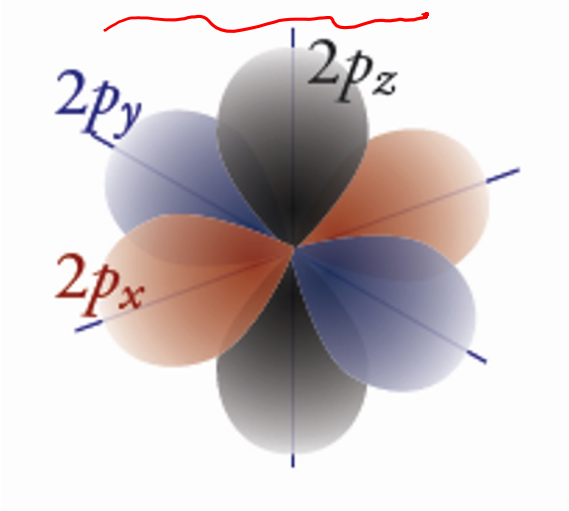
Chapter 2

Lecture 4

Atoms



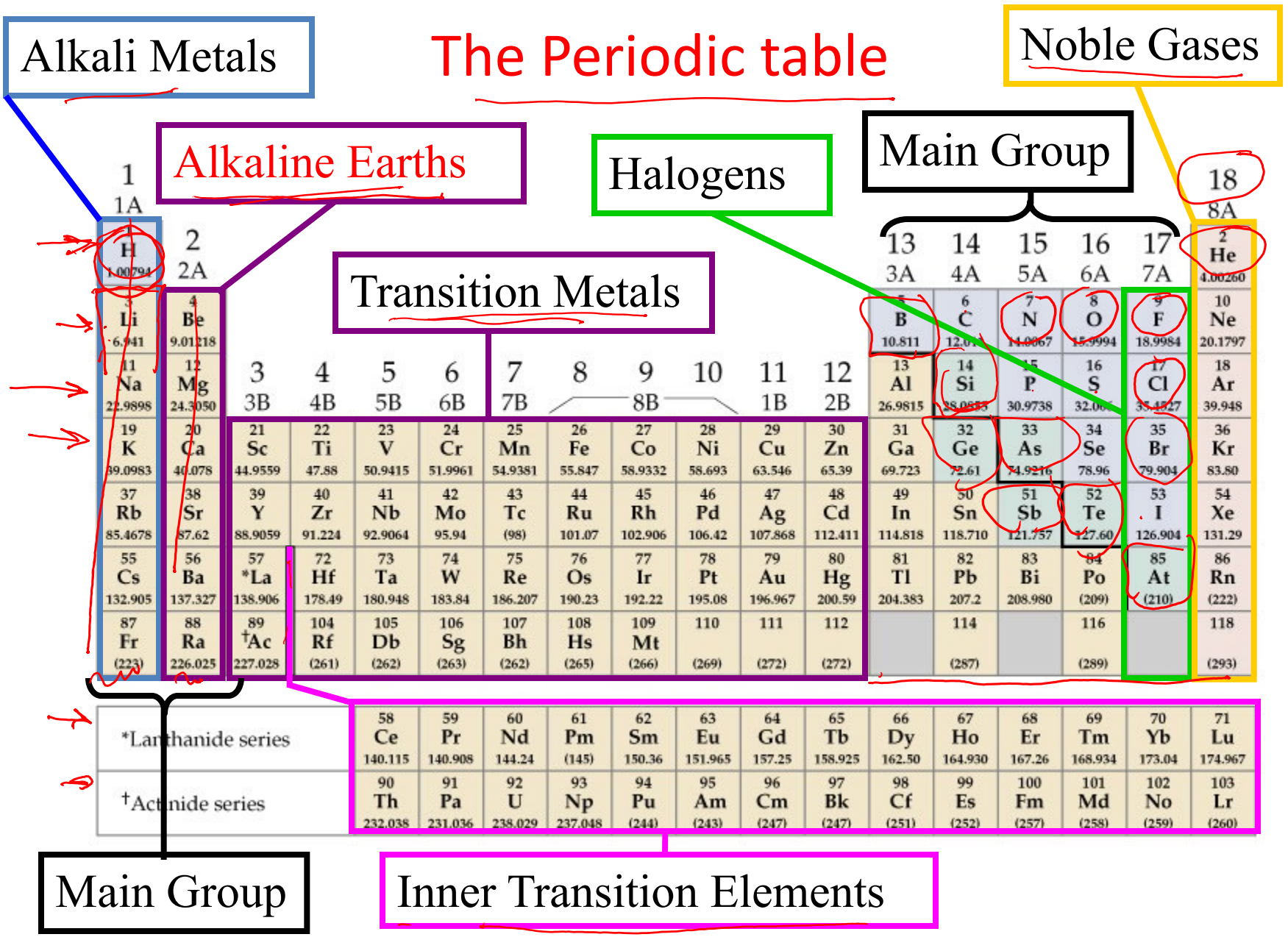
2.5 The periodic table

A. Origin of the periodic table

- In 1860, Mendeleev and another scientist produced on of the first periodic tables
- Mendeleev arranged the elements in increasing order of their atomic weight then in order of recurring properties into periods.
- He discovered that elements of the same group are similar in their chemical properties.

