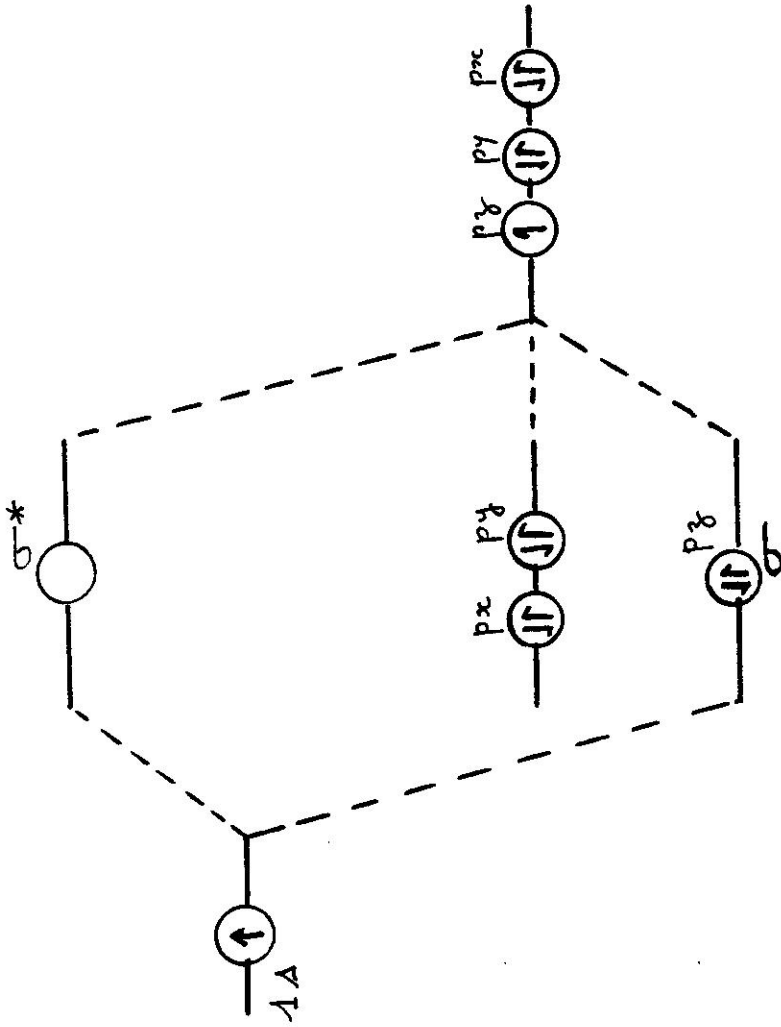


OM
H₂O

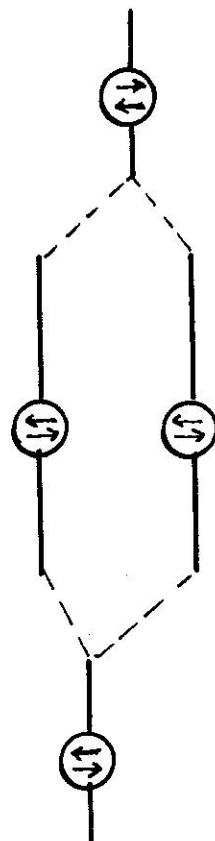
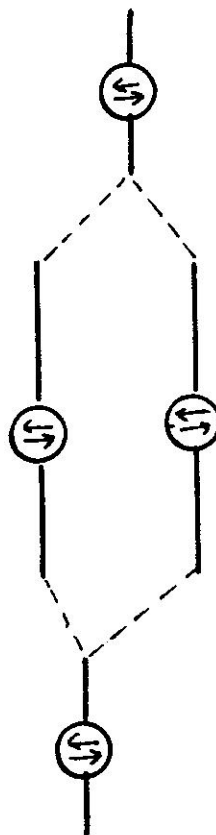
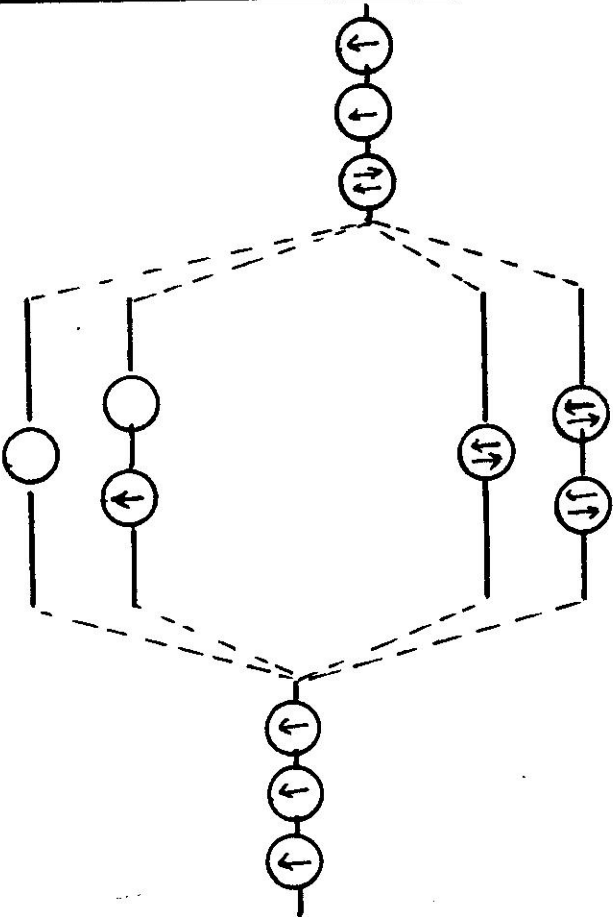
LA MOLECULE D'EAU



← ENERGIE CROISSANTE

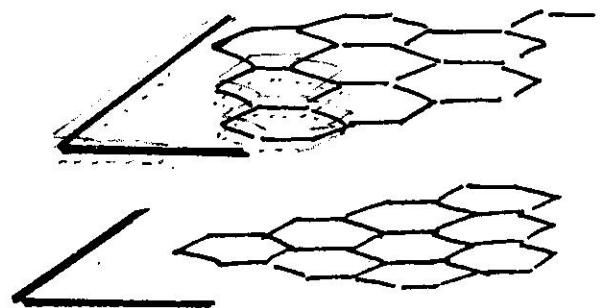
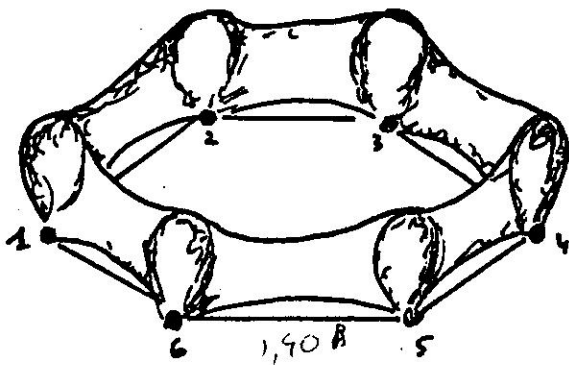
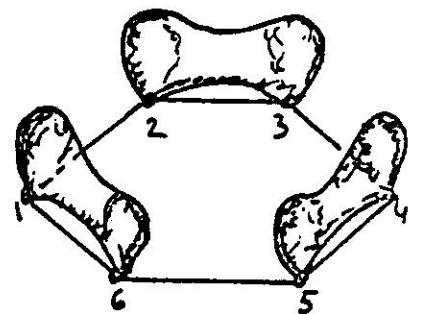
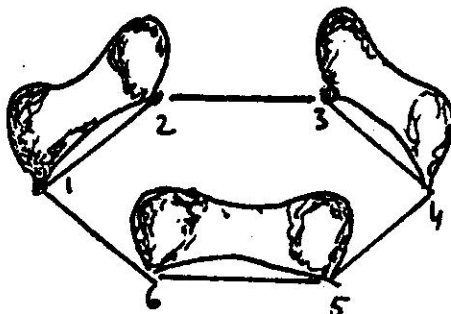
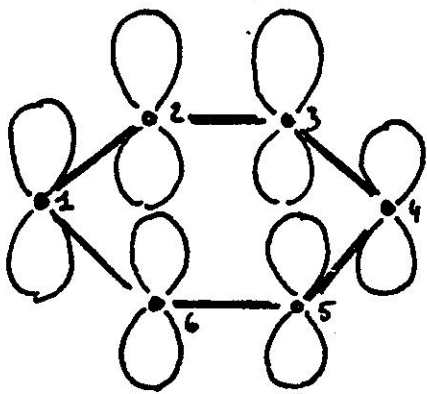
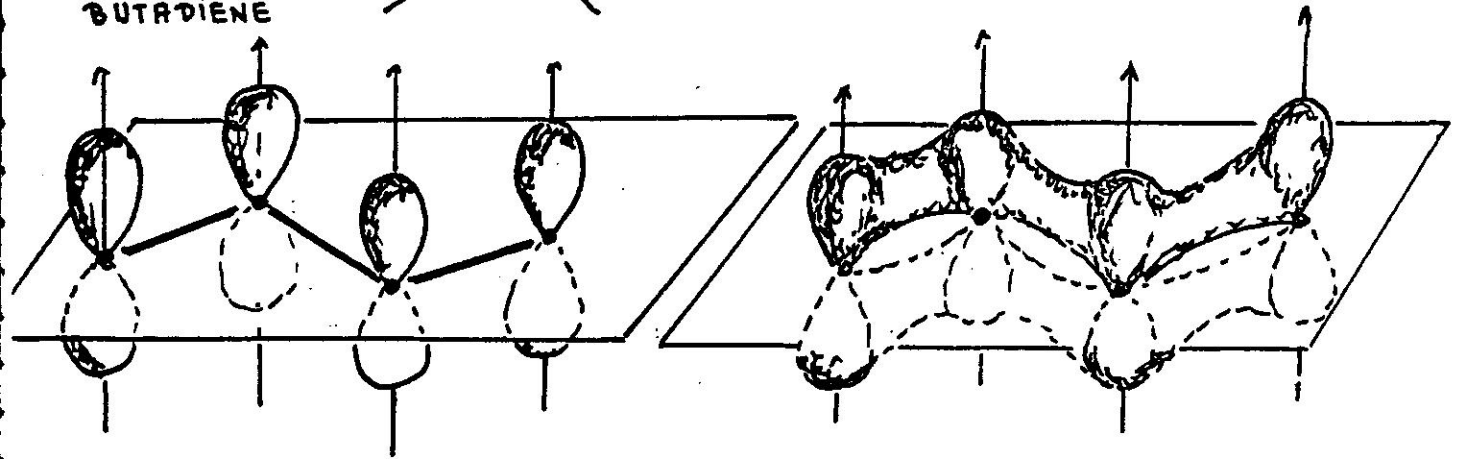
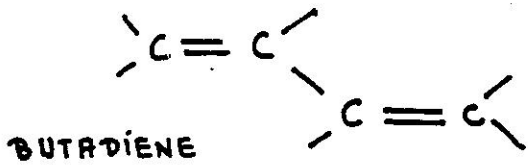


H HF F




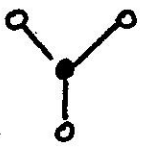
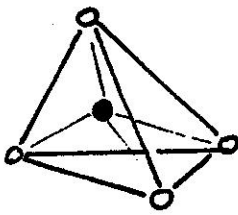
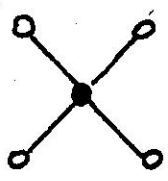
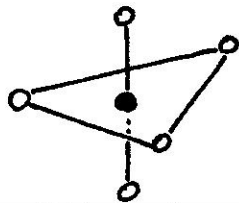
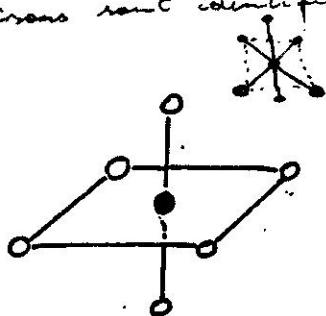
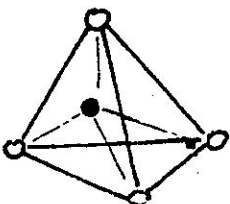
N O NO

