







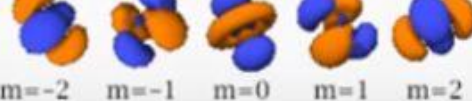
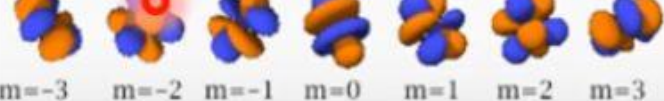


## SOLUTION TO SE FOR SINGLE ATOM CONT.,

- The solution of the SE gives 3D wave functions, or atomic orbitals.
- Each orbital can hold 2 electrons of opposite spin. Every orbital is assigned a unique number  $n, l, m$ . They are also named in the  $s, p, d, f, g$ .
- $p, d, f$  orbitals are mutually perpendicular

	$s (l=0)$	$p (l=1)$	$d (l=2)$	$f (l=3)$
$n=1$	 $m=0$			
$n=2$	 $m=0$	 $m=-1 \quad m=0 \quad m=1$		
$n=3$	 $m=0$	 $m=-1 \quad m=0 \quad m=1$	 $m=-2 \quad m=-1 \quad m=0 \quad m=1 \quad m=2$	
$n=4$	 $m=0$	 $m=-1 \quad m=0 \quad m=1$	 $m=-2 \quad m=-1 \quad m=0 \quad m=1 \quad m=2$	 $m=-3 \quad m=-2 \quad m=-1 \quad m=0 \quad m=1 \quad m=2 \quad m=3$



## ENERGY STATES NOTATION

spdf Notation	n	l	m	s/ħ	Allowable states in subshell	Allowable states in complete shell
1s	1	0	0	$\pm \frac{1}{2}$	2	2
2s	2	0	0	$\pm \frac{1}{2}$	2	8
2p		1	-1	$\pm \frac{1}{2}$	6	
			0	$\pm \frac{1}{2}$		
			1	$\pm \frac{1}{2}$		
3s	3	0	0	$\pm \frac{1}{2}$	2	18
3p		1	-1	$\pm \frac{1}{2}$	6	
			0	$\pm \frac{1}{2}$		
			1	$\pm \frac{1}{2}$		
3d		2	-2	$\pm \frac{1}{2}$	10	
			-1	$\pm \frac{1}{2}$		
			0	$\pm \frac{1}{2}$		
			1	$\pm \frac{1}{2}$		
			2	$\pm \frac{1}{2}$		

