

## Valence Electrons

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### ● OBJECTIVES:

- Use the periodic table to infer the number of **valence electrons** in an atom, recognize **cations** and **anions**, and draw **Lewis dot structures**.

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## Valence Electrons

- The electrons responsible for the chemical properties of atoms are those in the outer energy level.
- **Valence electrons** - The **s** and **p** electrons in the outer energy level
  - the highest occupied energy level
- **Core electrons** - those in the energy levels below.

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### Keeping Track of Electrons

- Atoms in the same group (column)...
  - Have the same outer electron configuration.
  - Have the same valence electrons.
- Easily found: group number on the periodic table for representative elem.
- Group 2: Be, Mg, Ca, etc.
  - 2 valence electrons

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### Electron Dot diagrams

- A way of keeping track of valence electrons.
- How to write them?
- Write the symbol.
- Put one dot for each valence electron
- Don't pair up until they have to (Hund's rule)



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## The Electron Dot diagram for Nitrogen

- Nitrogen has 5 valence electrons.
- First we write the symbol.
- Then add 1 electron at a time to each side.
- Until they are forced to pair up.



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## Write electron dot diagrams:

- Na
- Mg
- C
- O
- F
- Ne
- V

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## Electron Configurations for Cations

- Metals lose electrons to attain noble gas configuration.
- They make positive ions (cations)
- If we look at the electron configuration, it makes sense to lose electrons:
- Na  $1s^2 2s^2 2p^6 3s^1$  1 valence electron
- $Na^{1+}$   $1s^2 2s^2 2p^6$  noble gas configuration

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### Electron Dots For Cations

- Metals will have few valence electrons (usually 3 or less)



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### Electron Dots For Cations

- Metals will have few valence electrons
- These will come off



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### Electron Dots For Cations

- Metals will have few valence electrons
- These will come off
- Forming positive ions



Now make Sc an ion.

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## Electron Configurations for Anions

- Nonmetals gain electrons to attain noble gas configuration.
- They make negative ions (anions)
- Halide ions- ions from chlorine or other halogens that gain electrons
- S  $1s^2 2s^2 2p^6 3s^2 3p^4$  6 valence electrons
- $S^{2-}$   $1s^2 2s^2 2p^6 3s^2 3p^6$  noble gas configuration.

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## Electron Dots For Anions

- Nonmetals will have many valence electrons (usually 5 or more)
- They will gain electrons to fill outer shell.



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## Stable Electron Configurations

- All atoms react to achieve noble gas configuration.
- Noble gases have 2 s and 6 p electrons.
- 8 valence electrons .
- Also called the octet rule.



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## Review of Ions

- an cation is an atom or molecule which has lost electrons and therefore has a positive charge
- an anion is an atom or molecule which has gained electrons and therefore has a negative charge

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## Polyatomic Ions

- Monoatomic Ions

- Ions with only one atom

- Polyatomic Ions

- Group of atoms with a net charge held together by shared electron bonding

$K_2SO_4$ Potassium sulfate	
$NaNO_3$ Sodium nitrate	
$Ca(OH)_2$ Calcium hydroxide	
$NH_4CN$ Ammonium cyanide	

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