Group / Period	I	II	III	IV	V	VI	VII	VIII
1	H=1							
2	Li=7	Be=9.4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27.3	Si=28	P=31	S=32	Cl=35.5	
4	K=39	Ca=40	?=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56,Co=59 Ni=59
5	Cu=63	Zn=65	?=68	?=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	?=100	Ru=104,Rh=104 Pd=106
7	Ag=108	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140				
9								
10			?Er=178	?La=180	Ta=182	W=184		Os=195,Ir=197 Pt=198
11	Au=199	Hg=200	Tl=204	Pb=207	Bi=208			
12				Th=231		U=240		

The Periodic table



B- Classification of Elements

Metals	Nonmetals
Metals are solids except mercury (liquid)	Some are solid like phosphorous and iodine, bromine is a liquid and the others are gases
shiny	dull
Conductors of electricity	Don't conduct electricity except graphite
Ductile (can be drawn into wires)	Not ductile
Malleable (hammered and rolled into sheets.	Brittle
They form alloys (bronze is an alloy of copper and tin), and pewter alloy of tin, antimony and lead.	Can form an alloys with metals
During chemical reactions metals lose electrons.	During chemical reactions they gain electrons

Metalloids

- Metalloids have some properties of metals and some properties of nonmetals.
- Some metalloid are shiny like metals but don't conduct electricity.
- Silicon is semiconductor because it does not conduct electricity at certain applied voltage so it silicon is a vital element for silicon valley and electronic industry.

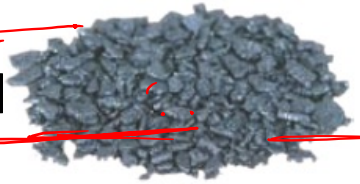
Metals (main group)
Metals (transition)
Metals (inner transition)
Metalloids
Nonmetals

IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)
5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00
13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45
31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90
49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9

periodic table 2.swf

Periodi

- Not on re similar in proper some regular).



Iodine

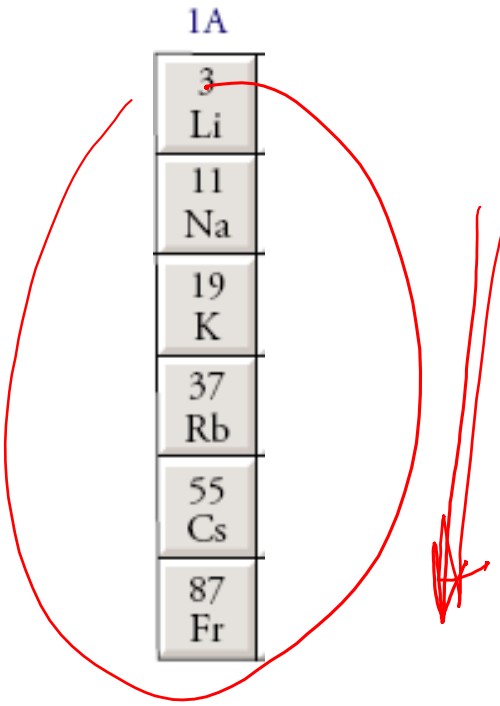
Bromine

Chlorine

Element	Melting Point (oC)	Boiling Point (oC)
Fluorine	-220	-188
Chlorine	-101	-35
Bromine	-7	59
Iodine	114	184
Astatine	302	337

