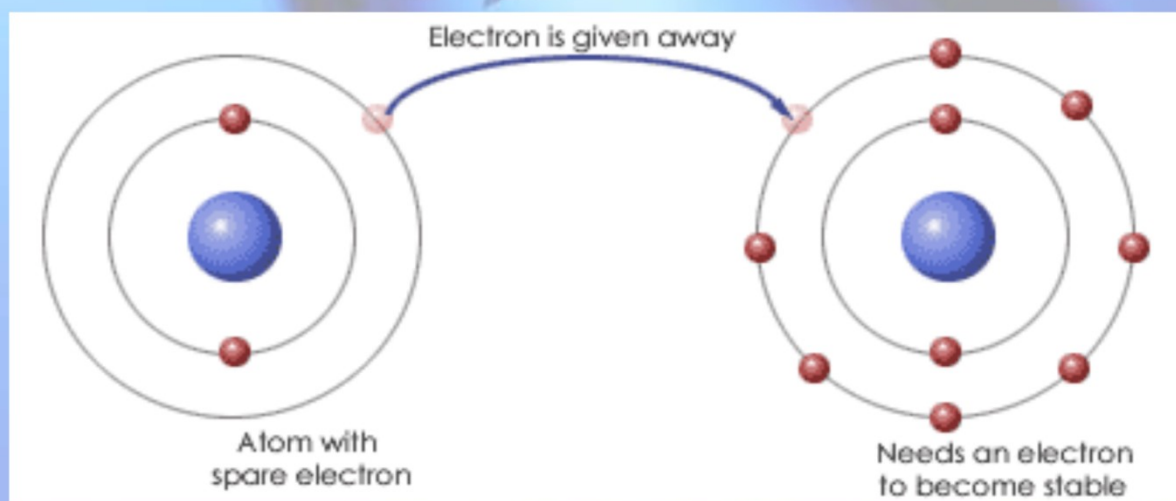


Chemistry

PRACTICE PACKET

Unit 4: Bonding & Naming



Regents Chemistry

Bonding: Energy & Electronegativity

- To break a chemical bond, energy must be
 - produced
 - absorbed
 - released
 - destroyed
- Which quantities must be conserved in all chemical reactions?
 - charge, volume, density
 - charge, volume, energy
 - mass, charge, energy
 - mass, charge, density
- Which statement describes a chemical change?
 - Water vapor forms snowflakes.
 - Table salt (NaCl) is crushed into powder.
 - Glucose (C₆H₁₂O₆) and oxygen produce CO₂ and H₂O.
 - Alcohol evaporates.
- Given the balanced equation representing a reaction:
$$\text{Cl}_2 \rightarrow \text{Cl} + \text{Cl}$$
What occurs during this reaction?
 - A bond is formed as energy is absorbed.
 - A bond is broken as energy is absorbed.
 - A bond is formed as energy is released.
 - A bond is broken as energy is released.
- Given the balanced equation representing a reaction:
$$\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g}) + \text{energy}$$
Which statement describes the energy changes in this reaction?
 - Energy is absorbed as bonds are broken, and energy is released as bonds are formed.
 - Energy is released as bonds are broken, only.
 - Energy is absorbed as bonds are formed, and energy is released as bonds are broken.
 - Energy is absorbed as bonds are formed, only.
- What occurs when an atom of chlorine and an atom of hydrogen become a molecule of hydrogen chloride?
 - A chemical bond is broken and energy is absorbed.
 - A chemical bond is formed and energy is released.
 - A chemical bond is formed and energy is absorbed.
 - A chemical bond is broken and energy is released.
- In a gaseous system at equilibrium with its surroundings, as molecules of A(g) collide with molecules of B(g) without reacting, the total energy of the gaseous system
 - decreases
 - increases
 - remains the same
- The forces between atoms that create chemical bonds are the result of interactions between
 - electrons
 - protons and nuclei
 - nuclei
 - protons and electrons
- As energy is released during the formation of a bond, the stability of the chemical system generally will
 - decrease
 - increase
 - remain the same
- Which particles may be gained, lost, or shared by an atom when it forms a chemical bond?
 - protons
 - electrons
 - nucleons
 - neutrons
- As a chemical bond forms between two hydrogen atoms the potential energy of the atoms
 - decreases
 - increases
 - remains the same
- Which kind of energy is stored in a chemical bond?
 - potential energy
 - activation energy
 - kinetic energy
 - ionization energy

