Valence Electrons and Ions

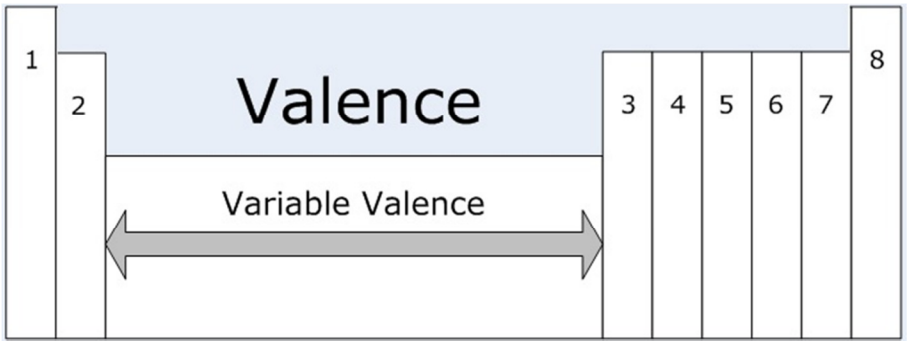
Name Key- Mr. Sudbury Period_____

Atoms are electrically neutral because they have the same number of protons and electrons. The protons are positively charged and the electrons are negatively charged.

An ***ion*** is an atom or group of bonded atoms with a positive or negative charge. *Atoms can lose or gain electrons to become ions.*

The only electrons that atoms can be lost or gained are the valence electrons. ***Valence electrons*** are the electrons in the outer energy level. The main reason that atoms become ions is so they can be more stable. In many cases, ions are more stable than atoms. To understand ions, we first must understand valence electrons and the octet rule. The ***octet rule*** simply states that atoms want to have 8 electrons in their outer energy (or valence) level. To fulfill the octet rule, atoms will either 1) gain electrons so they have 8, or 2) lose electrons, so they have a full octet underneath.

The number of valence electrons is a group (or family) trend on the PT.



Use the location on the PT to determine the number of valence electrons for the following elements.

1. Oxygen 6
2. Magnesium 2
3. Potassium 1
4. Aluminum 3
5. Nitrogen 5
6. Bromine 7
7. Argon 8
8. Silicone 4
9. Hydrogen 1
10. Helium 2 * He only has 2, not 8 to be full.
11. Nickel ? ** 1, 2, or 3 nickel (& all transition metals cannot be predicted by location since they vary)

Use the location on the periodic table to draw Lewis Dot Diagrams to represent the valence electrons in the following elements.

12. Oxygen ·Ö:
13. Magnesium ·Mg·
14. Potassium K·
15. Aluminum ·Al·
16. Nitrogen ·N:
17. Bromine :Br·
18. Argon :Ar:
19. Silicone ·Si·
20. Hydrogen H·
21. Helium ·He:*
22. Nickel ? ** you must be told # VE for transition metals.

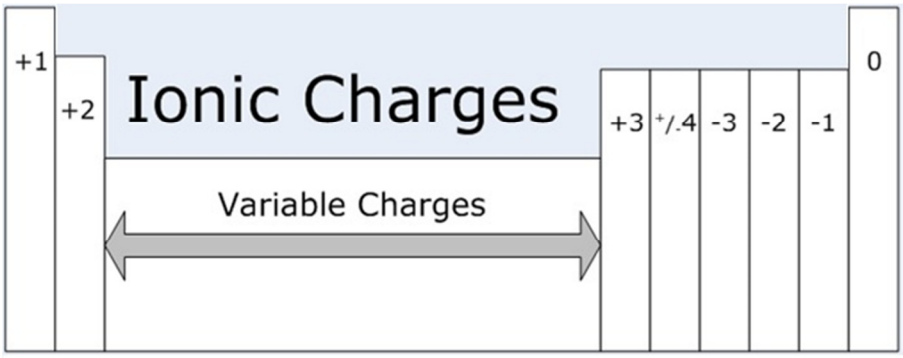
The number of valence electrons is directly tied to the charge an ion will have. Knowing the valence electrons allows you to know the charge of any ion if you understand that atoms try to follow the octet rule. An atom with 3 or fewer VE will lose those electrons (become +) and have a full shell beneath. Atoms with 5 or more VE will gain electrons (become more -) to get a full octet. The exception to this is hydrogen and helium because they only need 2 VS to have full valence electrons. Atoms that have 4 VE can either gain 4 electrons or lost 4 electrons to have a full shell. Complete the following chart:

	Atom	# VE	**Lose** or **gain** to get octet?	Ion Charge
23.	Sr	2 ve	Lose 2	Sr^{+2}
24.	P	5 ve	Gain 3	P^{-3}
25.	Na	1 ve	Lose 1	Na^{+}
26.	Br	7 ve	gain 1	Br^{-}
27.	Ca	2 ve	Lose 2	Ca^{2+}
28.	O	6 ve	gain 2	O^{2-}
29.	Al	3 ve	Lose 3	Al^{3+}
30.	Si	4 ve	Lose 4 or gain 4	Si^{4+} or Si^{4-}
31.	Kr	8 ve	Not Lose or gain	Kr ← no charge
32.	Li	1 ve	Lose 1	Li^{+}

33. Will noble gases ever form ions? Why or why not?

they already have a full octet (8) so they won't lose or gain any e^{-}.

Hopefully you recognize that the charges of ions are related to location of an element on the periodic table and can be determined by the number of valence electrons.



Use the location on the PT to determine the charge following elements and write the symbol with the charge. (X^{+2})

34. Oxygen O^{-2}
35. Magnesium Mg^{2+}
36. Potassium K^{+}
37. Aluminum Al^{3+}
38. Nitrogen N^{3-}
39. Bromine Br^{1-}
40. Argon Ar
41. Silicone Si^{4+} Si^{4-}
42. Hydrogen H^{+}
43. Fluorine F^{-1}
44. Boron B^{+3}
45. Carbon C^{+4} C^{-4}
46. Iodine I^{-}
47. Phosphorus P^{-3}
48. Rubidium Rb^{+}
49. Francium Fr^{+}
50. Barium Ba^{2+}
51. Antimony Sb^{-3}
52. Lithium Li^{+}
53. Beryllium Be^{+2}
54. Chlorine Cl^{-}
55. Gallium Ga^{+3}
56. Sodium Na^{+}
57. Indium In^{3+}