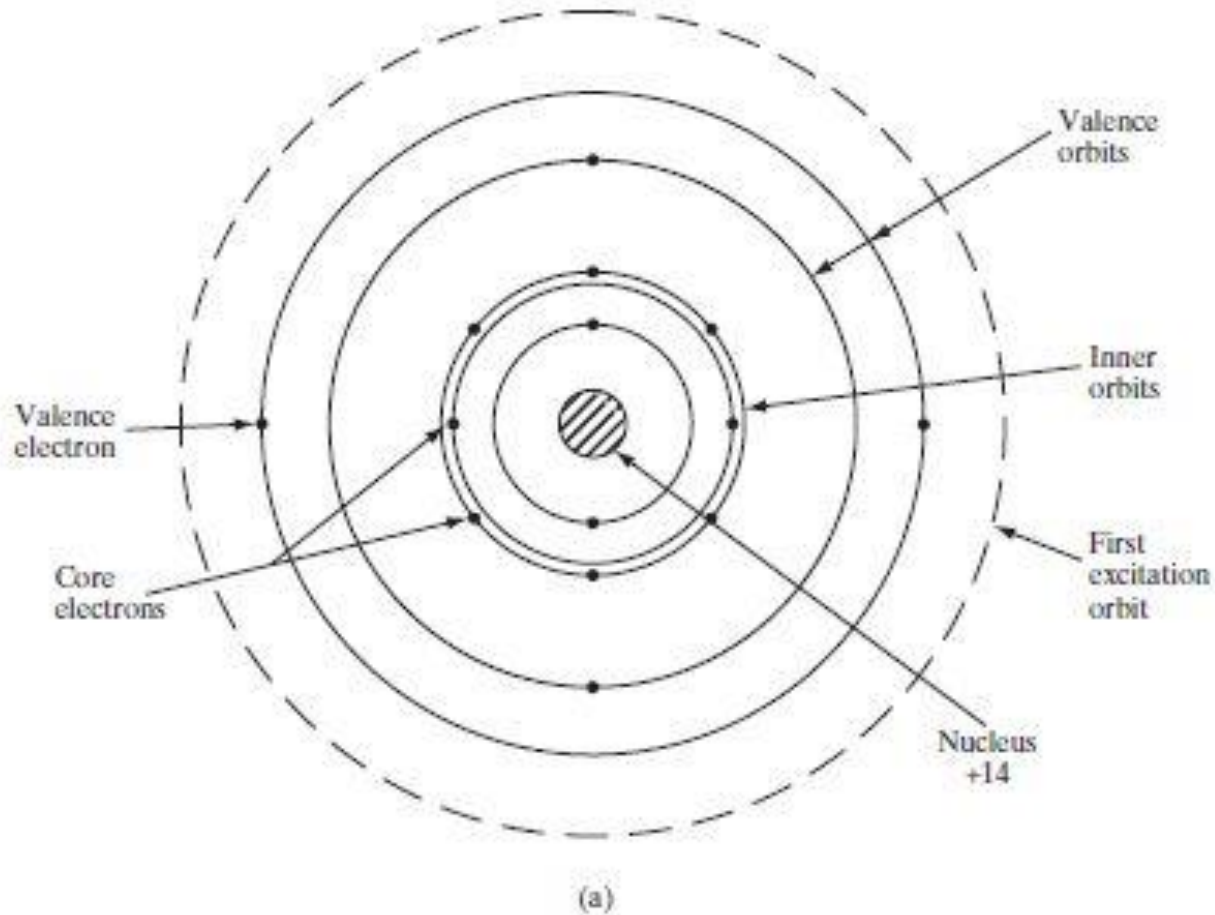


## ELECTRONIC CONFIGURATION OF OTHER ATOMS

Atomic number (Z)	Element	Number of electrons						Shorthand notation		
		n = 1 l = 0		2 0 1		3 0 1 2		4 0 1		
		1s	2s 2p	3s 3p	3d	4s	4p			
1	H	1						1s <sup>1</sup>		
2	He	2						1s <sup>2</sup>		
3	Li	helium core, 2 electrons		1				1s <sup>2</sup> 2s <sup>1</sup>		
4	Be			2				1s <sup>2</sup> 2s <sup>2</sup>		
5	B			2	1			1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>1</sup>		
6	C			2	2			1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>2</sup>		
7	N			2	3			1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>3</sup>		
8	O			2	4			1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>4</sup>		
9	F			2	5			1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>5</sup>		
10	Ne			2	6			1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup>		
11	Na	neon core, 10 electrons			1			[Ne] 3s <sup>1</sup>		
12	Mg				2			3s <sup>2</sup>		
13	Al				2	1		3s <sup>2</sup> 3p <sup>1</sup>		
14	Si				2	2		3s <sup>2</sup> 3p <sup>2</sup>		
15	P				2	3		3s <sup>2</sup> 3p <sup>3</sup>		
16	S				2	4		3s <sup>2</sup> 3p <sup>4</sup>		
17	Cl				2	5		3s <sup>2</sup> 3p <sup>5</sup>		
18	Ar				2	6		3s <sup>2</sup> 3p <sup>6</sup>		
19	K	argon core, 18 electrons					1		[Ar] 4s <sup>1</sup>	
20	Ca						2		4s <sup>2</sup>	
21	Sc					1	2		3d <sup>1</sup> 4s <sup>2</sup>	
22	Ti					2	2		3d <sup>2</sup> 4s <sup>2</sup>	
23	V					3	2		3d <sup>3</sup> 4s <sup>2</sup>	
24	Cr					5	1		3d <sup>5</sup> 4s <sup>1</sup>	
25	Mn					5	2		3d <sup>5</sup> 4s <sup>2</sup>	
26	Fe					6	2		3d <sup>6</sup> 4s <sup>2</sup>	
27	Co					7	2		3d <sup>7</sup> 4s <sup>2</sup>	
28	Ni					8	2		3d <sup>8</sup> 4s <sup>2</sup>	
29	Cu					10	1		3d <sup>10</sup> 4s <sup>1</sup>	
30	Zn					10	2		3d <sup>10</sup> 4s <sup>2</sup>	
31	Ga					10	2	1	3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>1</sup>	
32	Ge					10	2	2	3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>2</sup>	
33	As					10	2	3	3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>3</sup>	
34	Se					10	2	4	3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>4</sup>	
35	Br					10	2	5	3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>5</sup>	
36	Kr					10	2	6	3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>6</sup>	