Regents Chemistry

Bond Types

1. Which element forms an ionic compound when it reacts with lithium? *Metal*
- A) ~~K~~ B) ~~Kr~~ C) Br D) ~~Fe~~
2. An ionic compound is formed when there is a reaction between the elements
- A) strontium and chlorine
 B) nitrogen and oxygen
 C) sulfur and oxygen
 D) hydrogen and chlorine
3. The bonds in BaO are best described as
- A) covalent, because valence electrons are shared
 B) ionic, because valence electrons are transferred
 C) ionic, because valence electrons are shared
 D) covalent, because valence electrons are transferred
4. Which compound contains both ionic and covalent bonds?
- A) ammonia
 B) methane
 C) sodium nitrate
 D) potassium chloride
5. When sodium and fluorine combine to produce the compound NaF, the ions formed have the same electron configuration as atoms of
- A) neither argon nor neon
 B) neon, only
 C) argon, only
 D) both argon and neon
6. Which formula represents an ionic compound?
- A) CH_3OH B) H_2
 C) NH_4Cl D) CH_4
7. Which sample contains particles in a rigid, fixed, geometric pattern?
- A) HCl(g) B) ~~$\text{CO}_2(\text{aq})$~~ *solid*
 C) KCl(s) D) ~~$\text{H}_2\text{O(l)}$~~ *aqueous*
liquid
8. Which statement best describes the substance that results when electrons are transferred from a metal to a nonmetal?
- A) It contains covalent bonds and has a low melting point.
 B) It contains covalent bonds and has a high melting point.
 C) It contains ionic bonds and has a low melting point.
 D) It contains ionic bonds and has a high melting point.
9. An ionic compound consists of positive and negative ions each with 10 electrons. Half of these ions have a charge of 1^+ and the other half have a charge of 1^- . What is the formula of this compound?
- A) NaCl B) NaF C) KF D) KCl
10. Element X is in Group 2 and element Y is in Group 17. What happens when a compound is formed between these two atoms?
- A) X gains electrons from Y to form a covalent bond.
 B) X loses electrons to Y to form a covalent bond.
 C) X gains electrons from Y to form an ionic bond.
 D) X loses electrons to Y to form an ionic bond.
11. Given the reactions:
- $$2 X(\text{s}) + 2 \text{H}_2\text{O}(\ell) \rightarrow 2 X^+(\text{aq}) + 2 \text{OH}^-(\text{aq}) + \text{H}_2(\text{g})$$
- $$2 Y(\text{s}) + 2 \text{H}_2\text{O}(\ell) \rightarrow 2 Y^+(\text{aq}) + 2 \text{OH}^-(\text{aq}) + \text{H}_2(\text{g})$$
- The unknowns, X and Y, are most likely
- A) nonmetallic elements in the same period
 B) nonmetallic elements in the same group
 C) metallic elements in the same group
 D) metallic elements in the same period
12. The bond between which two elements is the least ionic in character?
- A) H-O B) H-Cl C) H-F D) H-I

Bond Types (Ionic vs. Covalent)

31. Which atoms are most likely to form covalent bonds?

- A) metal atoms that share electrons
 B) metal atoms that share protons
 C) nonmetal atoms that share electrons
 D) nonmetal atoms that share protons

32. A substance was found to be a soft, non-conducting solid at room temperature. The substance is most likely

- A) a metallic solid B) a molecular solid
 C) an ionic solid D) a network solid

33. The bonding in NH_3 is most similar to the bonding in

- A) MgO B) KF
 C) H_2O D) NaCl
- Handwritten notes: Non-metal, Non-metal*

34. Which statement correctly describes diamond and graphite, which are different forms of solid carbon?

- A) They differ in their properties, only.
 B) They differ in their molecular structure and properties.
 C) They differ in their molecular structure, only.
 D) They do not differ in their molecular structure or properties.