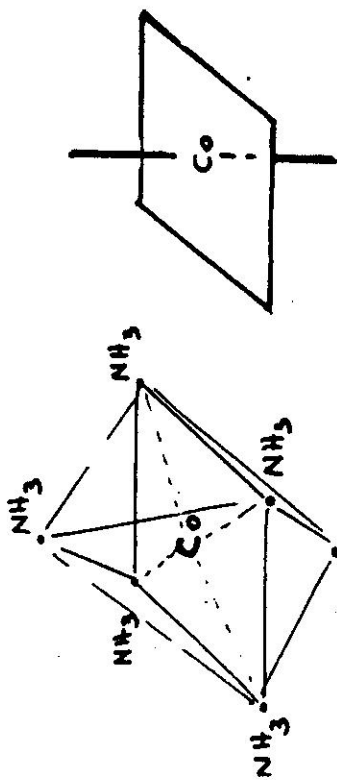
LIAISONS DÉLOCALISÉES



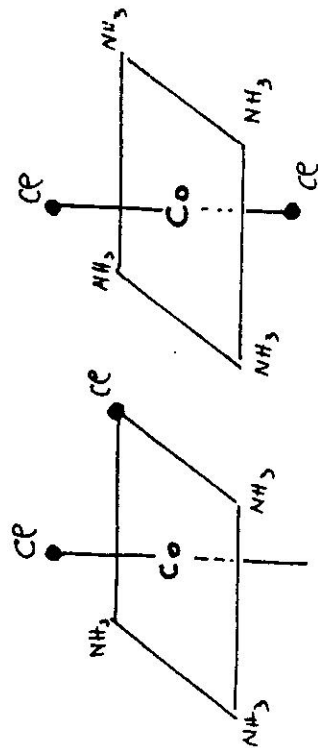
RESEAU LAMELLAIRE DU GRAPHITE

Les électrons pi sont délocalisés dans les plans des couches.

Hybridations	FORMES DES MOLECULES	EXEMPLES
sp	linéaire 	B_2Cl_2 B_2H_2 CO_2
sp^2	triangle plan 	B_2Cl_3 BH_3 SO_3 NO_3^- CO_3^{2-}
sp^3	tétraèdre 	CH_4 NH_4^+ SO_4^{2-} PH_4^+ BF_4^-
dsp^2 (n précédent) sp^2d (même n)	Carré 	$PtCl_4^{2-}$ $[Ni(CN)_4]^{2-}$ $[Co(NH_3)_4]^{2+}$
sp^3d	bipyramide triangulaire (rare) 	PCl_5
et sp^3d^2 même n d^2sp^3 n précédent	les six liaisons sont identiques Octaèdre 	FeF_6^{3-} SF_6 $[Fe(CN)_6]^{3-}$ $[Ti(H_2O)_6]^{3+}$ $[Co(NH_3)_6]^{3+}$
d^3s	tétraèdre 	MnO_4^- CrO_4^{2-}



HEXAMINE COBALT III
Hexamine

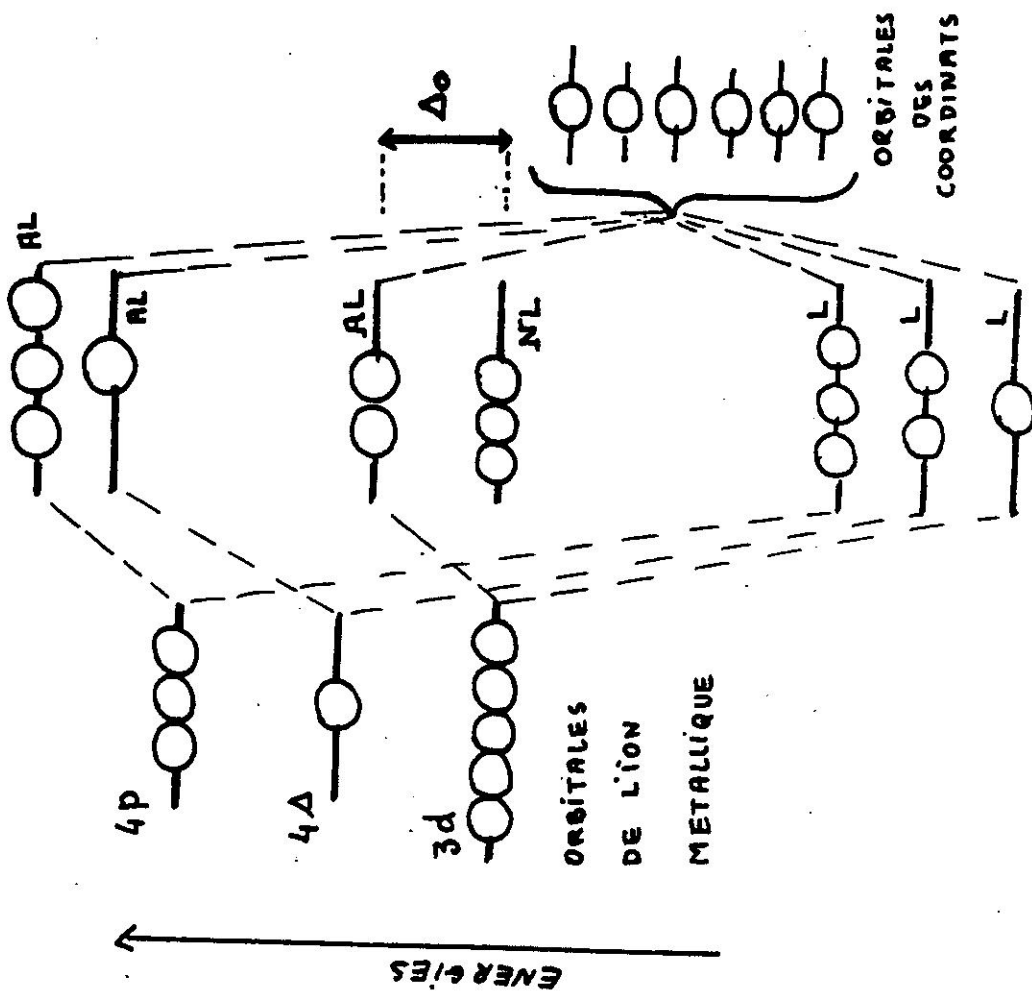


Cis TRANS

ISOMERES

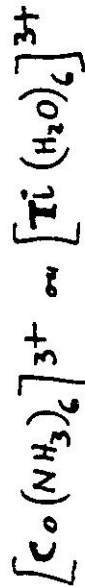
DU CATION

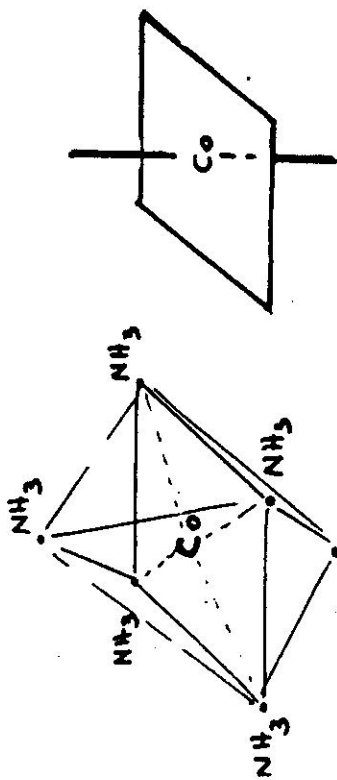
DICHLORO TETRAMINE COBALT III



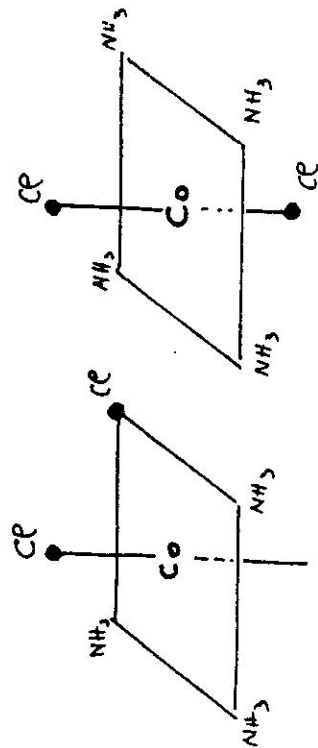
O. MOLECULAIRE

O.N POUR UN COMPLEXE TYPE





HEXAMINE COBALT III
Hexamine

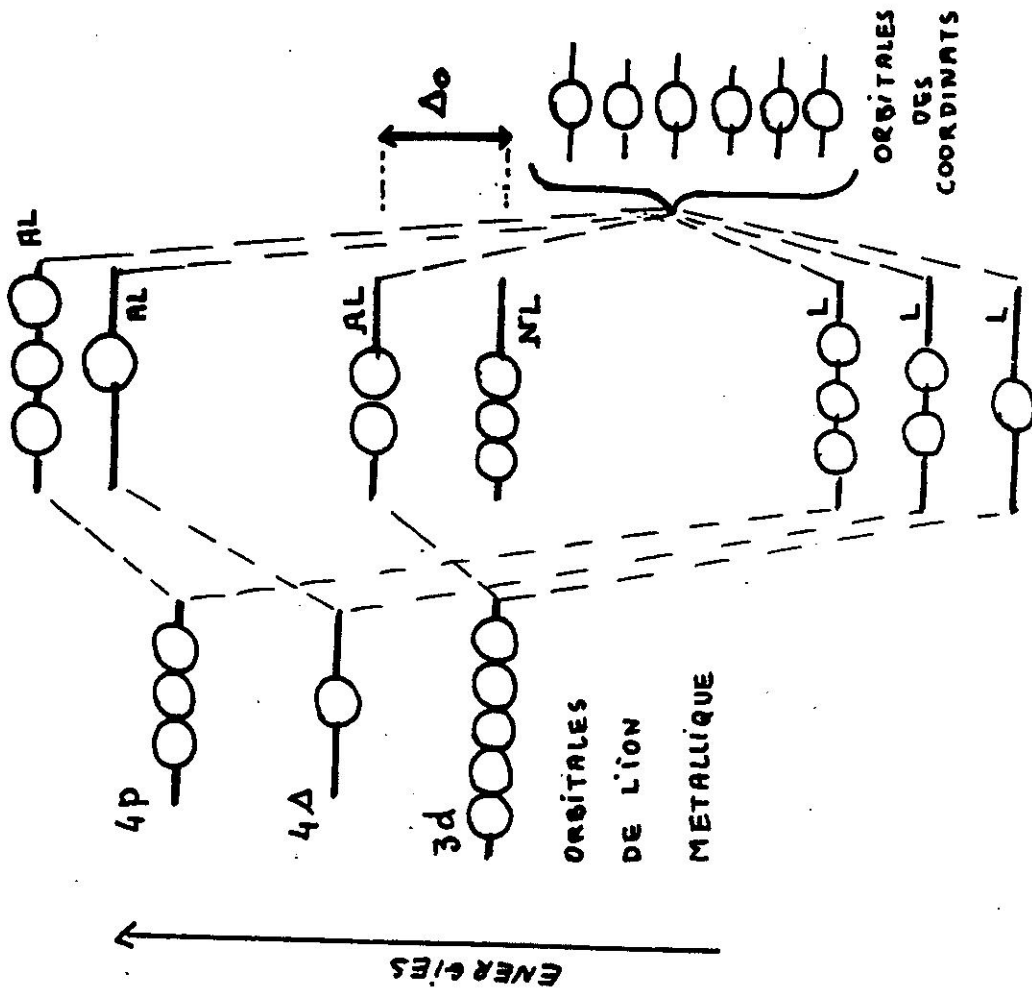


Cis TRANS

ISOMERES

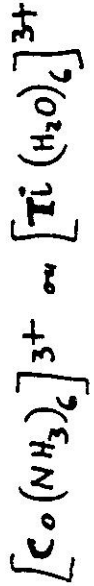
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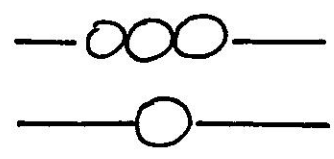
DICHLORO TETRAMINE COBALT III



