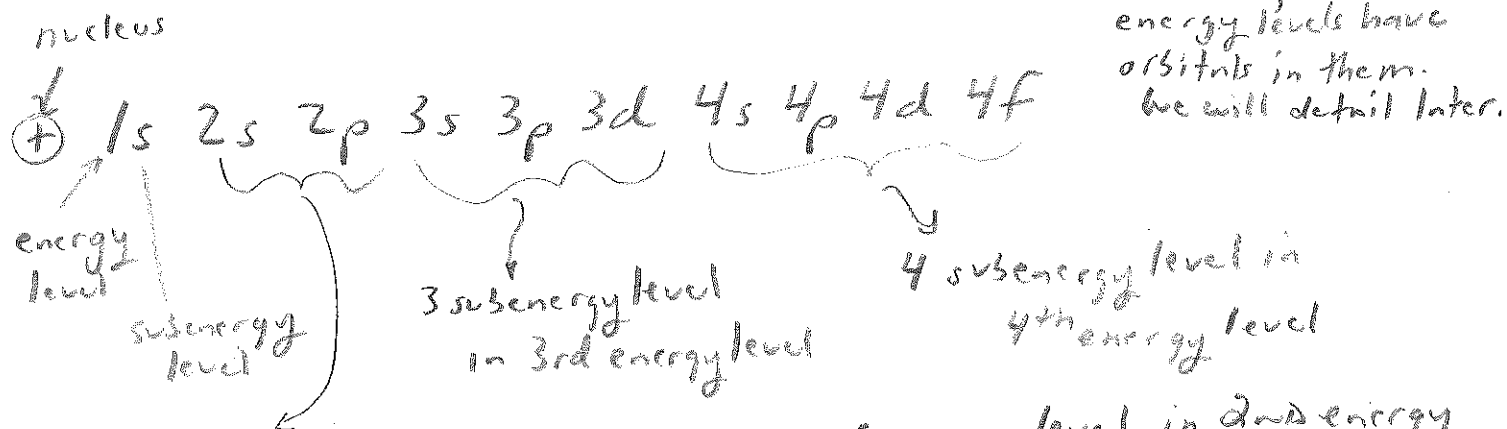


Ordering of Energy Levels, Subenergy levels, and orbitals

①

As we have talked about importance of "location" of the electron outside of nucleus and that region is "cut up" into smaller subregions (orbitals), it would be important to make a list of subregions from closest to nucleus to furthest one away.

From our knowledge of energy level, subenergy levels, & orbitals, we can make the list, by



Since # of subenergy = number of energy level, in 2nd energy level you have 2 subenergy level, s & p.

THIS IS CORRECT LIST OF SUBENERGY LEVELS FOR Hydrogen only!! It is only element that has 1 electron. So orbitals & subenergy levels are BOTH DEgenerate.

THIS IS NOT TRUE FOR ALL the other elements on Periodic Table. They are called Polyelectronic elements. Meaning they all have more than one electron.

Ordering of Energy Levels, Subenergy Levels and Orbitals (2)

? Why does having more than 1 electron affect things?

ANSWER: The electrons will eventually get close enough together to interact with each other (repel each).

? SO ? It causes 2 effects:

1) Subenergy levels are not degenerate (orbitals still) ^{are}
so s is always closest, then p, then d,
and f is farthest away.

2) Since distance between energy levels decrease as you go to higher energy levels and there are more subenergy levels (there not degenerate) eventually you will get "overlapping".

