Announcements – Lecture VII– Tuesday, Sep 29th

1. **Exam I – Tuesday, October 6th – In Class**

2. **Second Lab – Saturday, October 3rd … 1-4pm … ISB 155/60 (A-E)**

   a) Print lab prior to coming to lab -- use the 'Print Friendly Version' located on the top left hand side of the page – this is the version that contains the 'Data Sheet' that you will hand in upon completing the lab.

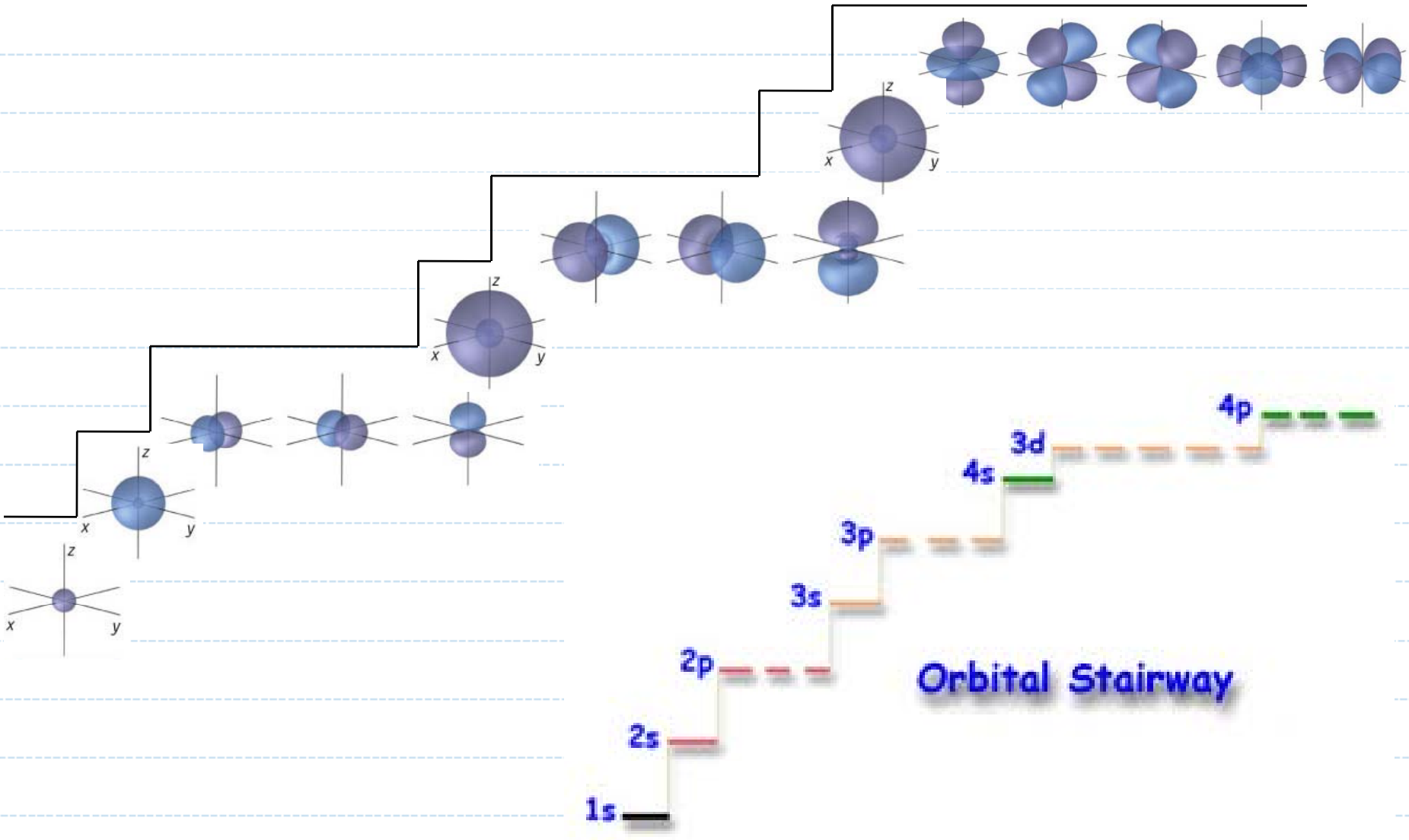
   b) First set of Lab Owls will appear in Owl after this lab. There are a total of 4 sets of Lab Owls and they are worth 25% of the Lab Grade.

3. 

iClicker:
Choose any letter: A-E

2.6 How Are the Electrons in an Atom Arranged?

A Orbital Stairway



2.6 How Are the Electrons in an Atom Arranged?

Electron Configurations Worksheet.

