Unit 3: Periodic Table

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Prep Chem

Unit 1 Learning Objectives:

By the end of the unit students will be able to…

- Locate and state the important properties of the main chemical families including the alkali metals, alkaline earth metals, halogens, noble gases, lanthanides, actinides and transition metals.
- Explain and define the following periodic trends, and how they relate to atomic structure.
    - Atomic Radius
    - Ionization Energy
    - Electronegativity
    - Ionic radius
- Draw Lewis Structures from Chemical Formulas
- Assign bond order
- Assign shapes to molecules using the VSEPR Theory and draw the VSEPR diagrams for a molecule
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Monday	Tuesday	Wednesday	Thursday	Friday
October 1 Intro: Paint Chip Activity Notes: Periodic Trends	**2** Notes: Periodic Trends	**3** Notes: Lewis Structures	**4** Notes: Lewis Structures	**5** Chemical Families Activity
8 Chemical Families Presentations	**9** Alien Periodic Table Challenge Activity	**10** Notes: VSEPR Theory	**11** Notes: VSEPR Theory	**12** Lab: Lewis Structures
15 Review	**16** **UNIT 3 TEST** **Homework Packet Due**	**17**	**18**	**19**

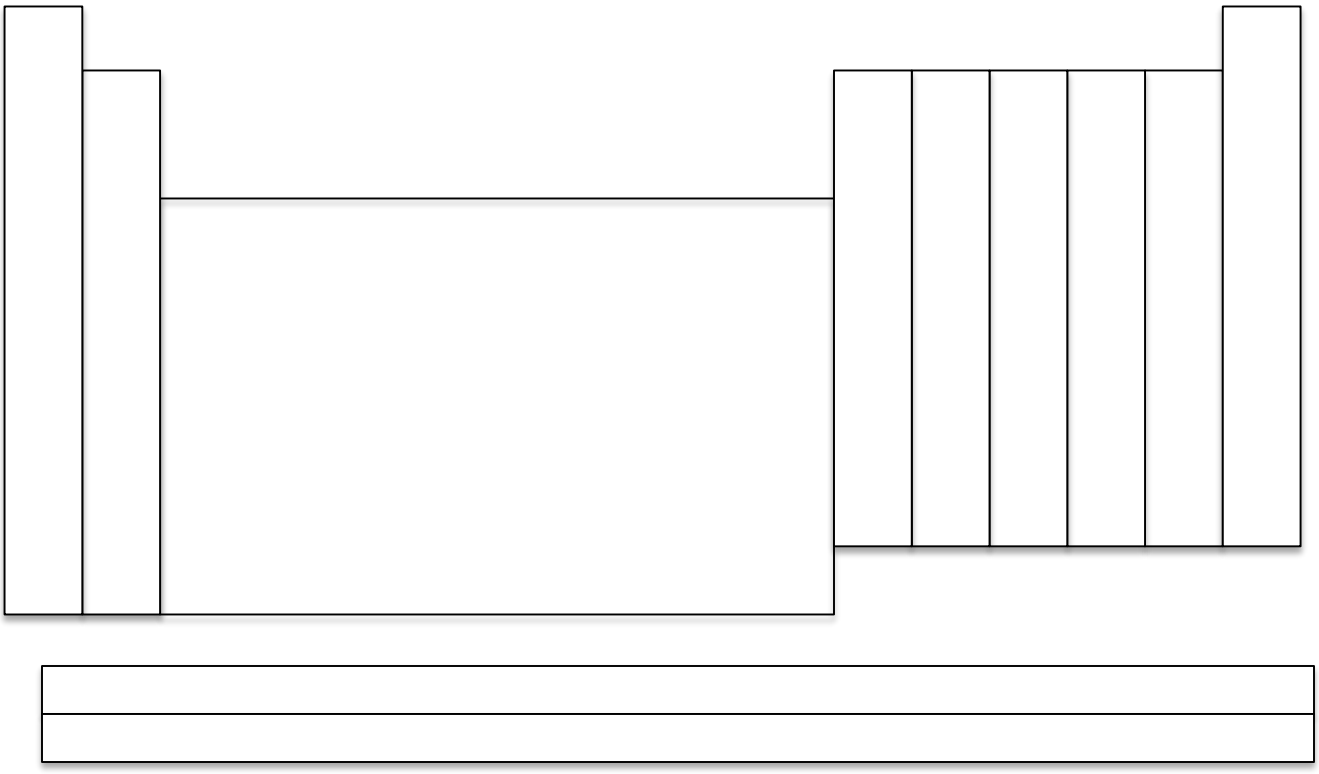
Periodic Table Trends

Periodic Trends: _____

_____

Periodic Trend	Definition	What happens when you do down a group?	What happens when you go across a row?	Examples
Atomic Radius				
Ionization Energy				
Electronegativity				
Ionic Radius				

Summary of Periodic Trends



Lewis Structures and Bonding

Electron Dot Structures

> Elements can be represented by **electron dot structures** to show the number of valence electrons. Recall, the number of valence electrons is equal to the group number. Only the valence electrons are shown, as these are the electrons that participate in bonding.

Example: Draw the electron dot structure for chlorine

Ex: Draw the electron dot structure for carbon

Atoms will bond with each other in order to _____. In general, atoms will follow the _____ rule and share _____ so that they have _____ electrons in their valence shell. *Note: There are exceptions to this rule.

Lewis Structure: _____

Example: Draw a Lewis Structure for the following compounds. The subscript in the formula indicates the number of atoms of each element in the compound. (ie, in Cl_2 the subscript "2" indicates that there are two chlorine atoms"

Rules for Drawing Lewis Structure:

Step 1: Add up the number of valence electrons in all of the atoms.