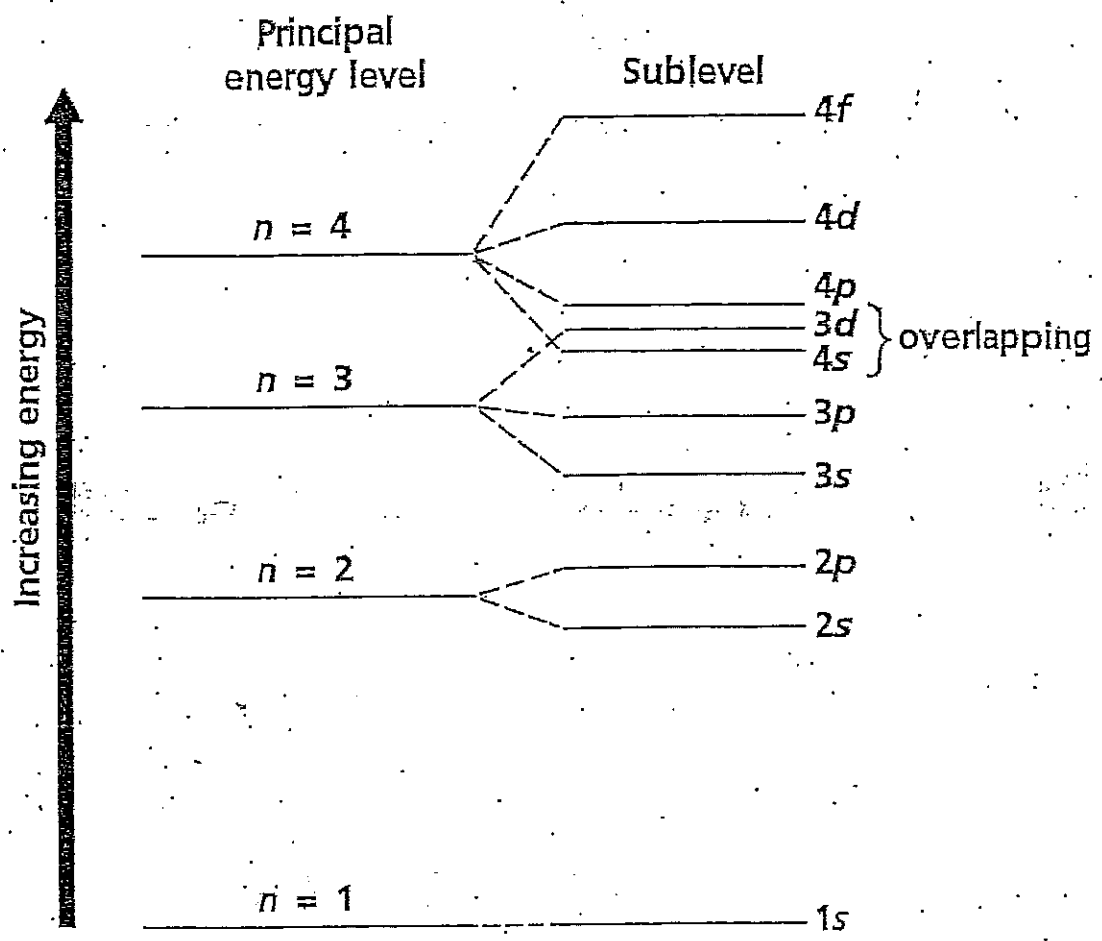
Overlapping is when a lower subenergy level of a higher energy level is closer to nucleus than a higher subenergy level of a lower energy level.

See attached sheet for diagram of overlapping.

NO OVERLAPPING

Principal Energy Level (n)	Sublevels Available
1	1s
2	2s 2p
3	3s 3p 3d
4	4s 4p 4d 4f
5	5s 5p 5d 5f 5g
6	6s 6p 6d 6f 6g 6h
7	7s 7p 7d 7f 7g 7h 7i

WITH OVERLAPPING



Ordering of Energy Levels, subenergy levels and Orbitals

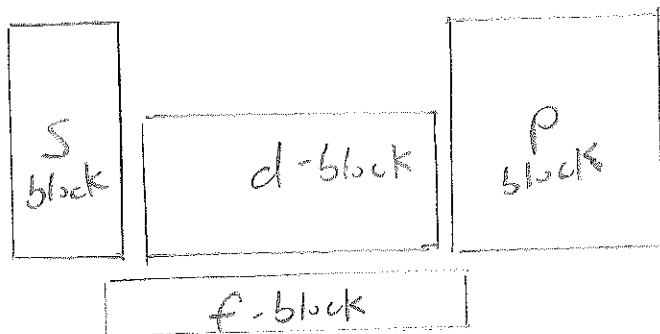
4

So how are we going to figure out how to align subenergy levels with overlapping.

Answer: There are 2 methods.