periodic table 2.swf

Alkali Metals

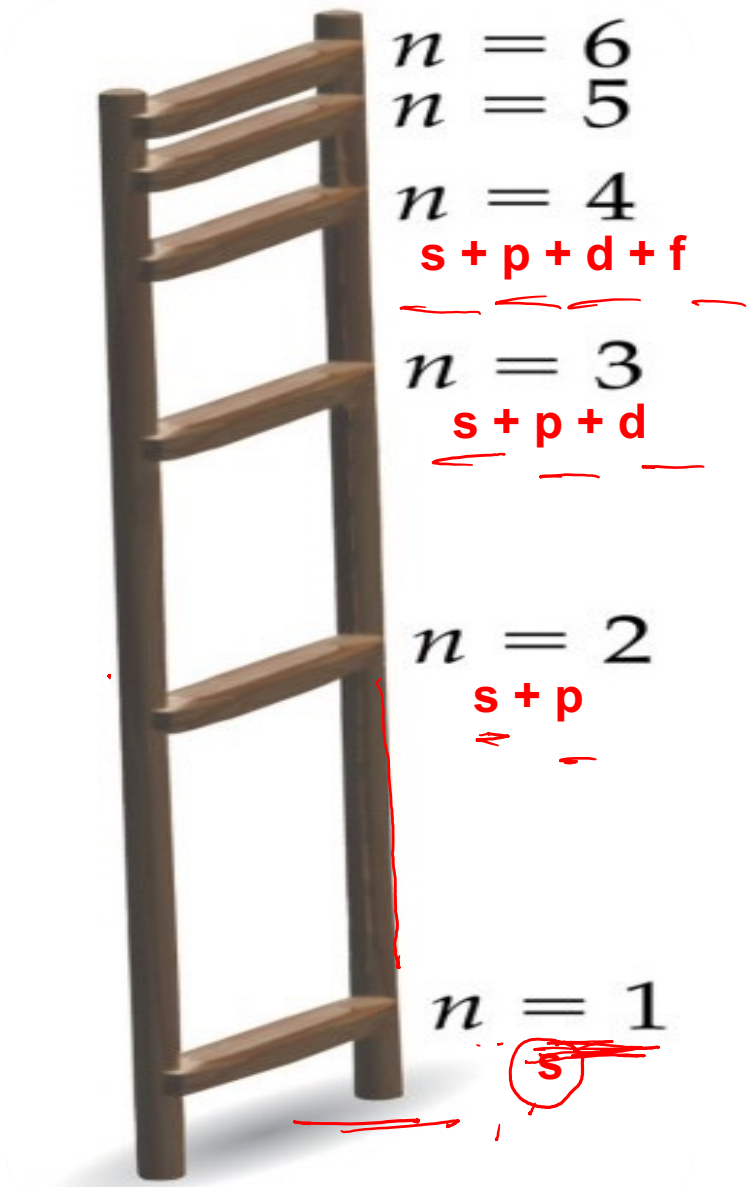


Element	Melting Point (°C)	Boiling Point (°C)
Lithium	180	1342
Sodium	98	883
Poassium	63	760
Rubidium	39	686
Cesium	28	669

- These are the elements of group 1A, these metals are soft i.e. easily cut by knife and their softness increases as we go down the group.
- They have relatively low melting and low boiling points.
- They react with water forming metal hydroxide MOH and H_2 gas. And the strength of the reaction increases as we go downward. They form stable compound with halogens

2.6 The Electron Configuration

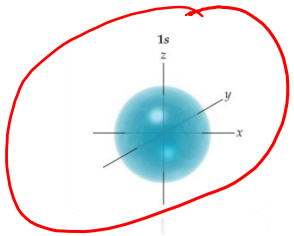
- Bohr in 1913 discovered the electrons orbit the nucleus in definite energy levels. Each energy level contains a number of electrons and each energy level has a certain amount of energy (quantized energy).
- The lowest possible energy level is known as ground state.

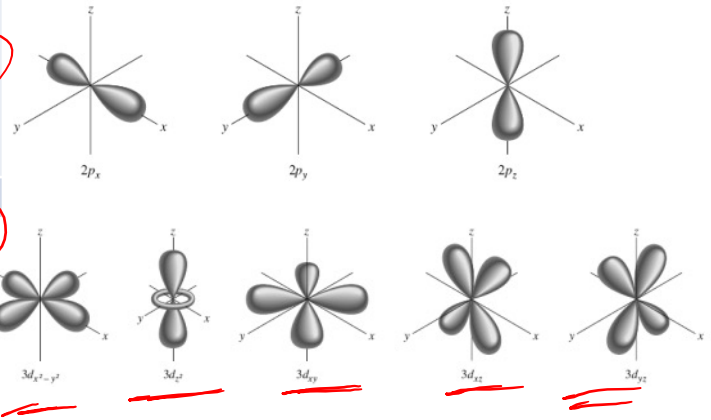


different models of atom.swf

A- Electrons are distributed in Shells, subshels and Orbitals

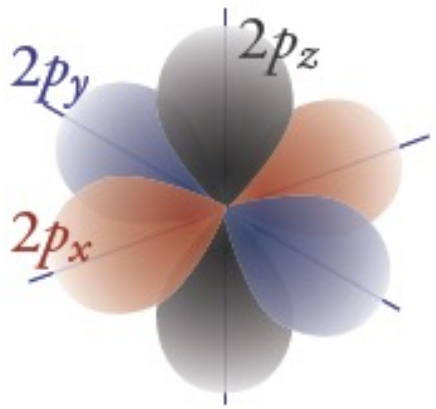
Sublevel	Shape	Number of Orbitals	Number of Electons
s	Symmetrical spherical shape	1	2
p	Dumbbell shaped	3	6
d	-	5	10