35. Which characteristic is a property of molecular substances? *- Covalent*

- A) low melting point
 B) good electrical conductivity
 C) high melting point
 D) good heat conductivity

36. A chemist performs the same tests on two homogeneous white crystalline solids, *A* and *B*. The results are shown in the table below.

	Solid A	Solid B
Melting Point	High, 801°C	Low, decomposes at 186°C
Solubility in H_2O (grams per 100.0 g H_2O at 0°C)	35.7	3.2
Electrical Conductivity (in aqueous solution)	Good conductor	Nonconductor

The results of these tests suggest that

- A) both solids contain only covalent bonds
 B) both solids contain only ionic bonds
 C) solid *A* contains only ionic bonds and solid *B* contains only covalent bonds
 D) solid *A* contains only covalent bonds and solid *B* contains only ionic bonds

37. A solid substance is an excellent conductor of electricity. The chemical bonds in this substance are most likely

- ~~A) ionic, because the valence electrons are mobile~~
~~B) metallic, because the valence electrons are stationary~~
 C) metallic, because the valence electrons are mobile
~~D) ionic, because the valence electrons are shared between atoms~~

38. Which substance contains metallic bonds?

- A) $\text{C}_6\text{H}_{12}\text{O}_6(\text{s})$ B) $\text{H}_2\text{O}(\ell)$
 C) $\text{NaCl}(\text{s})$ D) $\text{Hg}(\ell)$

39. Which element consists of positive ions immersed in a "sea" of mobile electrons?

- A) calcium B) nitrogen
 C) sulfur D) chlorine

40. Which substance will conduct electricity in both the solid phase and the liquid phase?

- A) AgCl B) Ag
 C) H_2 D) HCl

Bond Types (Ionic vs. Covalent)

41. Base your answer to the following question on The table below lists the melting points of various substances.

SUBSTANCE	PHASE CHANGE (solid → liquid)	MELTING POINT (K)
chlorine	$\text{Cl}_2(\text{s}) \rightarrow \text{Cl}_2(\ell)$	172
water	$\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\ell)$	273
sodium chloride	$\text{NaCl}(\text{s}) \rightarrow \text{NaCl}(\ell)$	1073
copper	$\text{Cu}(\text{s}) \rightarrow \text{Cu}(\ell)$	1356

(Tricky!) Based on this table, which type of substance has the highest melting point?

- A) metallic
 B) nonpolar covalent
 C) polar covalent
 D) ionic
42. Silicon dioxide (SiO_2) and diamonds are best described as
- A) network solids with ionic bonding
 B) molecular substances with coordinate covalent bonding
 C) molecular substances with ionic bonding
 D) network solids with covalent bonding
43. A diamond is an example of
- A) a metallic substance
 B) a network solid
 C) a supercooled liquid
 D) an ionic compound
44. The table below shows properties of four solids, *A*, *B*, *C*, and *D*.

Substance	Melting Point	Conductivity in Solid State	Solubility in Water
<i>A</i>	high	no	soluble
<i>B</i>	high	yes	insoluble
<i>C</i>	high	no	insoluble
<i>D</i>	low	no	insoluble

Which substance could represent diamond, a network solid?

- A) *A* B) *B* C) *C* D) *D*

Practice: Determine the oxidation number of each element and polyatomic ion within the compounds below. ~~That includes elements within polyatomic ions.~~