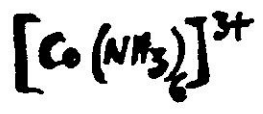
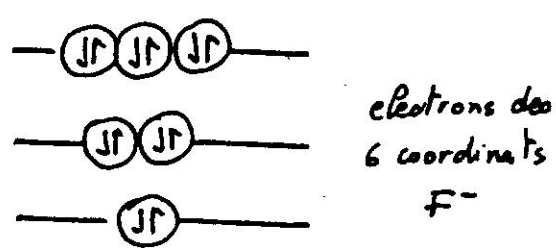
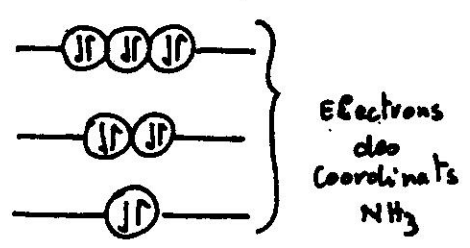
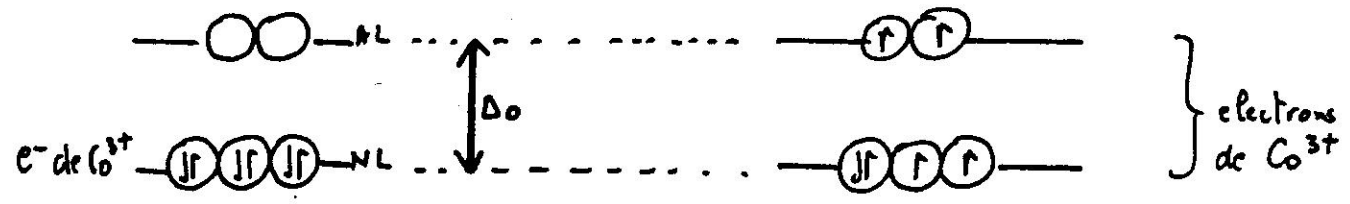
O. MOLECULAIRE

O. P. POUR UN COMPLEXE TYPE



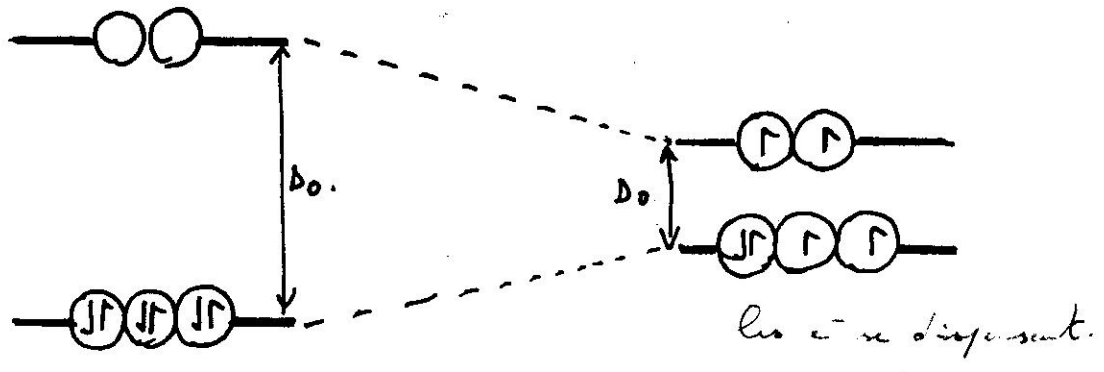


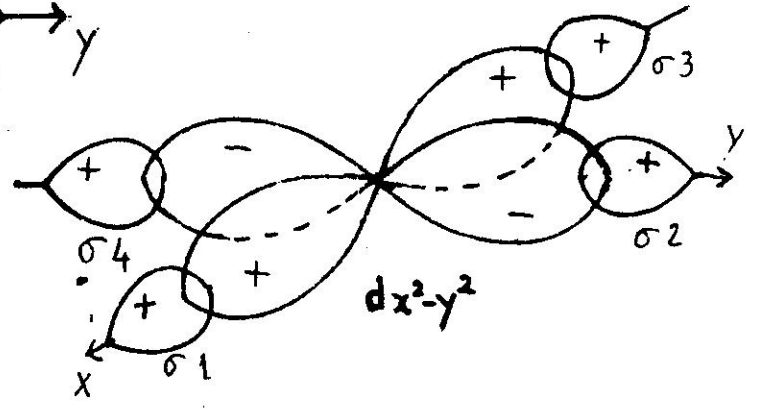
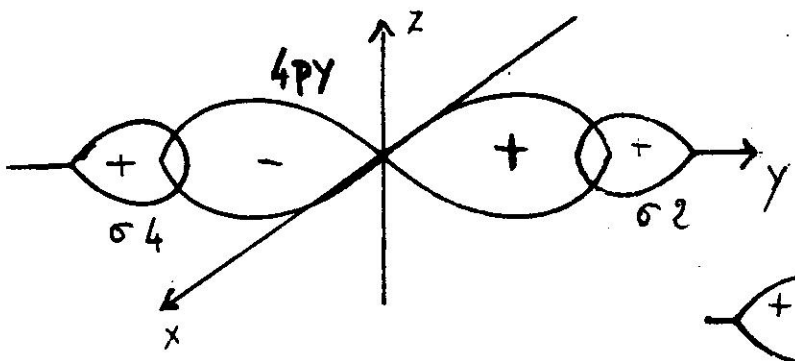
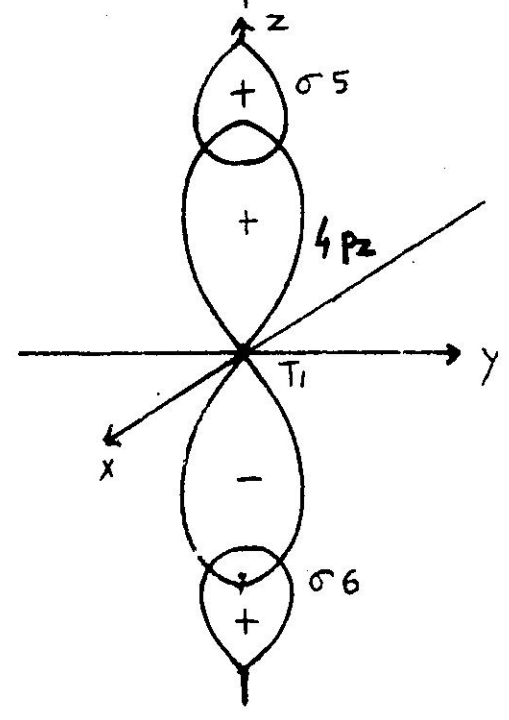
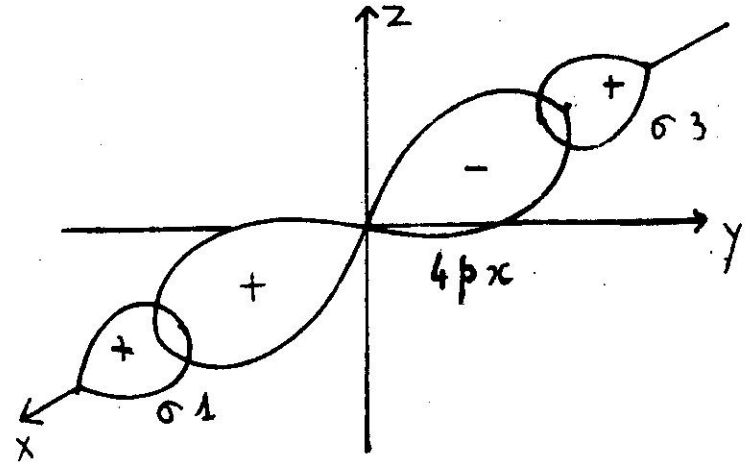
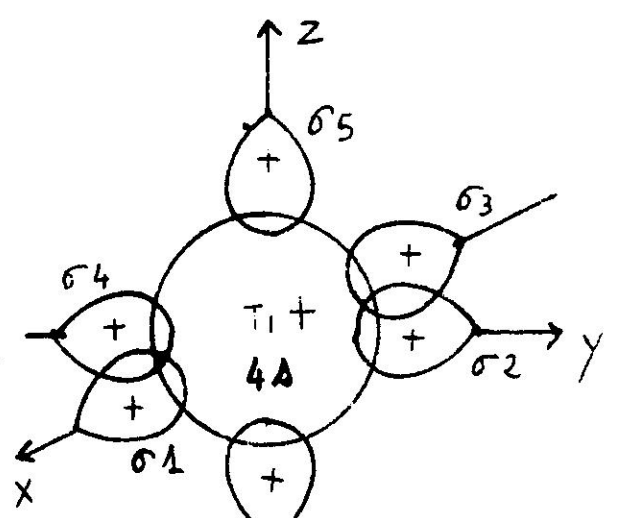
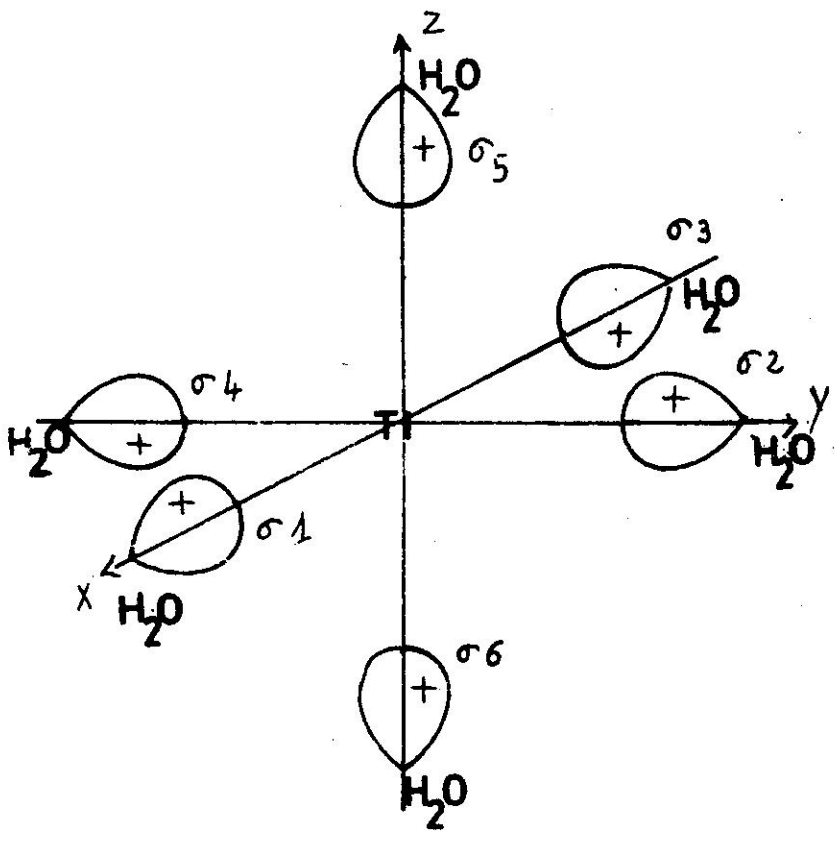
Energie ↑

