Take notes while watching the following videos to prepare for the "Electronic Structure of Atoms & Ionic Compounds Activity".

Atoms & Elements Part 1b:

Atomic Structure: The electrons

Matter is anything with mass and volume.

What else do we know about electrons?

1)

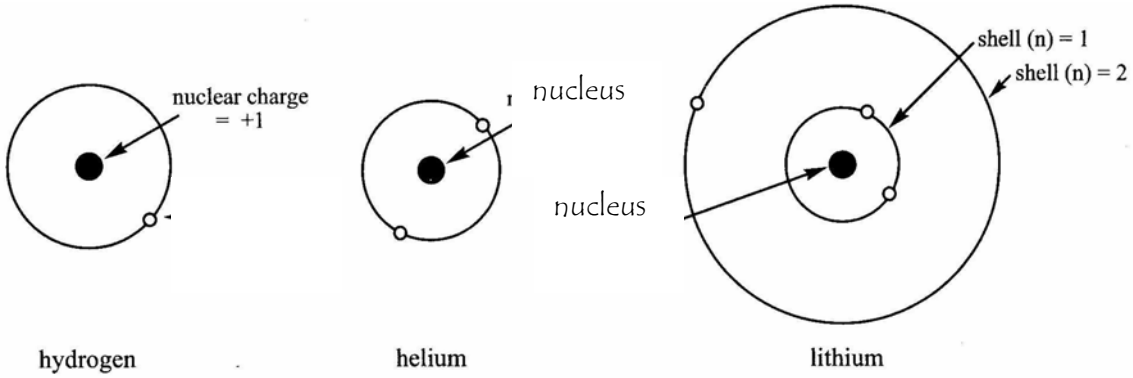
2)

3)

Electronic structure can be viewed as a peace agreement between electrons who want to share a nucleus.

Electrons travel in mathematically defined regions around the nucleus. These regions are called _____.

Shells are described by the letter 'n'. Shells with higher energy have larger values of 'n'. The higher the energy of the shell and the larger the shell becomes and the further from the nucleus the electrons are found.



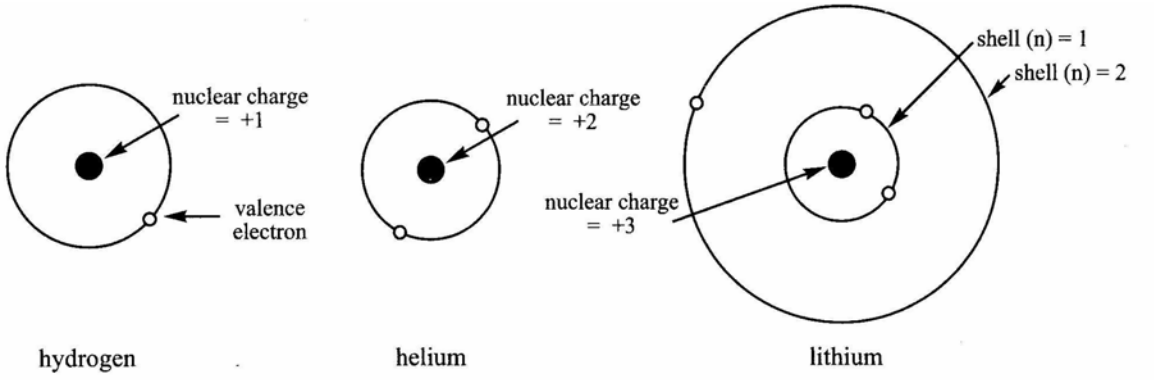
The larger the value of 'n', the more electrons a shell can hold. The maximum number of electrons can be determined from the formula $2n^2$, where n is the shell number.

Electron shell	Max Number of electrons
n = 1	
n = 2	
n = 3	
n = 4	

Not all electrons are equal.

The outer most electron shell is called the **valence shell**.
Everything else is the **core**.

Valence electrons can be gained or lost by atoms to create ions. Core electrons are held tightly by the nucleus and are "trapped" inside the atom.



How many electrons are in the valence shell of Li?