Compound	Oxidation Numbers
1. NH ₄ Cl	NH ₄ = +1 N H Cl = -1 +1 + (-1) = 0
2. H ₂ O	H = +1 O = -2 2(+1) + (-2) = 0
3. (NH ₄) ₃ PO ₄	NH ₄ = N H PO ₄ =
4. H ₂ S ₂ O ₇	⁺² H = +1 ⁺² S = +6 ⁻⁴ O = -2 = 0
5. Ba ₃ P ₂	Ba = +2 P = -3
6. H ₂ O ₂	H = +1 O = -1
7. CO ₂	C = +4 ⁻⁴ O = -2
8. NaOH	Na = +1 OH = -1
9. Al ₂ O ₃	Al = +3 O = -2
10. NO ₂	N = +4 O = -2
11. AlPO ₄	Al = +3 PO ₄ = -3
12. P ₂ O ₅	⁺¹⁰ P = +5 ⁻¹⁰ O = -2
13. Na ₂ O ₂	⁺² Na = +1 ⁻² O ₂ = -2
14. FeO	Fe = +2 O = -2
15. Fe ₂ O ₃	⁺⁶ Fe = +3 ⁻⁶ O = -2 = 0

Naming Ionic Compounds

Write the names for each of the following IONIC compounds. Don't forget Roman Numerals when dealing with a transition metal.

- | | |
|--|--|
| 1. $MgSO_4$ <u>Magnesium sulfate</u> | 19. $MgCl_2$ <u>magnesium chloride</u> |
| 2. NH_4Cl <u>Ammonium chloride</u> | 20. $FeCl_3$ <u>Iron III chloride</u> |
| 3. $CrPO_4$ <u>Chromium III phosphate</u> | 21. NH_4NO_3 <u>Ammonium nitrate</u> |
| 4. $Ba(OH)_2$ <u>Barium hydroxide</u> | 22. $Al(OH)_3$ <u>Aluminum hydroxide</u> |
| 5. PbS <u>Lead II sulfide</u> | 23. $CuC_2H_3O_2$ <u>Copper I acetate</u> |
| 6. Na_2CO_3 <u>Sodium carbonate</u> | 24. $PbSO_3$ <u>Lead II sulfite</u> |
| 7. BaF_2 <u>Barium fluoride</u> | 25. $NaClO_2$ <u>sodium chlorite</u> |
| 8. $Cu(NO_3)_2$ <u>Copper II nitrate</u> | 26. $CaCrO_4$ <u>Calcium chromate</u> |
| 9. AgI <u>Silver iodide</u> | 27. $NiBr_3$ <u>Nickel III bromide</u> |
| 10. $NiSO_4$ <u>Nickel II sulfate</u> | 28. $(NH_4)_3PO_4$ <u>Ammonium phosphate</u> |
| 11. $Zn_3(PO_4)_2$ <u>Zinc phosphate</u> | 29. $NaHSO_4$ <u>sodium hydrogen sulfate</u> |
| 12. Na_3N <u>Sodium nitride</u> | 30. Hg_2Cl_2 <u>Mercury II chloride</u> |
| 13. Cu_2CO_3 <u>Copper I carbonate</u> | 31. $Mg(NO_2)_2$ <u>Magnesium nitrite</u> |
| 14. $(NH_4)_2SO_4$ <u>Ammonium sulfate</u> | 32. $CuSO_4$ <u>Copper II sulfate</u> |
| 15. $CaCO_3$ <u>Calcium carbonate</u> | 33. $NaHCO_3$ <u>Sodium hydrogen carbonate</u> |
| 16. KCl <u>Potassium chloride</u> | 34. FeO <u>Iron II oxide</u> |
| 17. $FeSO_4$ <u>Iron II sulfate</u> | 35. Fe_2O_3 <u>Iron III oxide</u> |
| 18. $LiBr$ <u>Lithium bromide</u> | 36. MgF_2 <u>Magnesium fluoride</u> |

Name of Compound	Positive Ion	Negative Ion	Formula
Cesium bromide	Cs^{+1}	Br^{-1}	CsBr
Calcium iodide	Ca^{+2}	I^{-1}	CaI_2
Aluminum chloride	Al^{3+}	Cl^{-}	AlCl_3
Strontium oxide	Sr^{2+}	O^{2-}	SrO
Radium chloride	Ra^{2+}	Cl^{-}	RaCl_2
Aluminum phosphide	Al^{3+}	P^{-3}	AlP
Tin (II) sulfide	Sn^{+2}	S^{-2}	SnS
Tin (IV) sulfide	Sn^{+4}	S^{-2}	SnS_2
Barium Chloride	Ba^{+2}	Cl^{-}	BaCl_2
Magnesium sulfide	Mg^{+2}	S^{-2}	MgS
Beryllium nitride	Be^{+2}	N^{-3}	Be_3N_2
Lead (IV) fluoride	Pb^{+4}	F^{-1}	PbF_4
Sodium oxide	Na^{+1}	O^{-2}	Na_2O
Magnesium arsenide	Mg^{+2}	As^{-3}	Mg_3As_2