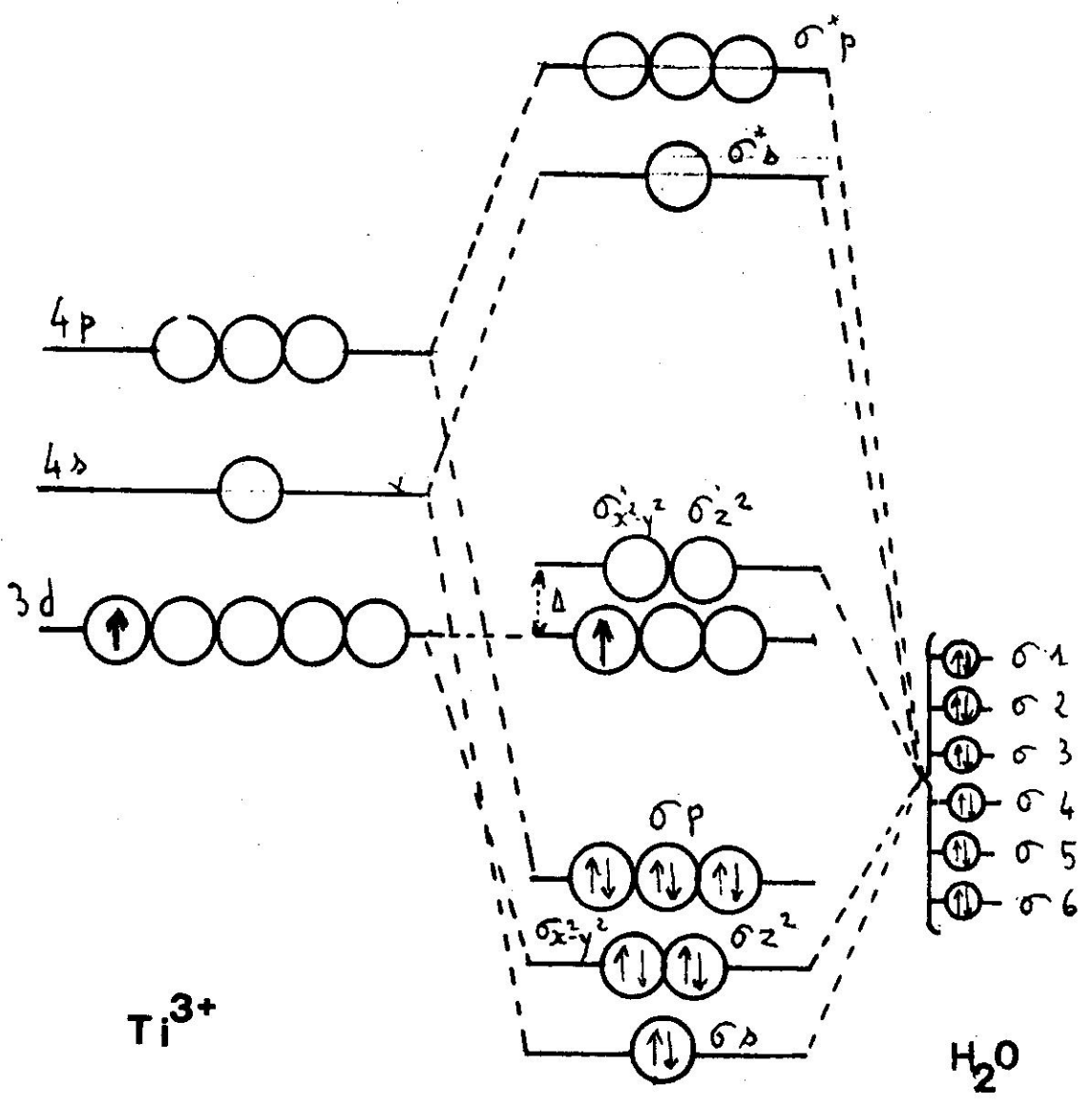
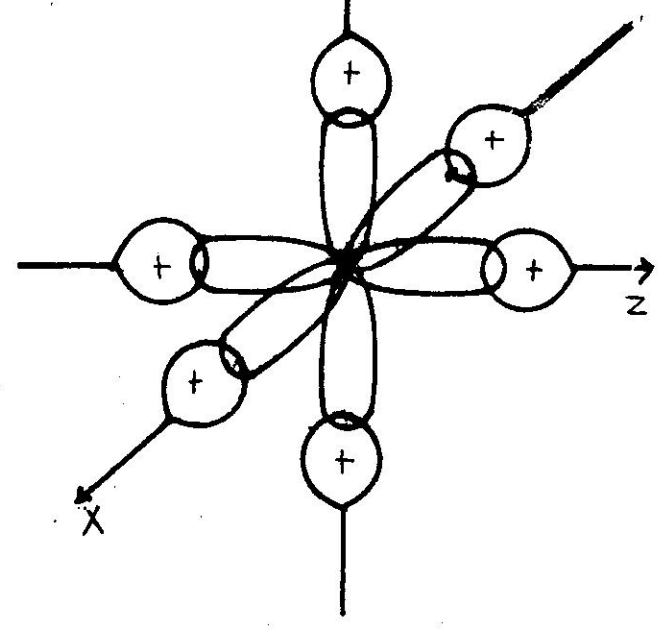
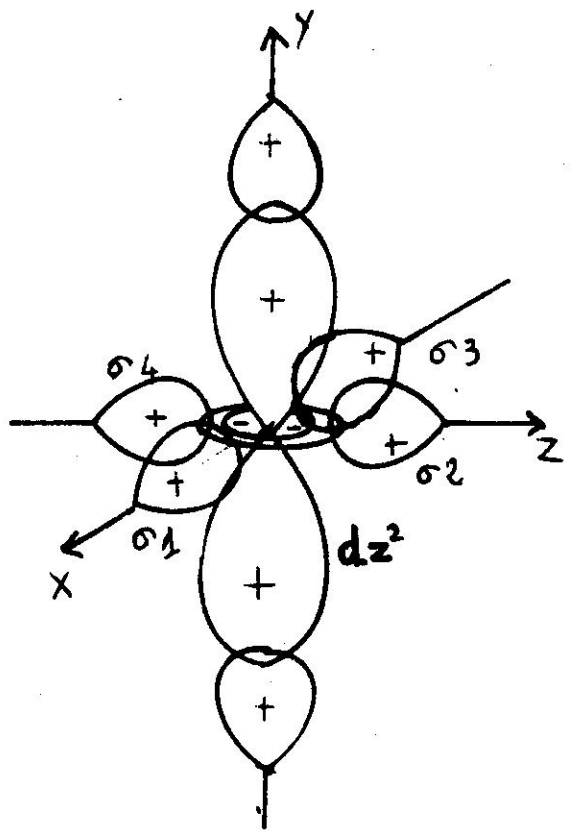


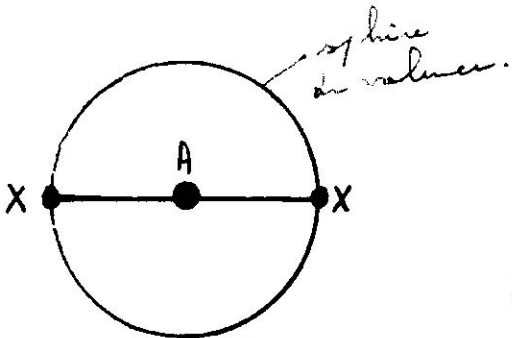
Δ_o grand
 Champ de coordinat fort
 Complexe spin bas