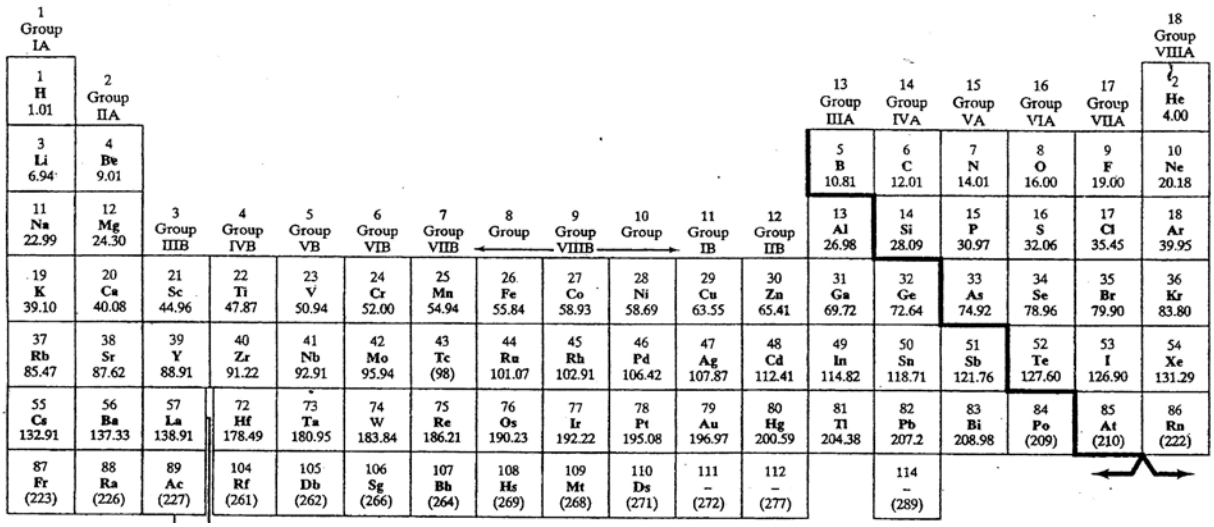
How many inner shell (core) electrons does Li have?

If core charge = nuclear charge + core electron charge, then what is the core charge of Li?

Valence electrons

The periodic table is arranged so that elements with same number of valence electrons occur in the same column. The number of valence electrons can be determined from the group number at the top of each column.

# of valence electrons =



1 Group IA												13 Group IIIA	14 Group IVA	15 Group VA	16 Group VIA	17 Group VIIA	18 Group VIIIA
1 H 1.01	2 Group IIA																2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30	3 Group IIIB	4 Group IVB	5 Group VB	6 Group VIB	7 Group VIIB	8 Group ← VIIIB →	9 Group	10 Group	11 Group IB	12 Group IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.84	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.41	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (269)	109 Mt (268)	110 Ds (271)	111 – (272)	112 – (277)		114 – (289)				

# of core electrons =

core charge =

Element	total # e^-	# valence e^-	# core e^-	nuclear charge	core charge
O					
Al					
K					

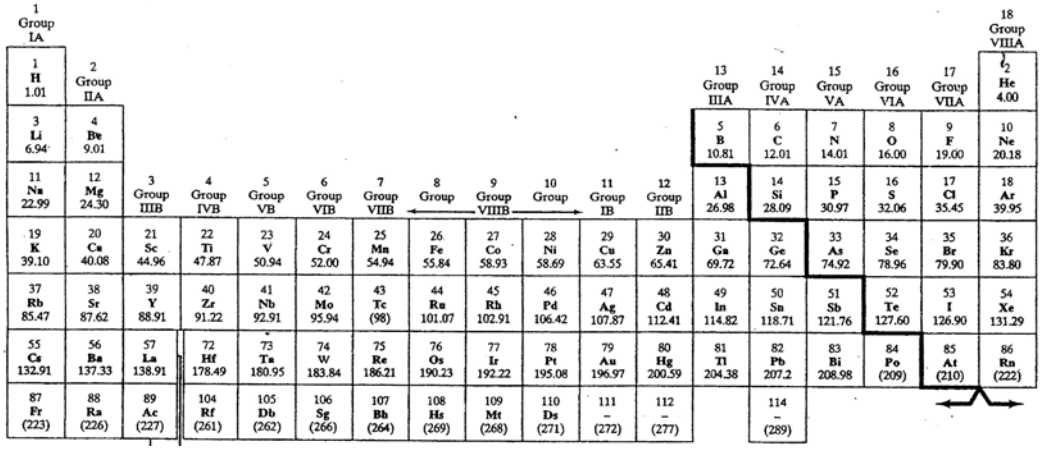
Valence electrons and Chemical Reactivity

Chemical properties are determined by the number of valence electrons.
Elements can gain or lose valence electrons.

Metals lose their valence electrons.

Non-metals gain valence electrons to fill their outermost shell (subshell).
For our course, we will focus on elements that fill their outermost shell with 8 electrons (octet).