Naming Covalent (Molecular) Compounds

# of atoms	1	2	3	4	5	6	7	8
Prefix	mono	di	tri	tetra	penta	hexa	hepta septa	octa

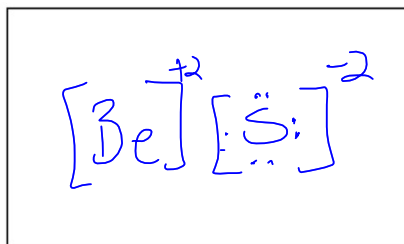
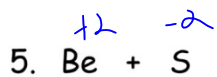
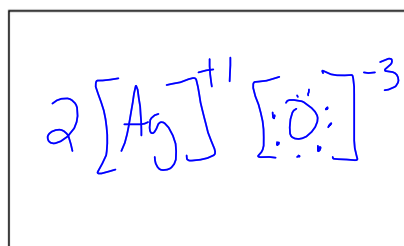
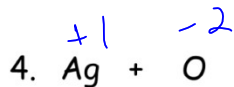
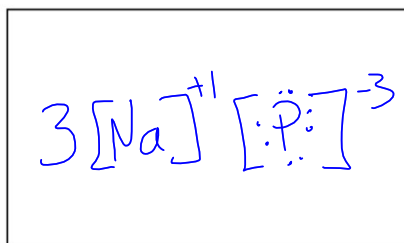
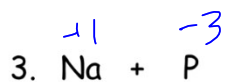
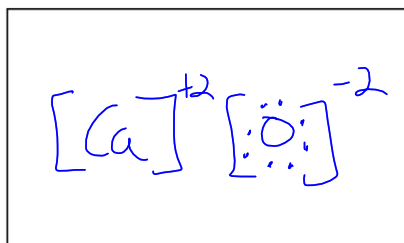
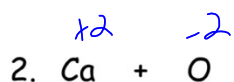
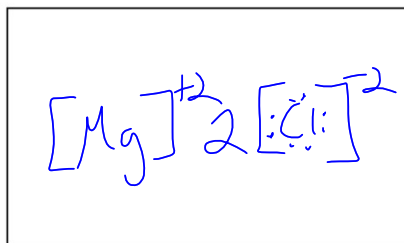
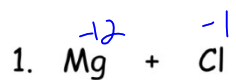
1. CO_2 carbon dioxide
2. CO carbon monoxide
3. SO_2 sulfur dioxide
4. BF_3 Boron trifluoride
5. N_2O dinitrogen monoxide
6. NO nitrogen monoxide
7. N_2O_3 dinitrogen trioxide
8. H_2S dihydrogen monosulfide
9. N_2O_4 dinitrogen tetroxide
10. N_2O_5 dinitrogen pentoxide
11. PCl_3 phosphorus trichloride
12. PCl_5 phosphorus pentachloride
13. NH_3 nitrogen trihydride
14. SCl_6 sulfur hexachloride

Writing Covalent Compound Formulas

1. silicon tetrafluoride	SiF_4
2. iodine pentafluoride	IF_5
3. sulfur hexafluoride	SF_6
4. chlorine dioxide	ClO_2
5. tetraphosphorous trisulfide	P_4S_3
6. sulfur tetrafluoride	SF_4
7. xenon tetrafluoride	XeF_4
8. dihydrogen monoxide	H_2O
9. carbon disulfide	CS_2
10. sulfur dioxide	SO_2
11. boron trichloride	BCl_3
12. carbon difluoride	CF_2
13. boron trifluoride	BF_3
14. diarsenic pentoxide	As_2O_5
15. phosphorus trichloride	PCl_3
16. dinitrogen pentoxide	N_2O_5
17. nitrogen trihydride	NH_3
18. carbon monoxide	CO
19. silicon dioxide	SiO_2
20. bromine pentachloride	BrCl_5
21. sulfur tetrabromide	SBr_4