Δ_o petit.
 Champ de coordinat faible
 Complexe spin elevé

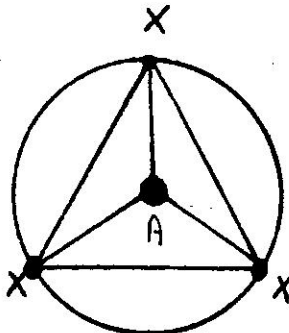




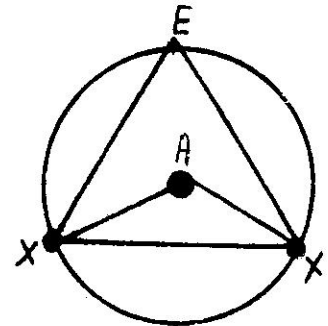




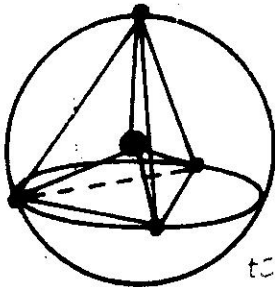
AX_2 linéaire



AX_3 triangle
équatorial

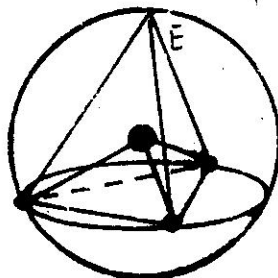


AX_2E
2 axes de 2ème ordre
1 axe de 1er ordre

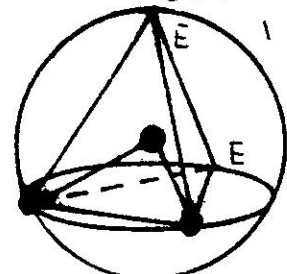


AX_4

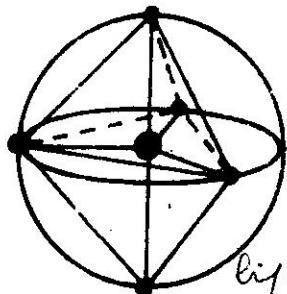
tétraiédre



AX_3E

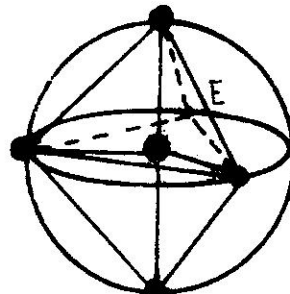


AX_2E_2

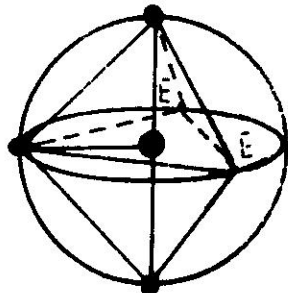


AX_5

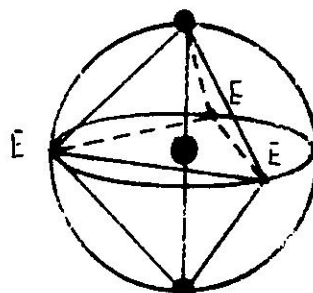
bipyramide
trigonale



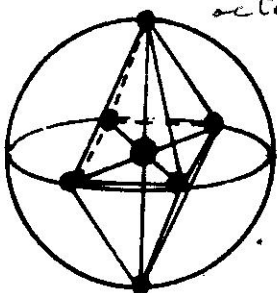
AX_4E



AX_3E_2

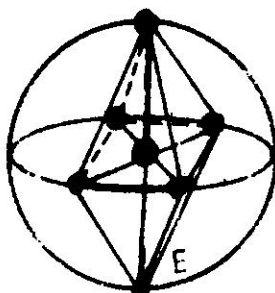


AX_2E_3

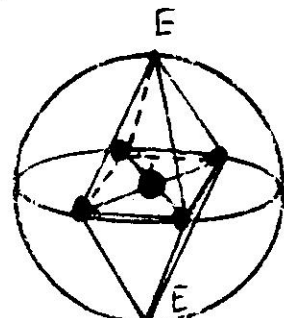


AX_6

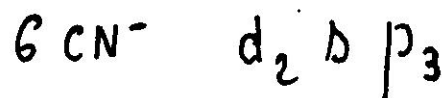
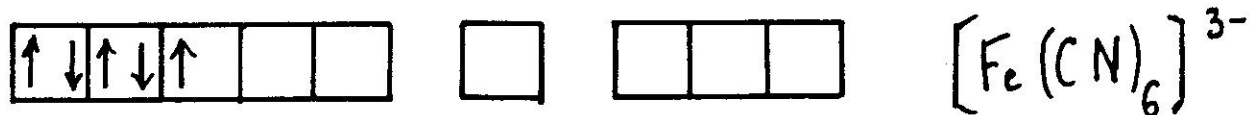
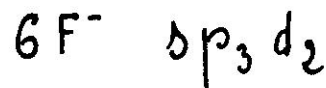
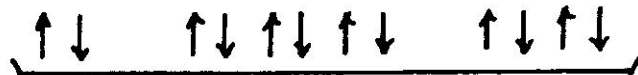
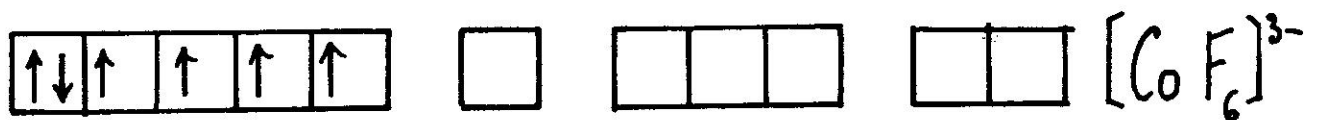
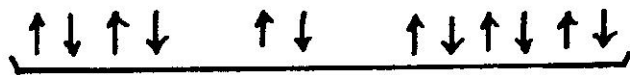
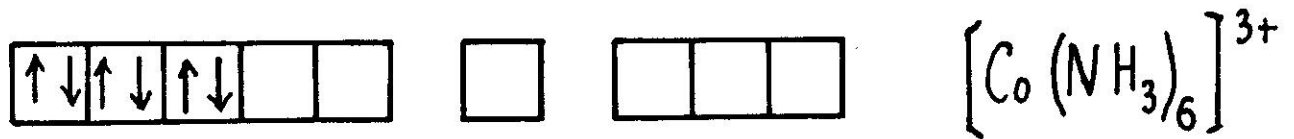
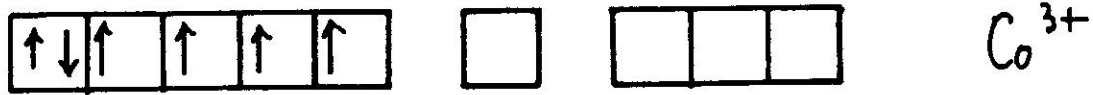
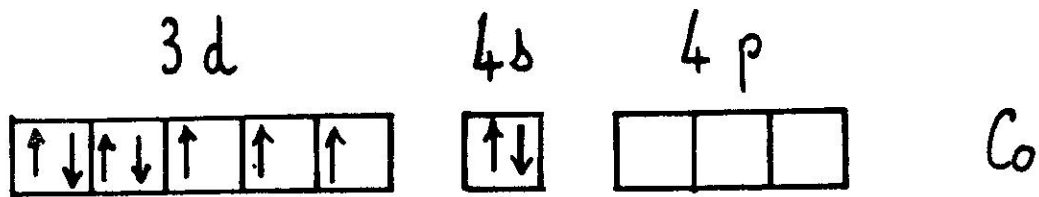
octaèdre

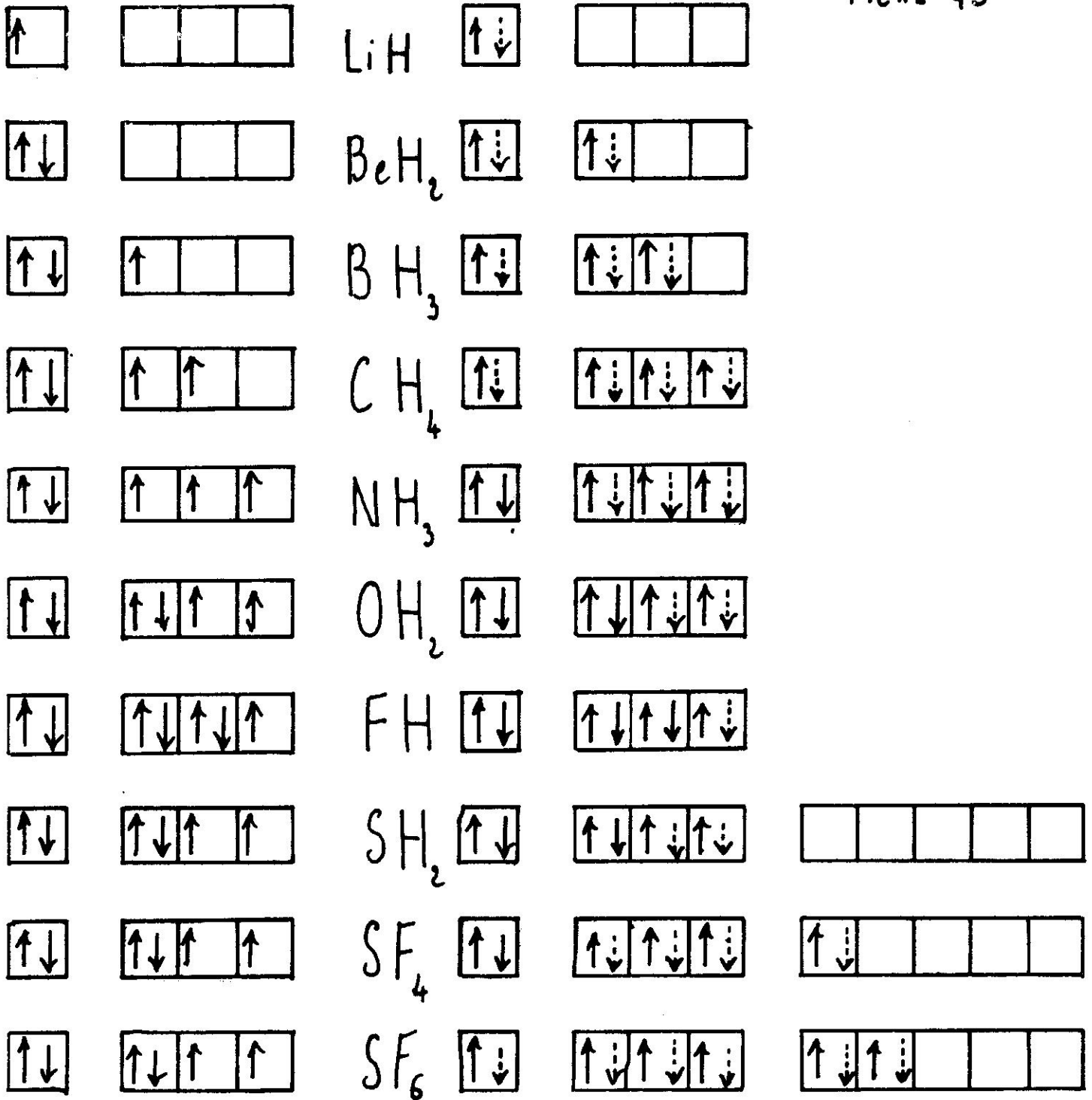


AX_5E

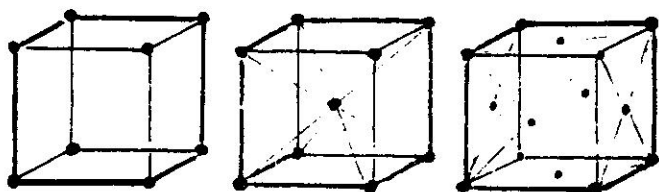


AX_4E_2

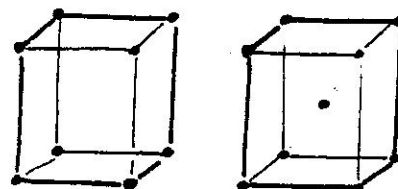




LES 14 TYPES DE RESEAU DE BRAVAIS



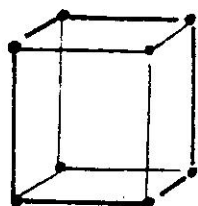
SIMPLE CENTRE FACES CENTRÉES



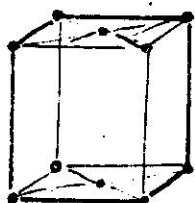
SIMPLE CENTRE

SYSTEME CUBIQUE
(DIAMANT - NaCl)

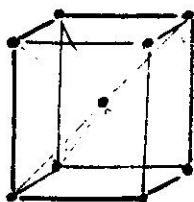
QUADRATIQUE
PRISME DROIT A BASE CARRÉE



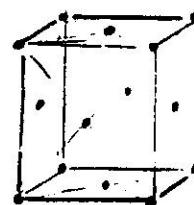
SIMPLE



A BASES CENTRÉES



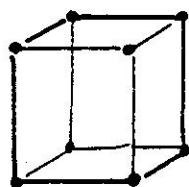
CENTRÉ



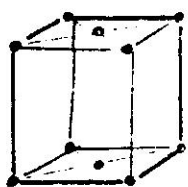
FACES CENTRÉES

ORTHORHOMBIQUE

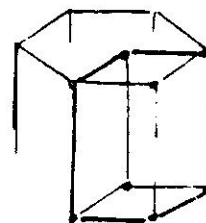
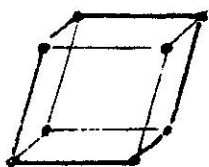
PRISME DROIT A BASE LOSANGE