The dark, stair-step line separates the metals from the non-metals.
All of the elements touching the stair-step are called metalloids EXCEPT aluminum.



What is the charge of the ion formed when the following atoms lose their valence electrons?

a) Ca

b) Al

What is the charge of the ion formed when the following atoms gain valence electrons to form an octet?

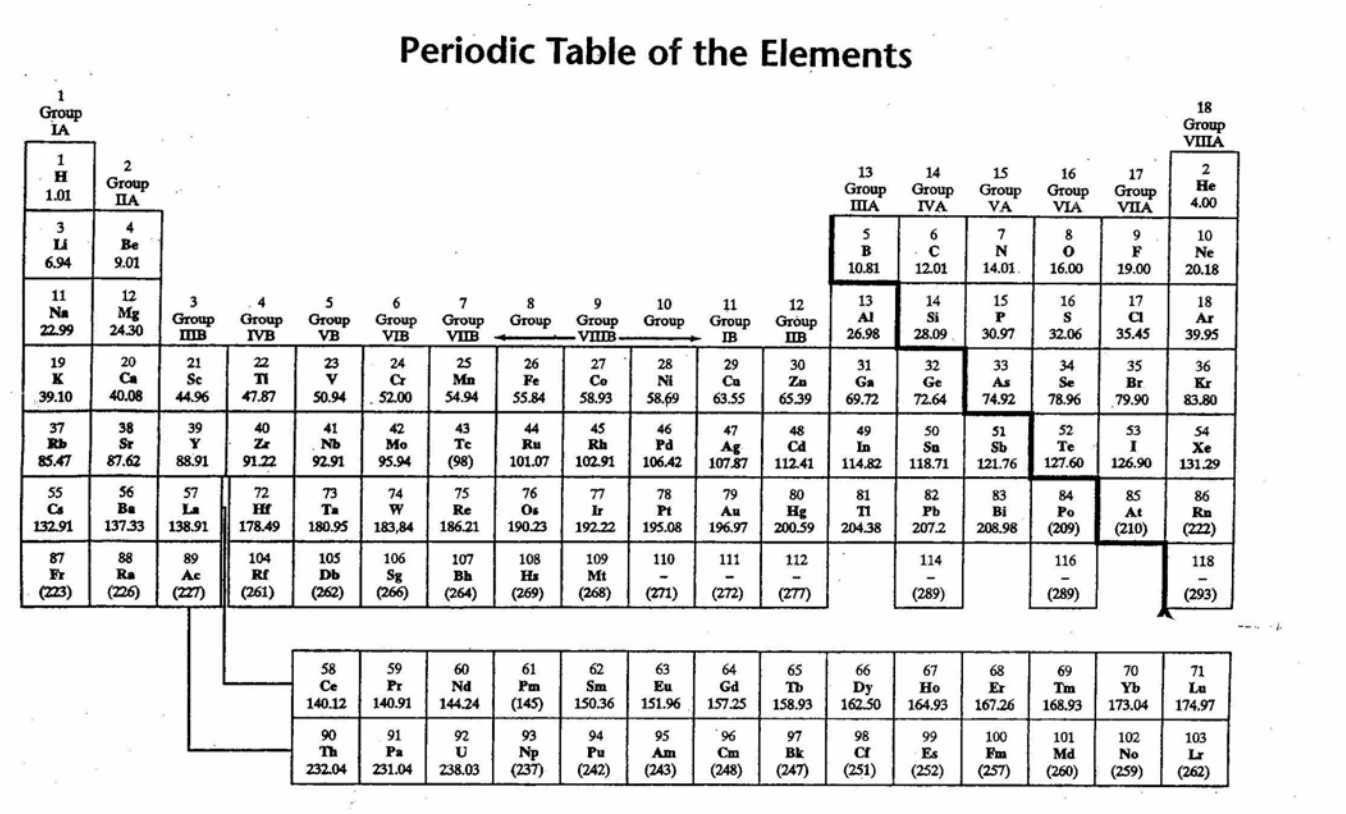
a) O

b) Br

Atoms & Elements Part 2:

Valence Electrons & the Octet Rule

Chemical properties are determined by the number of valence electrons. The elements are arranged in the periodic table so that elements with same number of valence electrons occur in the same column. The number of valence electrons can be determined from the group number at the top of each column. We can show the valence electrons as dots around the element symbol.