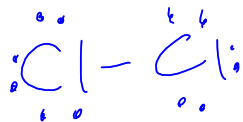
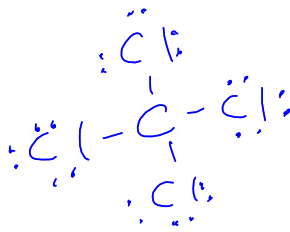
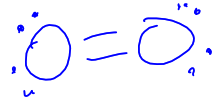
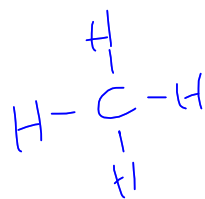
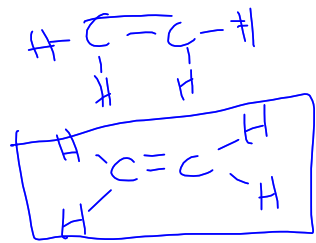
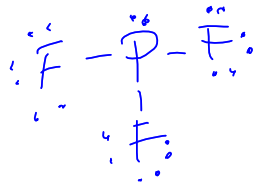
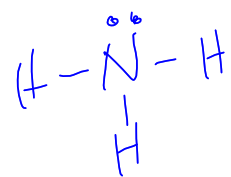
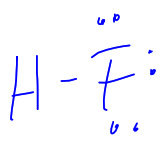
IONIC Lewis Dot Bonding

Draw Lewis dot bonding diagrams for the IONIC compounds below.



COVALENT Lewis Dot Bonding

Draw Lewis dot bonding diagrams for the COVALENT compounds below.

Cl_2 	CCl_4 
O_2 	CH_4 
C_2H_4 	PF_3 
NH_3 	HF 

Regents Chemistry

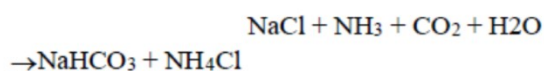
Bonding: Lewis Structure

1. What is the total number of electron pairs shared between the two atoms in an O_2 molecule?
A) 1 B) 2 C) 6 D) 4
2. The nitrogen atoms in a molecule of N_2 share a total of
A) one pair of electrons
B) one pair of protons
C) three pairs of electrons
D) three pairs of protons
3. Base your answer to the following question on Given the formula of a substance:
- $$\begin{array}{ccccccc} & H & & H & & H & & H \\ & | & & | & & | & & | \\ H & - & C & = & C & - & C & = & C & - & H \\ & | & & | & & | & & | \\ & H & & & & & & & & & H \end{array}$$
- What is the total number of shared electrons in a molecule of this substance?
A) 9 B) 22 C) 11 D) 6
4. Base your answer to the following question on What is the total number of electrons shared in the bonds between the two carbon atoms in a the molecule shown below?
 $H-C \equiv C-H$
A) 6 B) 8 C) 2 D) 3
5. Which element has atoms that can form single, double, and triple covalent bonds with other atoms of the same element?
A) fluorine B) carbon
C) hydrogen D) oxygen
6. Multiple covalent bonds exist in a molecule of
A) H_2 B) F_2 C) Br_2 D) N_2
7. Which is the correct electron-dot formula for a hydrogen molecule at STP?
A) $H \cdot$ B) $H \cdot H$ C) $H:H$ D) $H:$
8. Atoms of which element can bond to each other to form chains, rings, and networks?
A) carbon B) fluorine
C) hydrogen D) oxygen
9. Which Lewis electron-dot diagram correctly represents a hydroxide ion?
A) $[:O:H:]^-$ B) $[:O:H:]^-$
C) $[:\ddot{O}:H:]^-$ D) $[:\ddot{O}::H:]^-$
10. Which electron-dot diagram best represents a compound that contains both ionic and covalent bonds?
A) $Ca^{2+} [:\ddot{O}:\ddot{S}:\ddot{O}:]^{2-}$ B) $H:\ddot{S}:H$
C) $K^+ [:\ddot{Br}:]^-$ D) $:\ddot{Br}:\ddot{Br}:$
11. Base your answer to the following question on Given a formula for oxygen:
 $:\ddot{O}=\ddot{O}:$
What is the total number of electrons shared between the atoms represented in this formula?
A) 1 B) 2 C) 8 D) 4
12. The bond between Br atoms in a Br_2 molecule is
A) ionic and is formed by the transfer of two valence electrons
B) covalent and is formed by the transfer of two valence electrons
C) covalent and is formed by the sharing of two valence electrons
D) ionic and is formed by the sharing of two valence electrons
13. Which molecule contains a triple covalent bond?
A) N_2 B) Cl_2 C) O_2 D) H_2
14. Which molecule will have a double covalent bond?
A) O_2 B) Cl_2 C) F_2 D) N_2