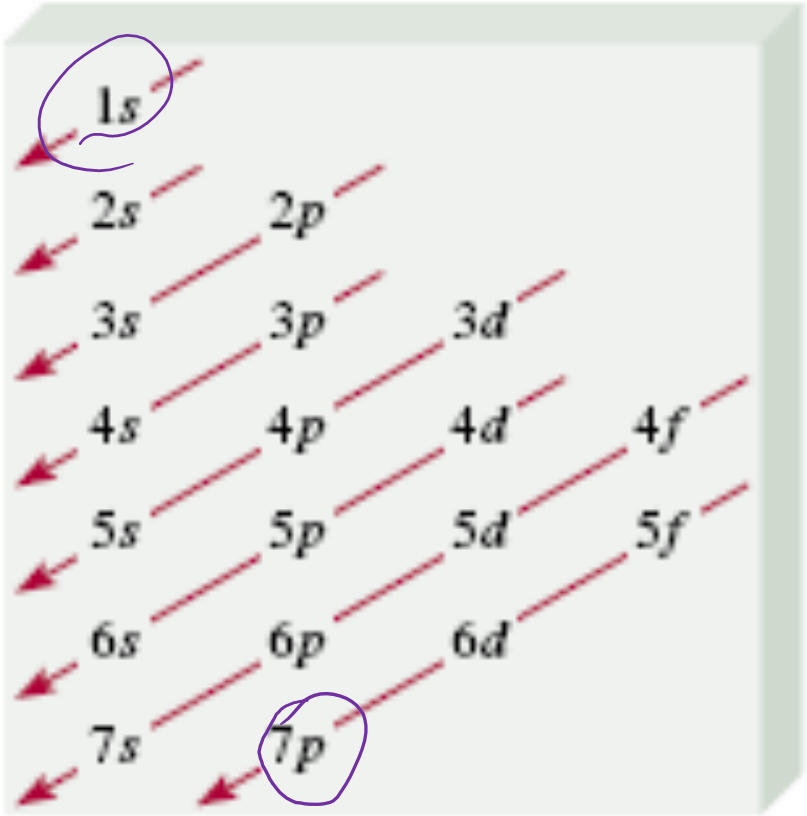
- Each energy level is divided into a number of sublevels, and each sublevel consists of a number of orbitals.
- The sublevel takes the symbols s, p, d, and f.
- Orbital: “it is a region of space around the nucleus that can hold up to two electrons.

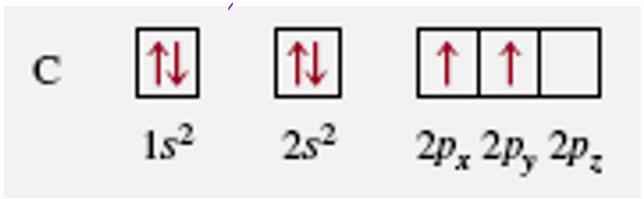
Shell	# of subshells	Letters specifying subshells
$n = 4$	4	s p d f
$n = 3$	3	s p d
$n = 2$	2	s p
$n = 1$	1	s



C- Electron Configurations of atoms Are Governed by Three Rules

- **Rule 1.** Electrons fill the orbitals in order of increasing orbital energy.
- **Rule 2**- Each orbital can hold up to two electrons with spins paired.
- **Rule 3.** when there is a set of orbitals of equal energy, each orbital becomes half filled before any of them becomes completely filled.





- Q_1 The natural abundance of three stable isotopes of magnesium are 78.99% magnesium-24 (23.99 amu), 10.00% magnesium-25 (24.99), and 11.01% magnesium-26 (25.98). Calculate the atomic weight of magnesium.

- Q_2 Write the condensed ground state electron configuration for each of the following elements. The elements atomic number is given in the parentheses.

- He (4) $1s^2\ 2s^2$
- Na (11) $1s^2\ 2s^2\ 2p^6\ 3s^1$
- Cl (17) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
- P (15) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

Cr
24

@ Chem34 phys

End of The Lecture

مع تحيات عبد الله محمد
دعواتكم بالتوفيق والنجاح