SIMPLE



BASES CENTRÉES



MONOCLINIQUE

PRISME OBLIQUE BASE LOSANGE
CLINORHOMBIQUE

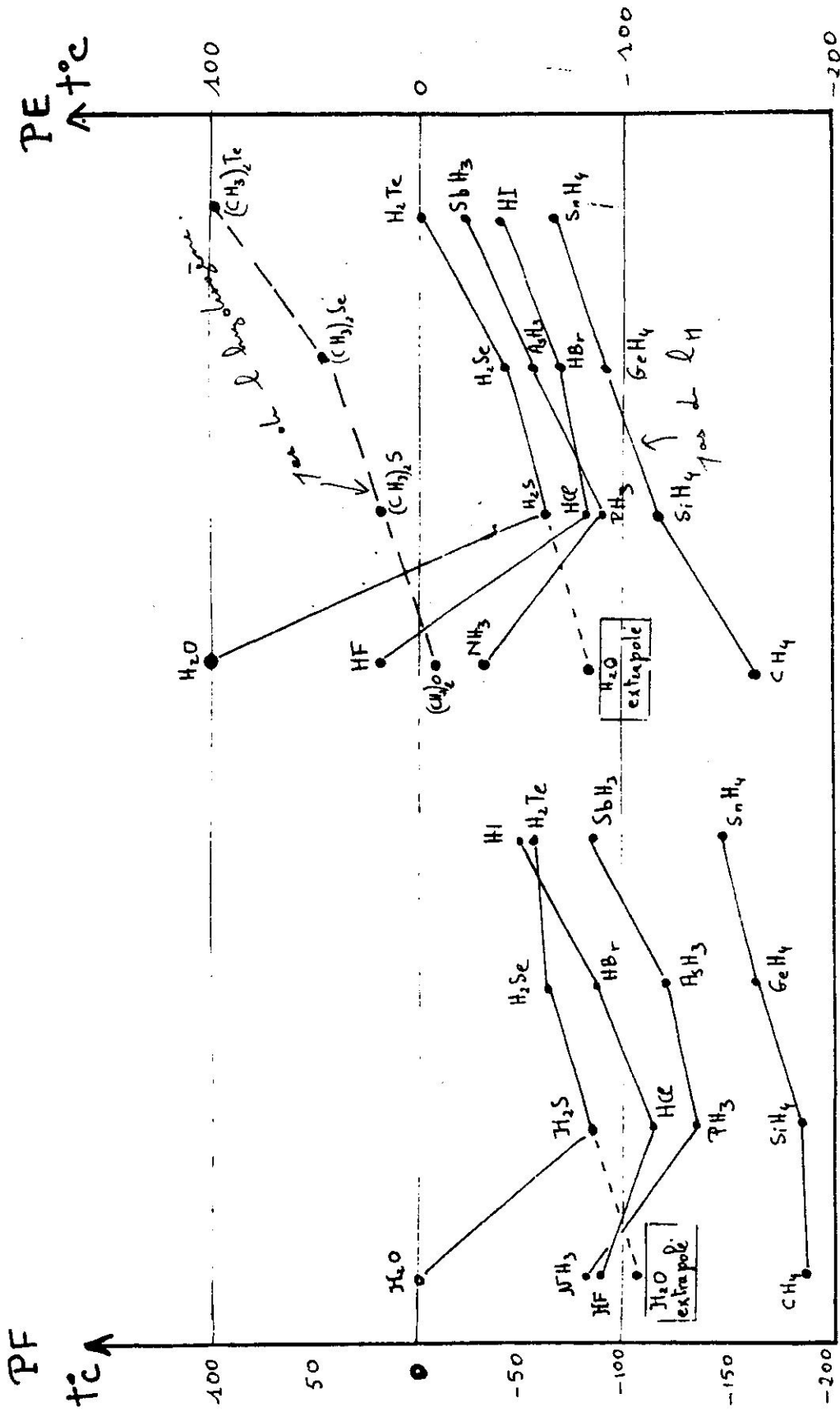
TRICLINIQUE

PARALLELEPEDE
QUELCONQUE

RHOMBOÉDRIQUE

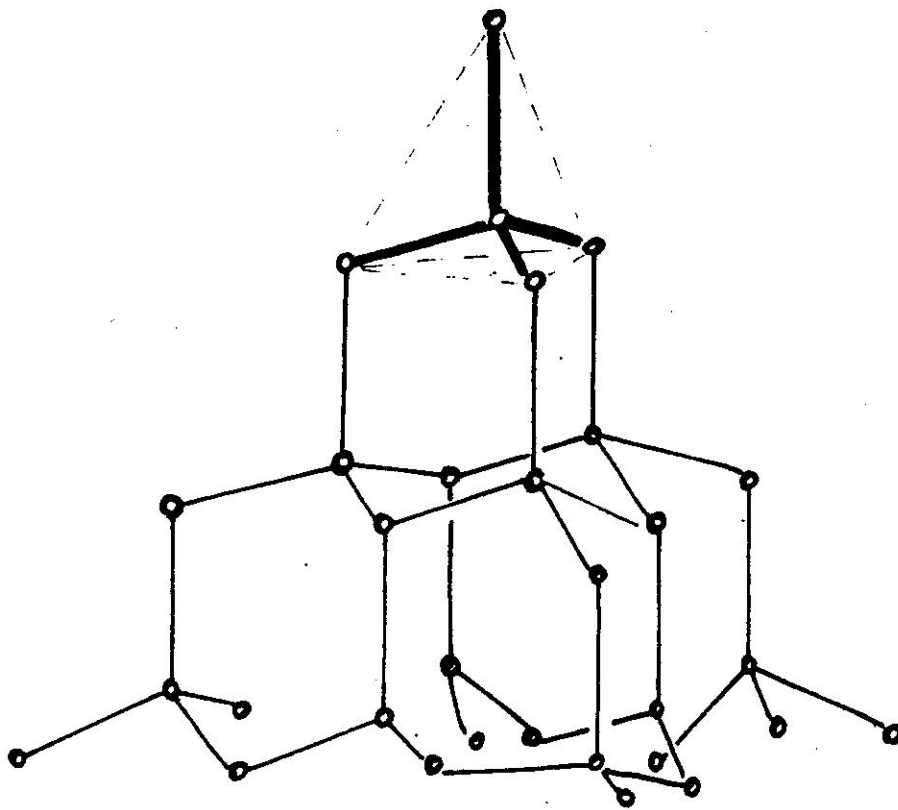
6 LOSANGES

HEXAGONAL

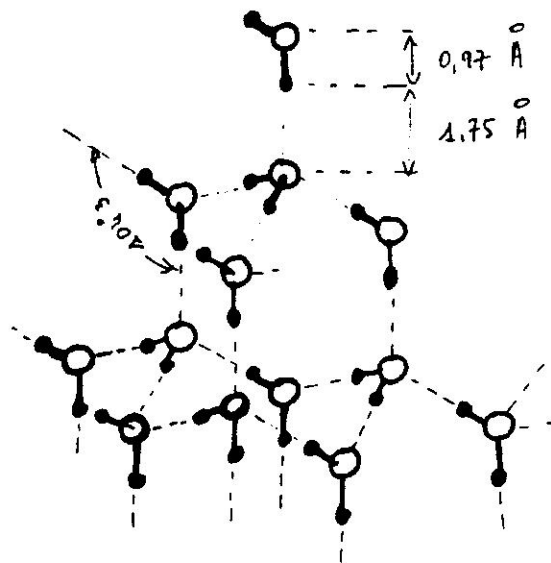


LIARIONS HYDROGÈNE ET PROPRIÉTÉS PHYSIQUES (PF-PE)

LH 1000 L N, 5, F

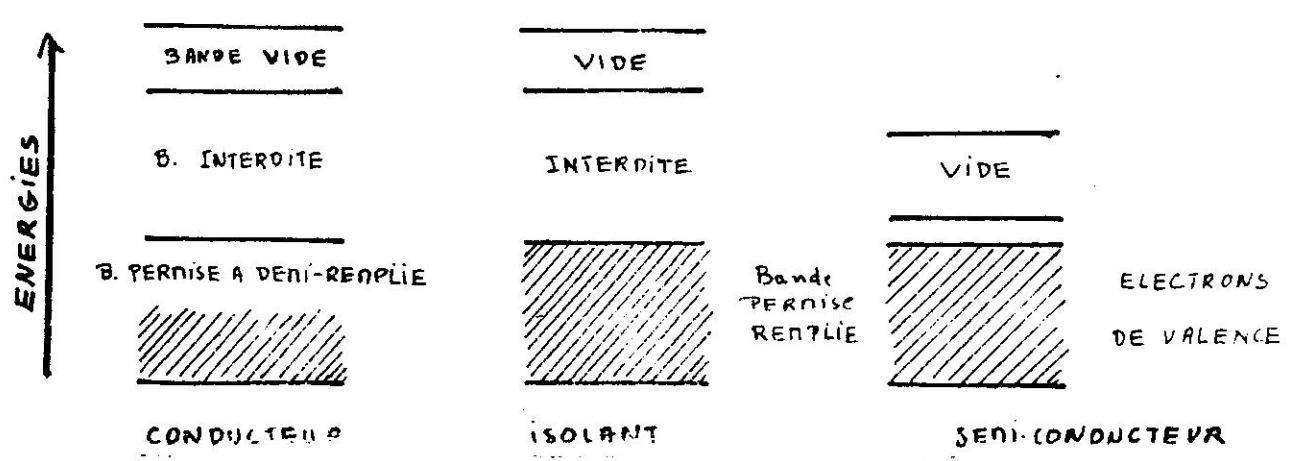
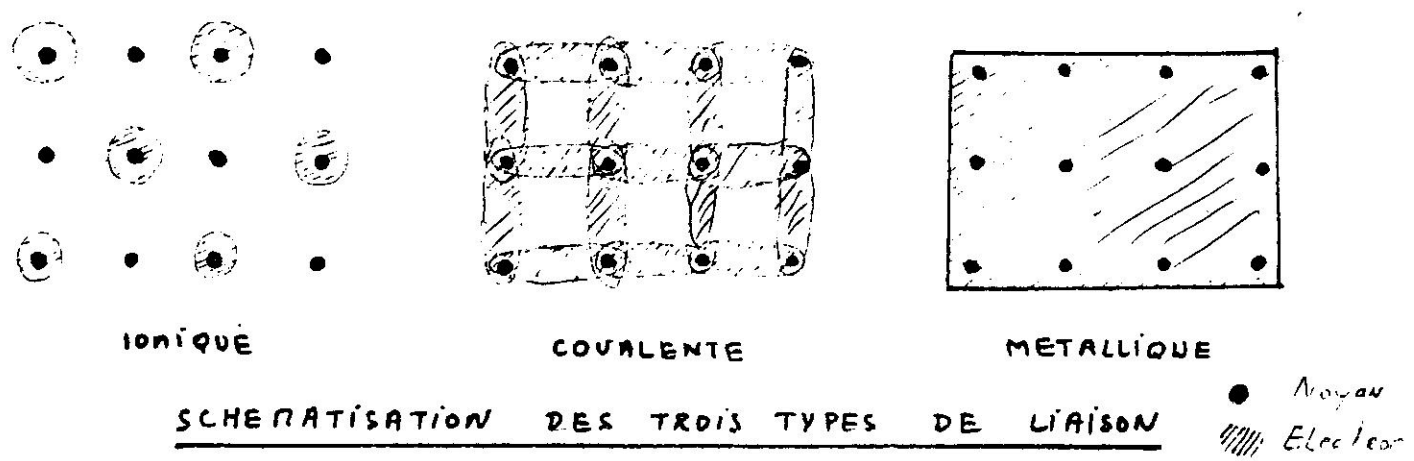
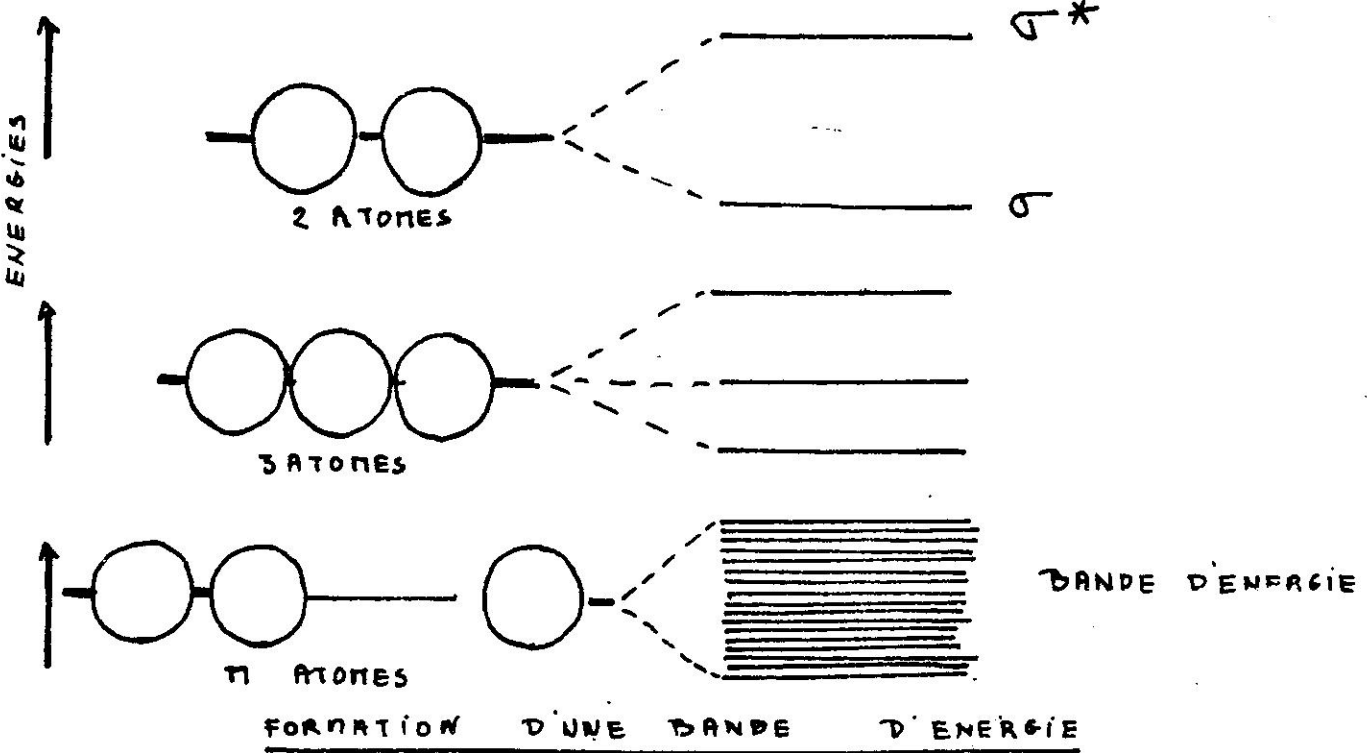