Orbital Box

Gp		#e	1s	2s	2p	3s	3p	Electronic Configuration	Noble Gas	Valence	Lewis Dot
1A	H	1	↑					$1s^1$			H
8A	He	2 (1)	↑↓					$1s^2$			He
1A	Li	3	↑↓	↑				$1s^2 2s^1$			Li
2A	Be	4	↑↓	↑↓				$1s^2 2s^2$			Be
3A	B	5	↑↓	↑↓	↑			$1s^2 2s^2 2p^1$			B
4A	C	6 (2)	↑↓	↑↓	↑ ↑			$1s^2 2s^2 2p^2$			C
5A	N	7	↑↓	↑↓	↑ ↑ ↑			$1s^2 2s^2 2p^3$			N
6A	O	8	↑↓	↑↓	↑↓ ↑ ↑			$1s^2 2s^2 2p^4$			O
7A	F	9	↑↓	↑↓	↑↓ ↑↓ ↑			$1s^2 2s^2 2p^5$			F
8A	Ne	10	↑↓	↑↓	↑↓ ↑↓ ↑↓			$1s^2 2s^2 2p^6$			Ne

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Electron Configurations Worksheet.

Gp		#e	1s	2s	2p	3s	3p	Electronic Configuration	Noble Gas	Valence	Lewis Dot
1A	Na	11	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑		$1s^2 2s^2 2p^6 3s^1$			Na
2A	Mg	12	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓		$1s^2 2s^2 2p^6 3s^2$			Mg
3A	Al	13	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑	$1s^2 2s^2 2p^6 3s^2 3p^1$			Al
4A	Si	14	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑ ↑	$1s^2 2s^2 2p^6 3s^2 3p^2$			Si
5A	P	15	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑ ↑ ↑	$1s^2 2s^2 2p^6 3s^2 3p^3$			P
6A	S	16	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑ ↑	$1s^2 2s^2 2p^6 3s^2 3p^4$			S
7A	Cl	17	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑ ↑	$1s^2 2s^2 2p^6 3s^2 3p^5$			Cl
8A	Ar	18	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑↓ ↑↓	$1s^2 2s^2 2p^6 3s^2 3p^6$			Ar

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Electron Configurations Worksheet.

Orbital Box

Gp		#e	1s	2s	2p	3s	3p	Electronic Configuration	Noble Gas	Valence	Lewis Dot
1A	H	1	↑					$1s^1$	$1s^1$	1	H•
8A	He	2	↑↓					$1s^2$	$1s^2$	2	He:
1A	Li	3	↑↓	↑				$1s^2 2s^1$	$[He]2s^1$	1	Li•
2A	Be	4	↑↓	↑↓				$1s^2 2s^2$	$[He]2s^2$	2	Be:
3A	B	5	↑↓	↑↓	↑			$1s^2 2s^2 2p^1$	$[He]2s^2 2p^1$	3	B:
4A	C	6	↑↓	↑↓	↑ ↑			$1s^2 2s^2 2p^2$	$[He]2s^2 2p^2$	4	•C:
5A	N	7	↑↓	↑↓	↑ ↑ ↑			$1s^2 2s^2 2p^3$	$[He]2s^2 2p^3$	5	•N:
6A	O	8	↑↓	↑↓	↑↓ ↑ ↑			$1s^2 2s^2 2p^4$	$[He]2s^2 2p^4$	6	•O:
7A	F	9	↑↓	↑↓	↑↓ ↑↓ ↑			$1s^2 2s^2 2p^5$	$[He]2s^2 2p^5$	7	:F:
8A	Ne	10	↑↓	↑↓	↑↓ ↑↓ ↑↓			$1s^2 2s^2 2p^6$	$[He]2s^2 2p^6$	8	:Ne:

① ② ③ ④

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Electron Configurations Worksheet.

Gp		#e	1s	2s	2p	3s	3p	Electronic Configuration	Noble Gas	Valence	Lewis Dot
1A	Na	11	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑		$1s^2 2s^2 2p^6 3s^1$	[Ne] $3s^1$	1	Na•
2A	Mg	12	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓		$1s^2 2s^2 2p^6 3s^2$	[Ne] $3s^2$	2	Mg••
3A	Al	13	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑	$1s^2 2s^2 2p^6 3s^2 3p^1$	[Ne] $3s^2 3p^1$	3	•Al••
4A	Si	14	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑ ↑	$1s^2 2s^2 2p^6 3s^2 3p^2$	[Ne] $3s^2 3p^2$	4	•Si••
5A	P	15	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑ ↑ ↑	$1s^2 2s^2 2p^6 3s^2 3p^3$	[Ne] $3s^2 3p^3$	5	•P••
6A	S	16	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑ ↑	$1s^2 2s^2 2p^6 3s^2 3p^4$	[Ne] $3s^2 3p^4$	6	•S••
7A	Cl	17	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑↓ ↑	$1s^2 2s^2 2p^6 3s^2 3p^5$	[Ne] $3s^2 3p^5$	7	•Cl••
8A	Ar	18	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑↓ ↑↓	$1s^2 2s^2 2p^6 3s^2 3p^6$	[Ne] $3s^2 3p^6$	8	•Ar••

2.6 How Are the Electrons in an Atom Arranged?

① **Pauli :** Maximum of two electrons per orbital.