A. Using the List of subenergy levels with NO OVERLAPPING (from previous page). There is a way to put arrows on list to get right order. I do not do this method. You can but you must memorize list.

B. By Periodic Table.



subenergy level	Energy level (n)
s + p	$n = \text{Row \#}$
d	$n = \text{Row \#} - 1$
f	$n = \text{Row \#} - 2$

*Actual Period Table is on next page

① 1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s 4f 5d 6p 7s 5f 6d 7p

1st overlap: arrow from 4s to 3d

2nd overlap: arrow from 5s to 4d

Notes

* Always start on top left of Periodic Table (table arranged so next element has one more electron)

2002 Massachusetts Comprehensive Assessment System

Periodic Table of the Elements

1	1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A	12A	13A	14A	15A	16A	17A	18A	19A	20A	21A	22A	23A	24A	25A	26A	27A	28A	29A	30A	31A	32A	33A	34A	35A	36A	37A	38A	39A	40A	41A	42A	43A	44A	45A	46A	47A	48A	49A	50A	51A	52A	53A	54A	55A	56A	57A	58A	59A	60A	61A	62A	63A	64A	65A	66A	67A	68A	69A	70A	71A	72A	73A	74A	75A	76A	77A	78A	79A	80A	81A	82A	83A	84A	85A	86A	87A	88A	89A	90A	91A	92A	93A	94A	95A	96A	97A	98A	99A	100A	101A	102A	103A	104A	105A	106A	107A	108A	109A	110A	111A	112A	113A	114A	115A	116A	117A	118A	119A	120A	121A	122A	123A	124A	125A	126A	127A	128A	129A	130A	131A	132A	133A	134A	135A	136A	137A	138A	139A	140A	141A	142A	143A	144A	145A	146A	147A	148A	149A	150A	151A	152A	153A	154A	155A	156A	157A	158A	159A	160A	161A	162A	163A	164A	165A	166A	167A	168A	169A	170A	171A	172A	173A	174A	175A	176A	177A	178A	179A	180A	181A	182A	183A	184A	185A	186A	187A	188A	189A	190A	191A	192A	193A	194A	195A	196A	197A	198A	199A	200A	201A	202A	203A	204A	205A	206A	207A	208A	209A	210A	211A	212A	213A	214A	215A	216A	217A	218A	219A	220A	221A	222A	223A	224A	225A	226A	227A	228A	229A	230A	231A	232A	233A	234A	235A	236A	237A	238A	239A	240A	241A	242A	243A	244A	245A	246A	247A	248A	249A	250A	251A	252A	253A	254A	255A	256A	257A	258A	259A	260A	261A	262A	263A	264A	265A	266A	267A	268A	269A	270A	271A	272A	273A	274A	275A	276A	277A	278A	279A	280A	281A	282A	283A	284A	285A	286A	287A	288A	289A	290A	291A	292A	293A	294A	295A	296A	297A	298A	299A	300A	301A	302A	303A	304A	305A	306A	307A	308A	309A	310A	311A	312A	313A	314A	315A	316A	317A	318A	319A	320A	321A	322A	323A	324A	325A	326A	327A	328A	329A	330A	331A	332A	333A	334A	335A	336A	337A	338A	339A	340A	341A	342A	343A	344A	345A	346A	347A	348A	349A	350A	351A	352A	353A	354A	355A	356A	357A	358A	359A	360A	361A	362A	363A	364A	365A	366A	367A	368A	369A	370A	371A	372A	373A	374A	375A	376A	377A	378A	379A	380A	381A	382A	383A	384A	385A	386A	387A	388A	389A	390A	391A	392A	393A	394A	395A	396A	397A	398A	399A	400A	401A	402A	403A	404A	405A	406A	407A	408A	409A	410A	411A	412A	413A	414A	415A	416A	417A	418A	419A	420A	421A	422A	423A	424A	425A	426A	427A	428A	429A	430A	431A	432A	433A	434A	435A	436A	437A	438A	439A	440A	441A	442A	443A	444A	445A	446A	447A	448A	449A	450A	451A	452A	453A	454A	455A	456A	457A	458A	459A	460A	461A	462A	463A</
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