Step 2: Write down the most likely arrangements.

Central atom usually comes 1st in chemical equation (exception acids)

The central atom is the atom with the lowest ionization

Arrange the atoms symmetrically around the central atom

Step 3: Place one electron pair between each pair of bonded atoms.

Step 4: Complete the octets or duplet (H). If there are not enough electron pairs, form multiple bonds.

Step 5: Represent each bonded electron pair by a line.

Cl_2	SBr_2
CI_4	SiO_2
AsF_3	HCN Note: Hydrogen has a full valence shell with only two electrons. H C N

Lone Pairs: _____

Bond Order: _____

Bond Order =1 for a single bond, two electrons are shared
Bond Order= 2 for a double bond, four electrons are shared
Bond Order=3 for a triple bond, six electrons are shared
Bond Order = 4 for a quadruple bond, eight electrons are shared.
* A compound my have more than one bond order. In this case, each type of bond is labeled separately.

Exceptions to the Octet Rule (Exceptions to having a full valence shell)

Some elements can be stable in a compound when they do not have a full valence shell of eight electrons.

Electron Deficient: valence shell is unfilled with fewer than eight electrons.
Ex. Boron can be stable with only six electrons in the valence shell

Ex. BF_3

Expanded Octet: valence shell is over filled with more than eight electrons.
Ex. Phosphorus can be stable with ten electrons in the valence shell.

Ex. PCl_5

Ex. Sulfur can be stable with twelve electrons in the valence shell

Ex. SF_6

VSEPR Theory: Valence Shell Electron Pair Repulsion Theory

To determine the polarity of a molecule, the three-dimensional shape of the molecule must be considered. VSEPR theory predicts the three-dimensional shape of a molecule based on the number of atoms bonded to the central atom and the number of lone pairs on the central atom. The bonds and lone pairs around the central atom will be oriented as far as possible from each other to minimize electron repulsion.

Example Molecule	Lewis Structure	# of atoms bonded to the central atom	# lone pairs bonded to central atom	Shape	VSEPR Diagram	Polar or Non-Polar
CO_2		2	0	Linear		Non-polar

BH_3		3	0	Trigonal Planar		Non-Polar
CH_4		4	0	Tetrahedral		Non-Polar
NH_3		3	1	Trigonal Pyrimidal		Polar
H_2O		2	2	Bent		Polar
PCl_5		5	0	Trigonal Bipyramidal		Non-Polar
SF_6		6	0	Octahedral		Non-Polar

Symbols Used in VSEPR Diagrams

Practice: Draw the Lewis Structure and using VSEPR theory determine the shape of the structure.

Ex. CF_4

Ex. PCl_3

Ex. CS_2