Bonding: Lewis Dot Structure

Base your answers to questions 15 and 16 on the information below.

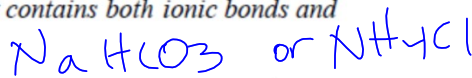
In 1864, the Solvay process was developed to make soda ash. One step in the process is represented by the balanced equation below.



15. In the space draw a Lewis electron-dot diagram for the reactant containing nitrogen in the equation.



16. Write the chemical formula for *one compound in the equation that contains both ionic bonds and covalent bonds.*



17. What is the total number of electron pairs shared between the carbon atom and one of the oxygen atoms in a carbon dioxide molecule?

2 pair

18. Base your answer to the following question on the information below.

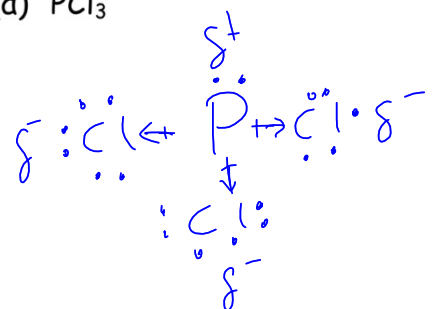
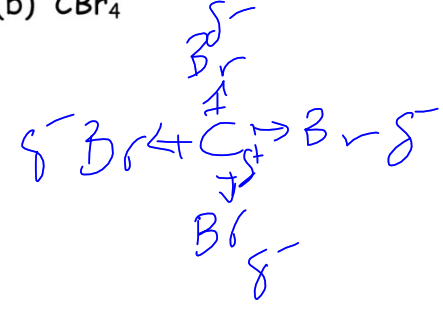
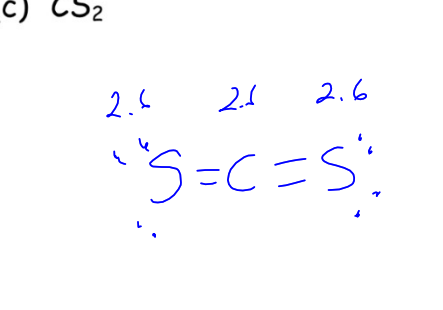
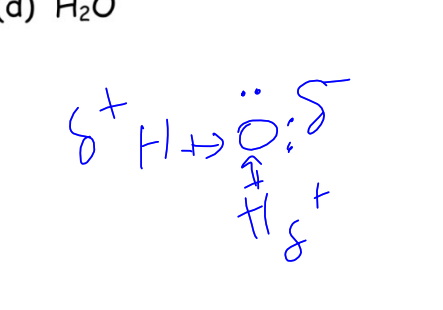
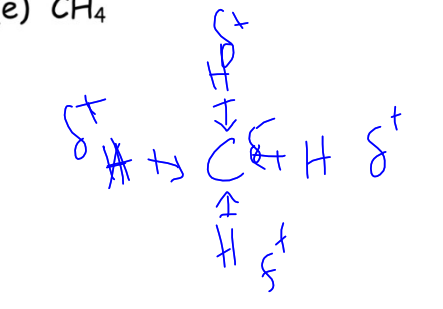
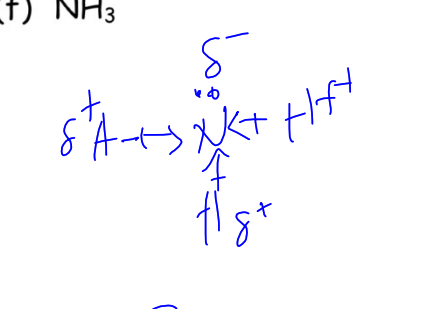
Atomic Diagrams of Magnesium and Aluminum