② **Hund :** Orbitals on the same level are filled singly first, then they are paired up.

③ **Noble Gas Electrons:** Their stability precludes them from any desire to get involved in any chemistry ! ... under NORMAL circumstances.

④ **Valence Electrons:** For Main Group elements ... the total number of electrons occupying the highest n valued orbitals.

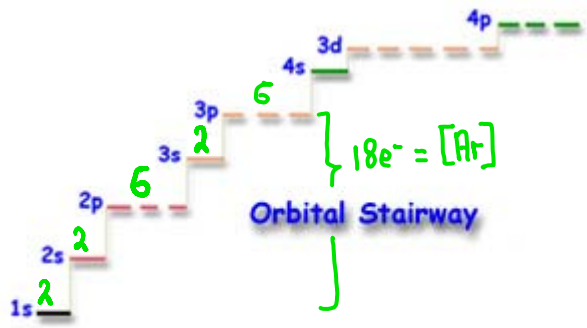
↳ I : $[Kr]\ 5s^2\ 4d^{10}\ 5p^5$ ... 7 Valence electrons

✓ ✗ ✓

2.6 How Are the Electrons in an Atom Arranged?

Transition Metals

21 Sc Scandium 44.9559	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.9380	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39



See class web site to check on these predictions

21	Sc:	$[Ar]\,4s^2 3d^1$	✓	
22	Ti:	$[Ar]\,4s^2 3d^2$	✓	
23	V:	$[Ar]\,4s^2 3d^3$	✓	
24	Cr:	$[Ar]\,4s^2 3d^4$	✗	Actual: $[Ar]\,4s^1 3d^5$
25	Mn:	$[Ar]\,4s^2 3d^5$	✓	Predicted
26	Fe:	$[Ar]\,4s^2 3d^6$	✓	
27	Co:	$[Ar]\,4s^2 3d^7$	✓	
28	Ni:	$[Ar]\,4s^2 3d^8$	✓	
29	Cu:	$[Ar]\,4s^2 3d^9$	✗	Actual: $[Ar]\,4s^1 3d^{10}$
30	Zn:	$[Ar]\,4s^2 3d^{10}$	✓	

2.6 How Are the Electrons in an Atom Arranged?

1A	Li	3	↑↓	↑								$1s^2 2s^1$	[He]$2s^1$	1	Li·
2A	Be	4	↑↓	↑↓								$1s^2 2s^2$	[He]$2s^2$	2	·Be·
3A	B	5	↑↓	↑↓	↑							$1s^2 2s^2 2p^1$	[He]$2s^2 2p^1$	3	·B·
4A	C	6	↑↓	↑↓	↑	↑						$1s^2 2s^2 2p^2$	[He]$2s^2 2p^2$	4	·C·
5A	N	7	↑↓	↑↓	↑	↑	↑					$1s^2 2s^2 2p^3$	[He]$2s^2 2p^3$	5	·N·
6A	O	8	↑↓	↑↓	↑↓	↑	↑					$1s^2 2s^2 2p^4$	[He]$2s^2 2p^4$	6	·O·
7A	F	9	↑↓	↑↓	↑↓	↑↓	↑					$1s^2 2s^2 2p^5$	[He]$2s^2 2p^5$	7	·F·
8A	Ne	10	↑↓	↑↓	↑↓	↑↓	↑↓					$1s^2 2s^2 2p^6$	[He]$2s^2 2p^6$	8	·Ne·
1A	Na	11	↑↓	↑↓	↑↓	↑↓	↑↓	↑				$1s^2 2s^2 2p^6 3s^1$	[Ne] $3s^1$	1	Na·
2A	Mg	12	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓				$1s^2 2s^2 2p^6 3s^2$	[Ne] $3s^2$	2	·Mg·
3A	Al	13	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑			$1s^2 2s^2 2p^6 3s^2 3p^1$	[Ne] $3s^2 3p^1$	3	·Al·
4A	Si	14	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	↑		$1s^2 2s^2 2p^6 3s^2 3p^2$	[Ne] $3s^2 3p^2$	4	·Si·
5A	P	15	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	↑	↑	$1s^2 2s^2 2p^6 3s^2 3p^3$	[Ne] $3s^2 3p^3$	5	·P·
6A	S	16	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	↑	$1s^2 2s^2 2p^6 3s^2 3p^4$	[Ne] $3s^2 3p^4$	6	·S·
7A	Cl	17	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	$1s^2 2s^2 2p^6 3s^2 3p^5$	[Ne] $3s^2 3p^5$	7	·Cl·
8A	Ar	18	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	$1s^2 2s^2 2p^6 3s^2 3p^6$	[Ne] $3s^2 3p^6$	8	·Ar·