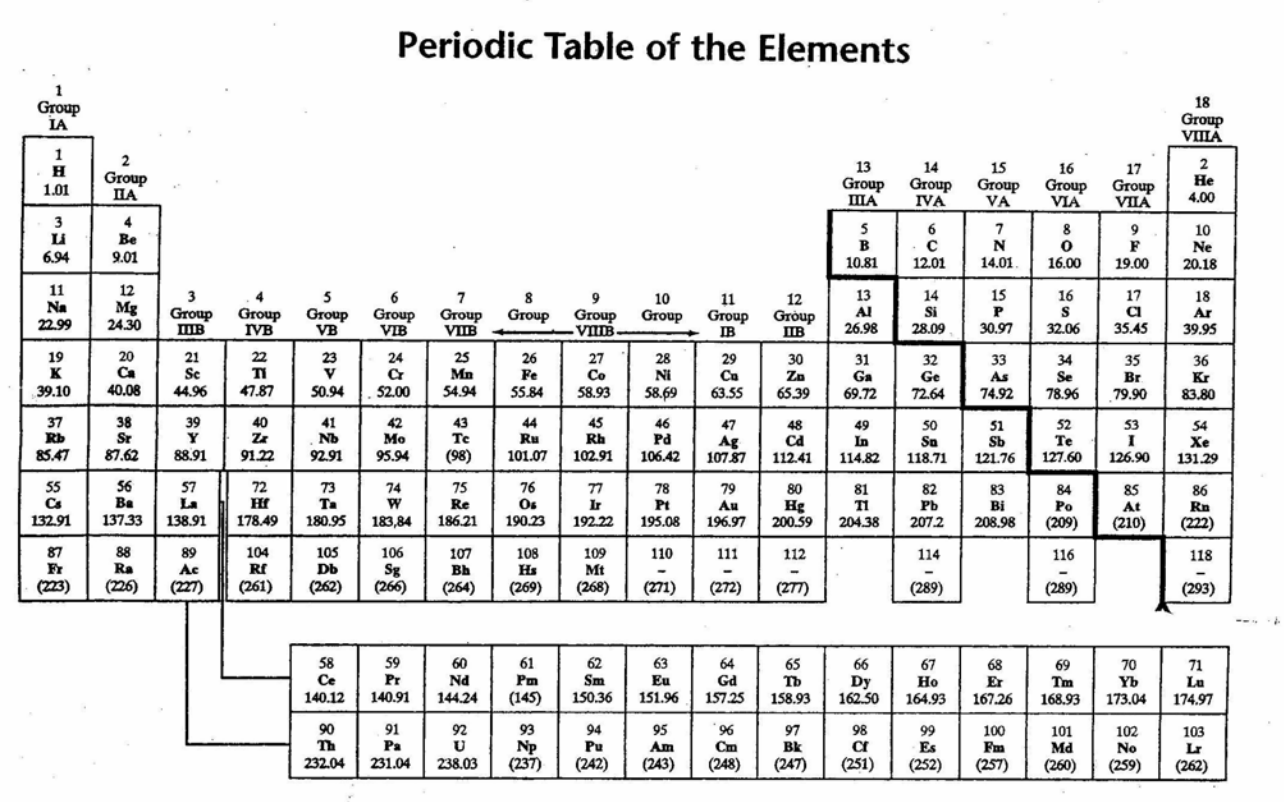
Octet Rule:

Ionic Compounds

Covalent Compounds

Use the Stair Step line to Recognize Ionic vs Covalent Cpds

"See" the number of valence electrons at the top of each group.



Compounds Part 1:

Ionic Compounds: Formula Units and Nomenclature

Ions – Atoms can gain or lose electrons to become ions.

Cation:

Anion:

The Octet Rule for Ionic Bonds

atoms gain or lose electrons to achieve a full valence shell of 8 electrons

Metals lose e^- to form _____.

Non-metals can gain e^- to form _____.

Ions create neutral salts through Electrostatic Forces.

Chemical formulas give us the ratio of ions to create a neutral compound.

Names follow the same pattern as the chemical formula

Write the formula unit and name for the ionic compounds (salts) formed by the following pairs of ions.

Ions	Formula	Name
K^+ with Br^-		
Mg^{2+} with OH^-		
Fe^{2+} with PO_4^{3-}		
Pb^{4+} with CO_3^{2-}		

Ionic compounds are solids in their pure state. The ions are locked in the crystal lattice created by the cations and anions maximizing their attractive forces and minimizing their repulsive forces.

However, when an ionic compound dissolves in water, the ions become completely independent of each other.

Predict how many ions are released into an aqueous solution when 1 formula unit is dissolved in water. Write your answer by completing the reaction for each compound below.

K_3PO_4

$NaCH_3CO_2$

$Cu(NO_3)_2$