

**STUDY GUIDE: UNIT 8 – Bonding (Ch 5, 7, 8)****UNIT 8 Objectives / Topics:****CH 5: Electrons in Atoms (& Ions – 7.1)**

- Explain the Bohr model, as well as the quantum mechanical model of the atom, taking into account energy levels, principal quantum numbers, and atomic orbitals.
- Determine an element's electron configuration using the rules for filling atomic orbitals (Pauli Exclusion principle, Hund's Rule).
- Use the periodic table to determine electron configurations.

**CH 7: Ions & Ionic Compounds**

- Determine the electron configuration of cations and anions.
- Use the periodic table to find the # of valence electrons in an atom.
- Draw electron dot formulas (Lewis structures) of the representative elements.
- State the octet rule and understand its significance in the formation of ions and ionic bonds.
- Describe the formation of a cation from an atom of a metallic element, and the formation of an anion from an atom of a nonmetallic element.
- Give the characteristics of ionic bond and recognize a compound as having ionic bonds.
- Identify characteristics of ionic compounds.

**CH 8: Covalent Bonds; Molecular Compounds**

- Describe the formation of a covalent bond between two nonmetallic elements.
- Describe double and triple covalent bonds.
- Draw structural formulas for simple covalent molecules containing single, double, or triple bonds.
- Use the VSEPR theory to describe the shapes of simple covalently bonded molecules.  
Linear, Bent, Tetrahedral, Trigonal Planar, Pyramidal
- Use electronegativity values to determine whether a bond is nonpolar covalent, polar covalent, or ionic.
- Show the relationship between polar covalent bonds and polar molecules.

**PROBLEMS:**

**1) Explain the contribution to atomic theory made by each individual listed below:**

A) Dalton:

B) Thomson:

C) Rutherford:

D) Bohr:

E) Schrodinger:

**2) Write the complete electron configurations and draw the orbital diagrams for:**

A) Mg

B) Ti

C) Si

D) O

E) As

F) Mo

**3) Give the electron configuration of:**

- A)  $\text{Sr}^{2+}$  \_\_\_\_\_
- B)  $\text{S}^{2-}$  \_\_\_\_\_
- C)  $\text{I}^-$  \_\_\_\_\_
- D)  $\text{Al}^{3+}$  \_\_\_\_\_

**4) For each electron configuration given below, identify the element it represents.**

- A)  $1s^2 2s^2 2p^6 3s^2 3p^4 4s^2 3d^{10} 4p^5$  \_\_\_\_\_
- B)  $1s^2 2s^2 2p^6 3s^2$  \_\_\_\_\_
- C)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$  \_\_\_\_\_
- D)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^9$  \_\_\_\_\_
- E)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$  \_\_\_\_\_
- F)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^3$  \_\_\_\_\_
- G)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^5$  \_\_\_\_\_
- H)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^3$  \_\_\_\_\_

**5) Classify each of the following compounds as IONIC or COVALENT:**

Compound:	Ionic or covalent?	Compound:	Ionic or covalent?	Compound:	Ionic or covalent?
NaCl		HCl		$\text{CaCl}_2$	
$\text{Li}_2\text{S}$		KI		$\text{S}_2\text{Cl}_2$	
$\text{H}_2\text{O}$		$\text{CO}_2$		$\text{Na}_2\text{O}$	
$\text{P}_2\text{O}_5$		$\text{N}_2$		$\text{NO}_2$	
$\text{Cs}_2\text{O}$		$\text{N}_2\text{O}$		$\text{MgCl}_2$	

**6) List the characteristics of bonds: (which elements form them? general properties? electrons shared or transferred?)**

IONIC:	COVALENT:

7) Draw the Lewis structure (electron dot structure) for each of the following:

K	As	P	In	C	Cl	He
Si	Rb	Se	I	Sr	Kr	Al

8) For the following pairs of atoms, use Lewis structures (electron dot structures) to show the formation of the ionic compound between them. Include the charge for each ion that results, the correct ionic formula, and the name!!

Lewis structures:

Ionic charges:

Formula and name:

A) Mg and N:

B) Li and O:

C) Al and Br:

D) K and F

9) For each of the following COVALENT compounds, draw the Lewis (electron dot) structure:

Formula

Lewis Structure

Formula

Lewis Structure

H<sub>2</sub>

O<sub>2</sub>

N<sub>2</sub>

Cl<sub>2</sub>

PBr<sub>3</sub>

CO<sub>2</sub>

NH<sub>3</sub>

CCl<sub>4</sub>

HCl

NO<sub>2</sub>

H<sub>2</sub>O

OH<sup>-</sup>

NO<sub>3</sub><sup>-</sup>

NH<sub>4</sub><sup>+</sup>

SO<sub>4</sub><sup>2-</sup>

SO<sub>3</sub>

10) Using a chart of electronegativity values, classify each compound in the table below as: nonpolar covalent, moderately polar covalent, very polar covalent, or ionic.

Compound:	Difference in Electronegativity:	Bond Type:
KF		
NaCl		
SO <sub>2</sub>		
HBr		
F <sub>2</sub>		
NO <sub>2</sub>		
CF <sub>4</sub>		
I <sub>2</sub>		
H <sub>2</sub> O		
NH <sub>3</sub>		
NaBr		
Cs <sub>2</sub> O		
SiCl <sub>4</sub>		
MgCl <sub>2</sub>		

11) What is meant by “resonance”? Show all resonance structures for the carbonate ion (CO<sub>3</sub><sup>2-</sup>).

12) Define each of the following terms:

- dispersion force: \_\_\_\_\_
- dipole interaction: \_\_\_\_\_
- hydrogen bond: \_\_\_\_\_

13) Draw (and write the name of) the 3-dimensional shape of the following compounds (tetrahedral, trigonal planar, pyramidal, linear, or bent):

A) CO<sub>2</sub>

B) CH<sub>4</sub>

C) H<sub>2</sub>S

D) PCl<sub>3</sub>

E) NO<sub>3</sub><sup>-</sup>