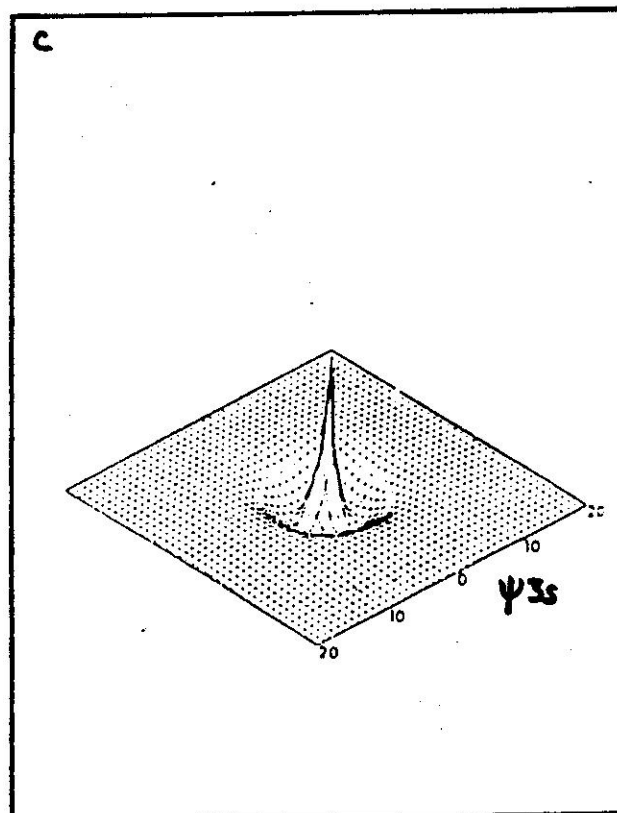
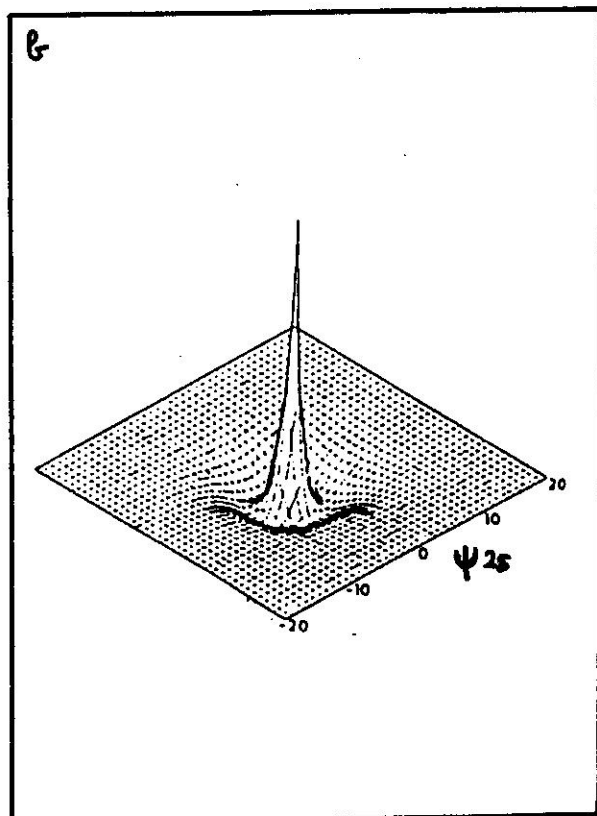
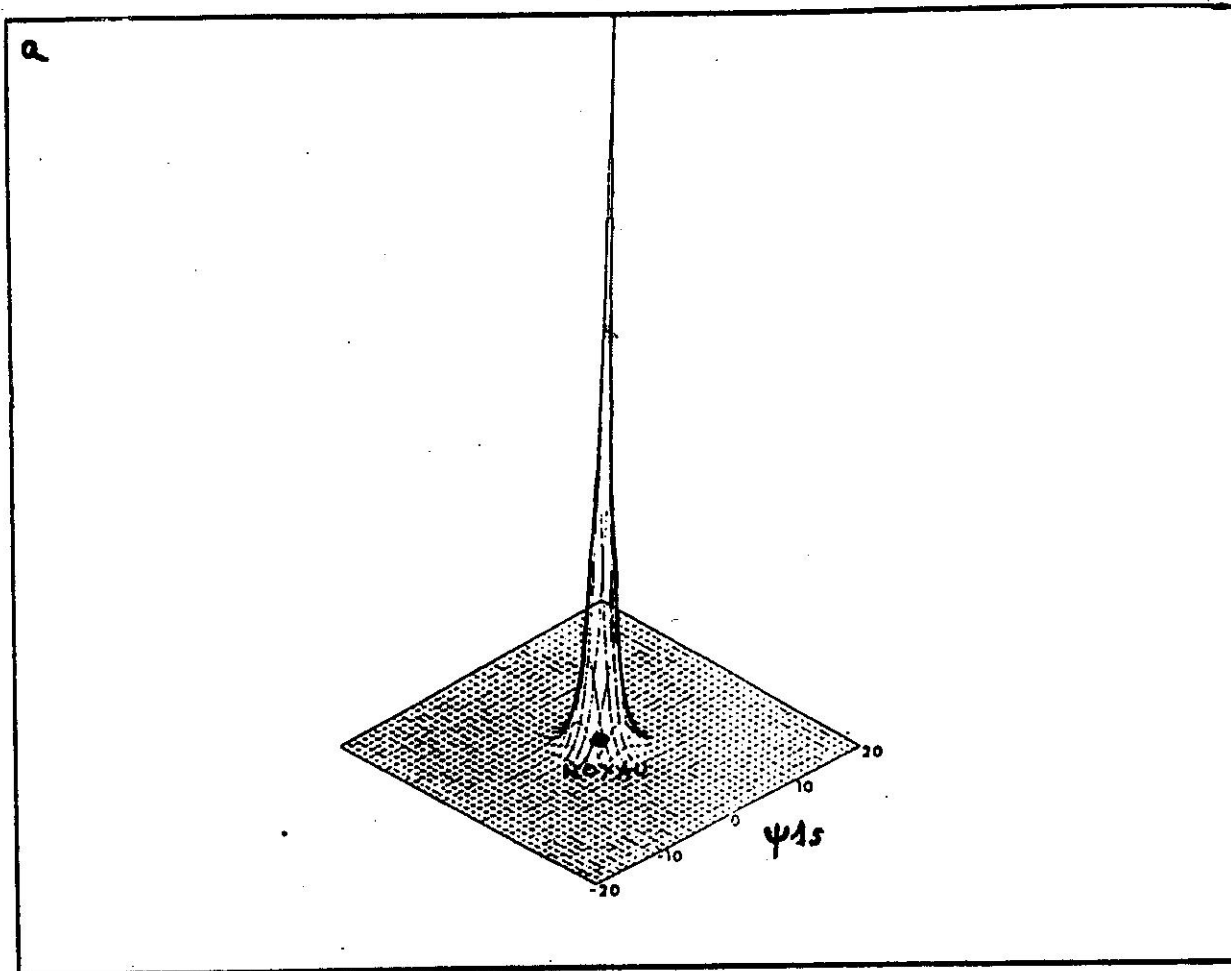
RESEAU DU DIAMANT

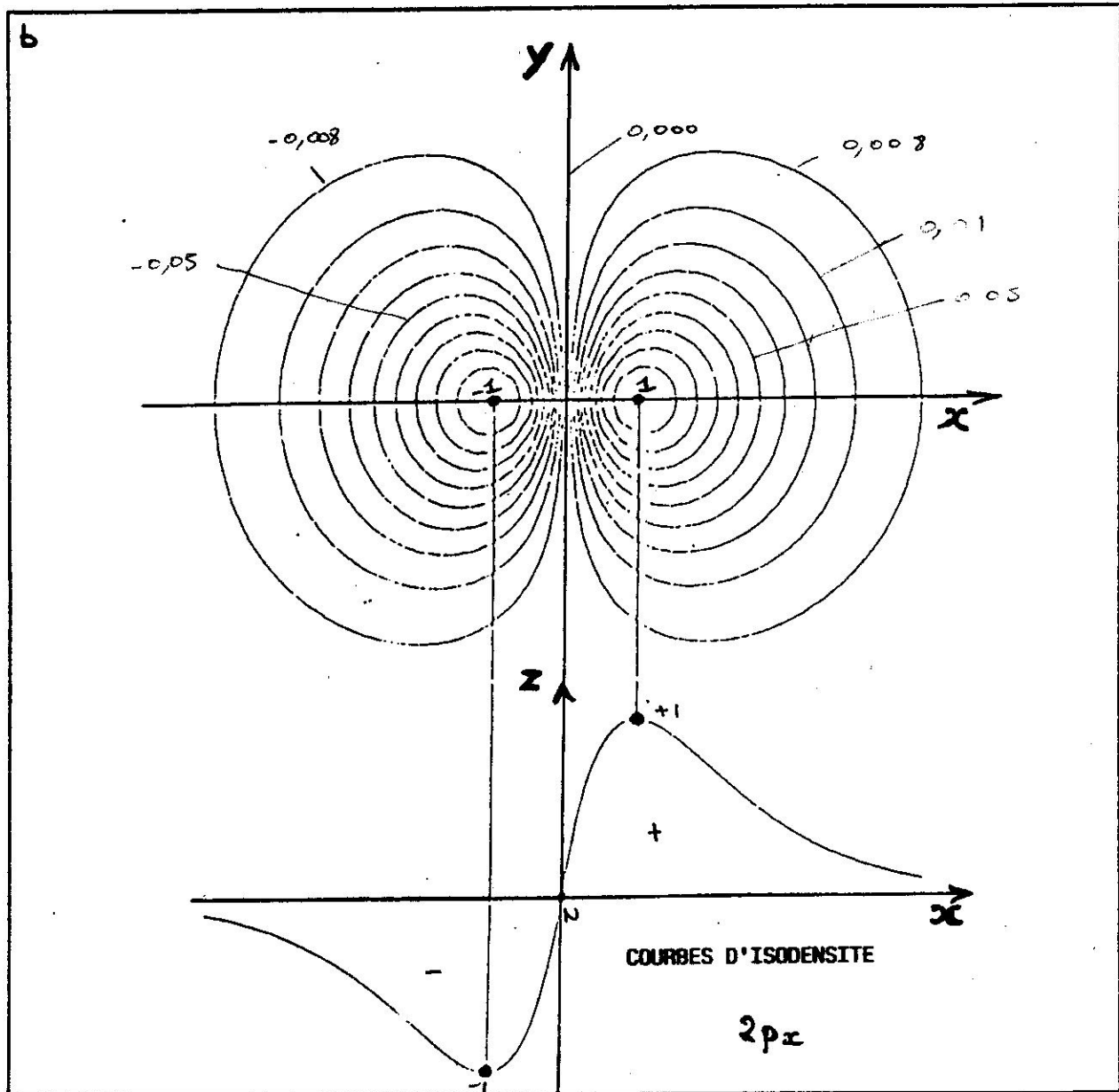
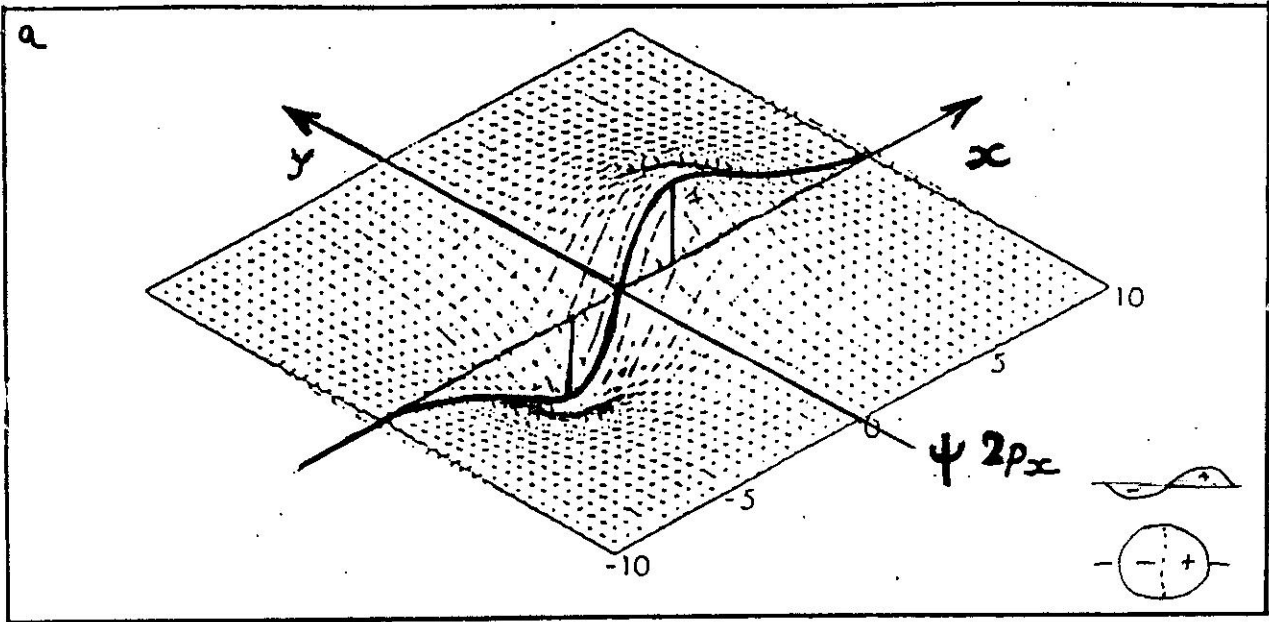