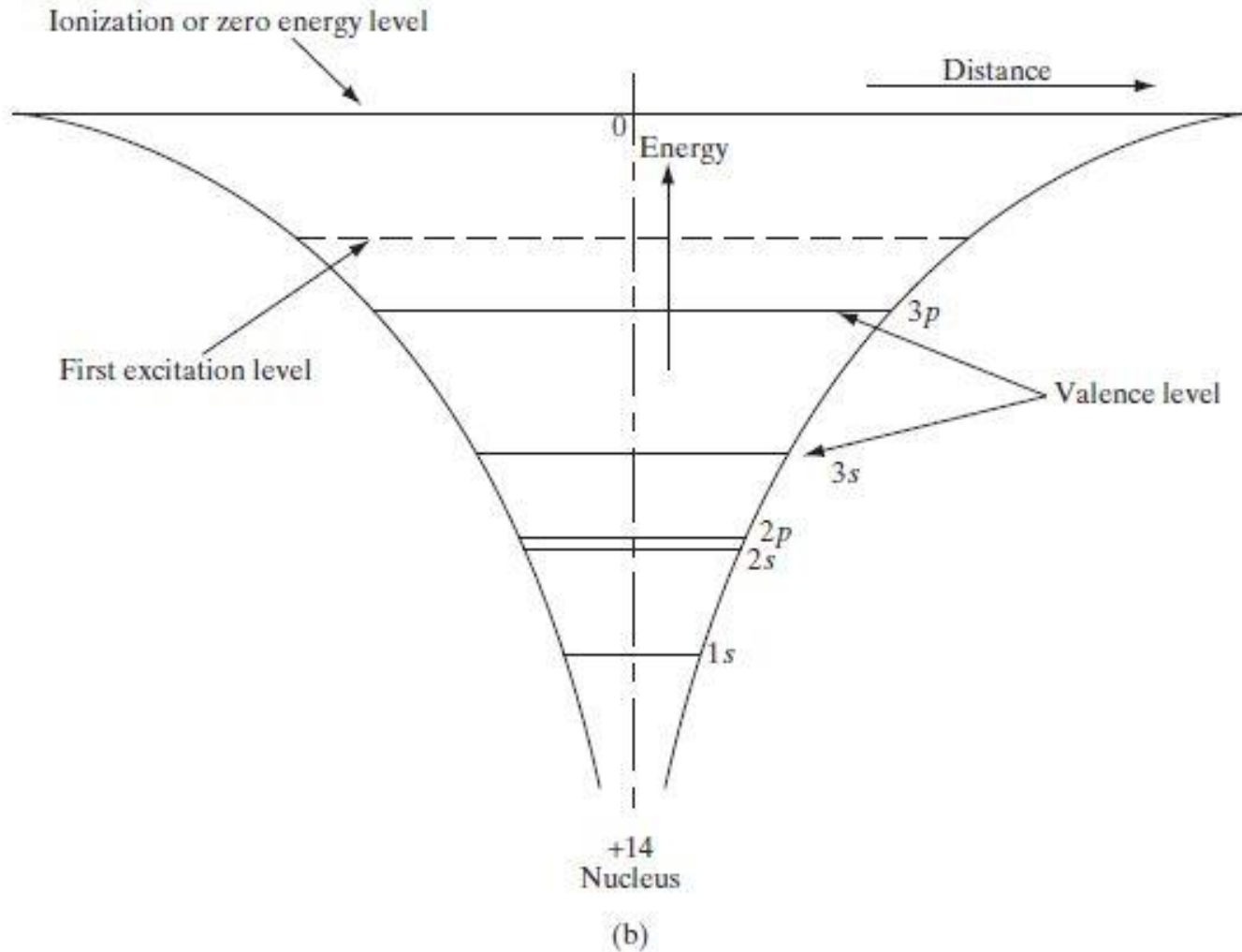


# ELECTRONIC STRUCTURE AND ENERGY LEVELS





## ELECTRONIC STRUCTURE AND ENERGY LEVELS





## Foundation of Domain Engineers?

Workhorse of a Software Engineer

Workhorse of Analog Design Engineer

Workhorse of Digital Design Engineer



**THANK YOU**