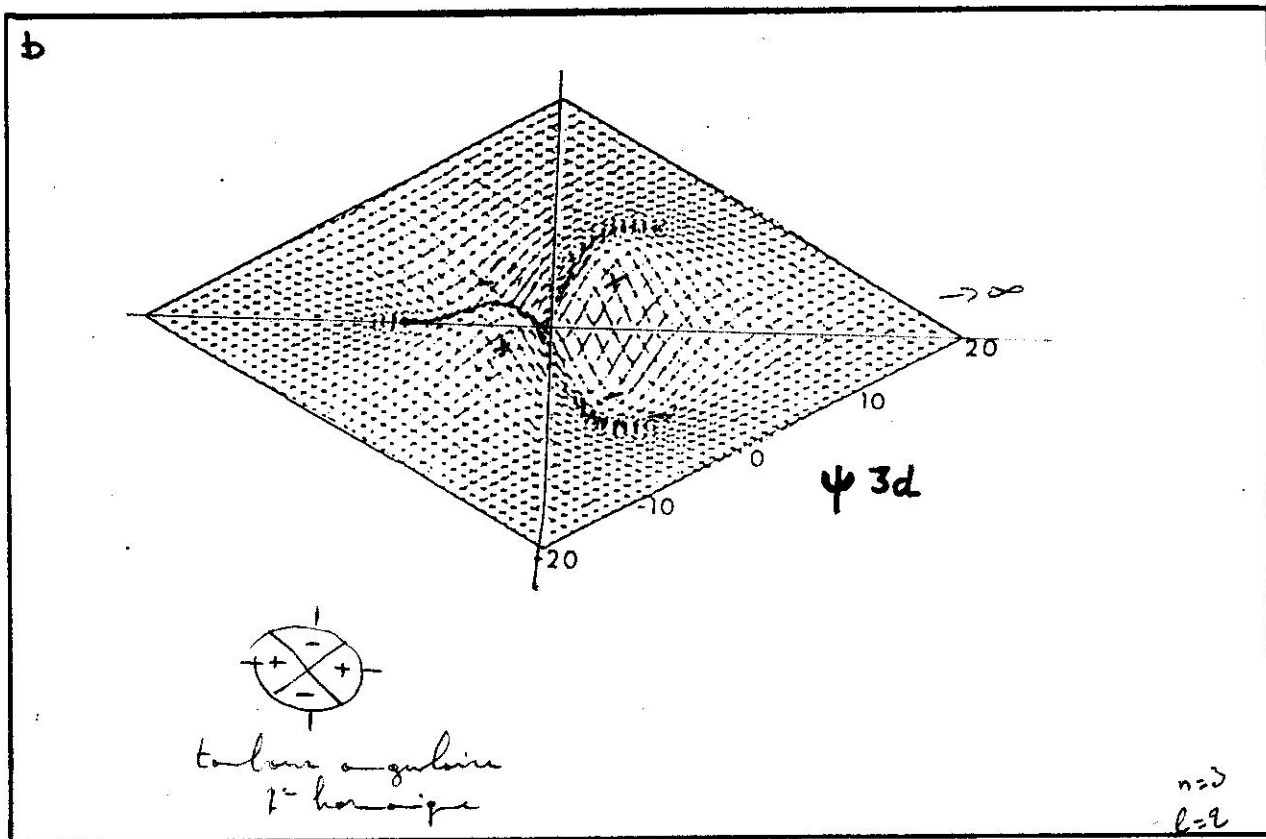
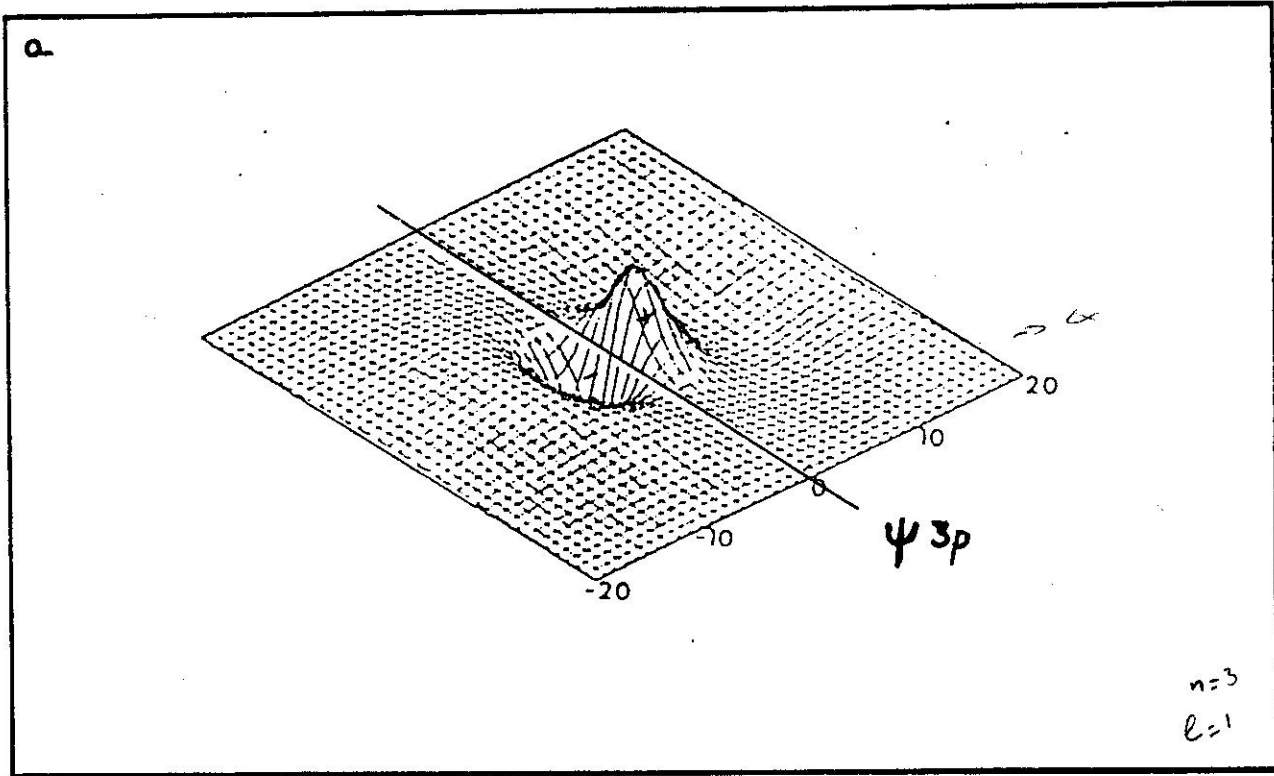
LIAISON H . STRUCTURE DE LA GLACE

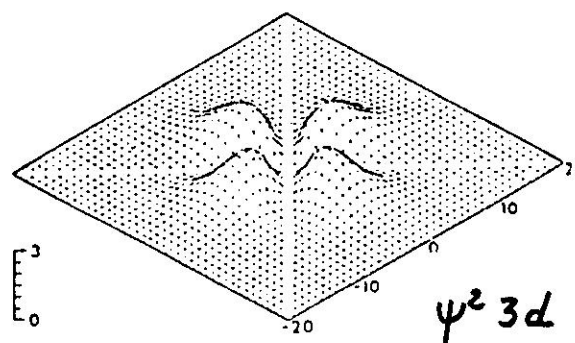
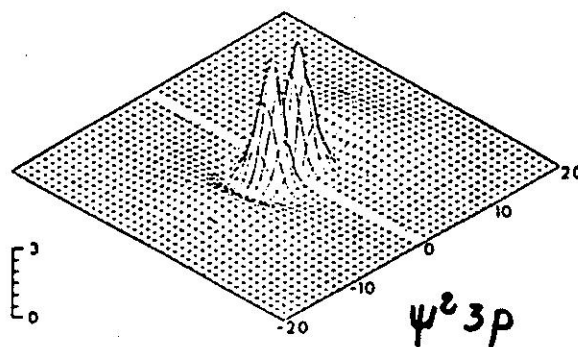
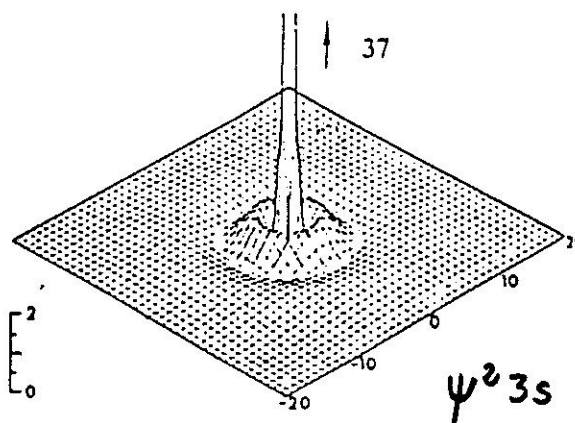
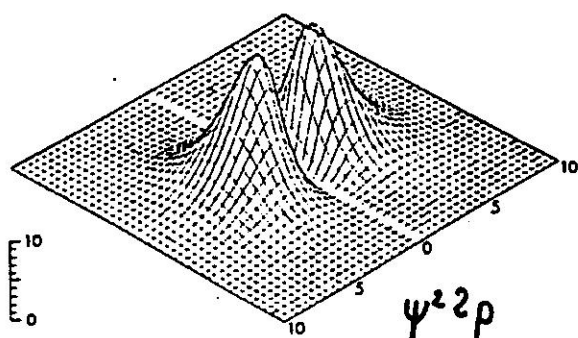
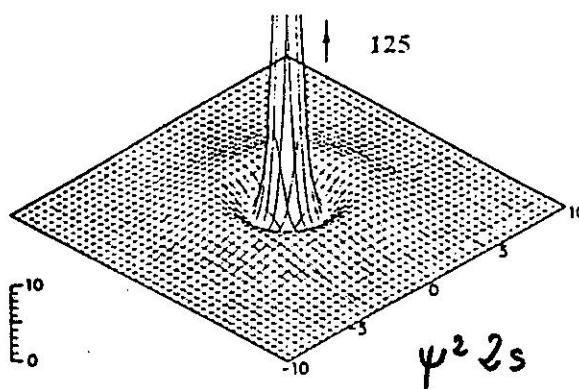
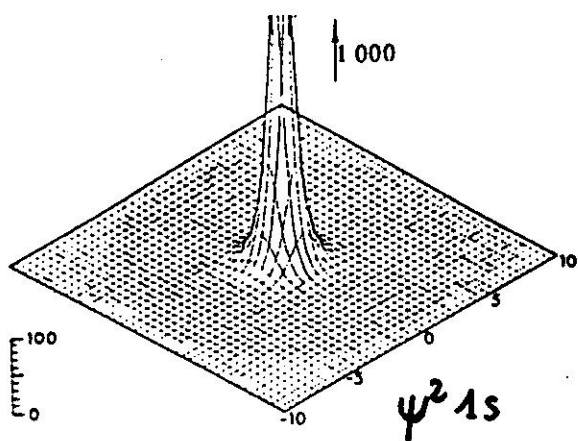
- Hydrogene
- Oxygene.











carre densite probabilites
DISTRIBUTION ELECTRONIQUE DES ORBITALES
positive radiale