Key	Element	Lewis Electron-Dot Diagram	Electron-Shell Diagram
• = electron	magnesium	Mg:	
	aluminum	Al:	

Explain why Lewis electron-dot diagrams are generally more suitable than electron-shell diagrams for illustrating chemical bonding.

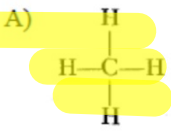
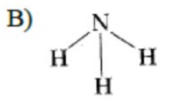
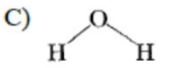
Lewis dot diagrams illustrate valence e⁻ and are less bulky than e⁻ shell diagrams

Write Lewis structures for each of the following molecules. Indicate any partial charges that may exist for polar bonds with δ^+ or δ^- . Also indicate POLAR (P) or NONPOLAR (NP) for the bonding and the molecule.

<p>(a) PCl_3</p>  <p>Bonding: <u>P</u> Molecule: <u>P</u></p>	<p>(b) CBr_4</p>  <p>Bonding: <u>P</u> Molecule: <u>NP</u></p>
<p>(c) CS_2</p>  <p>Bonding: <u>NP</u> Molecule: <u>NP</u></p>	<p>(d) H_2O</p>  <p>Bonding: <u>P</u> Molecule: <u>P</u></p>
<p>(e) CH_4</p>  <p>Bonding: <u>P</u> Molecule: <u>NP</u></p>	<p>(f) NH_3</p>  <p>Bonding: <u>P</u> Molecule: <u>P</u></p>

Regents Chemistry

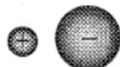




Polarity & IMF's

1. Which formula represents a polar molecule?
 A) CO₂ B) CCl₄ C) H₂ D) H₂O
2. Which substance is correctly paired with its type of bonding?
 A) Br₂—polar covalent
 B) NH₃—polar covalent
 C) NaBr—nonpolar covalent
 D) HCl—nonpolar covalent
3. When two atoms form a chemical bond by sharing electrons, the resulting molecule will be
 A) polar, only
 B) nonpolar, only
 C) either polar or nonpolar
 D) neither polar nor nonpolar
4. Which molecule is the most polar?
 A) H₂S B) H₂Te
 C) H₂Se D) H₂O
5. Which of these substances has the strongest intermolecular forces?
 A) H₂O B) H₂Se
 C) H₂S D) H₂Te
6. Which compound has hydrogen bonding between its molecules?
 A) KH B) CaH₂
 C) CH₄ D) NH₃
7. The liquids hexane and water are placed in a test tube. The test tube is stoppered, shaken, and placed in a test tube rack. The liquids separate into two distinct layers because hexane and water have different
 A) pH values
 B) molecular polarities
 C) specific heats
 D) formula masses
8. Which structural formula represents a nonpolar symmetrical molecule?
 A)  B) 
 C)  D) H—F
9. Which is the formula of a nonpolar molecule containing nonpolar bonds?
 A) CO₂ B) H₂ C) NH₃ D) H₂O
10. Two fluorine atoms are held together by a covalent bond. Which statement correctly describes this bond?
 A) It is polar and forms a polar molecule.
 B) It is nonpolar and forms a nonpolar molecule.
 C) It is polar and forms a nonpolar molecule.
 D) It is nonpolar and forms a polar molecule.
11. Given the formula representing a molecule:

$$\text{H} - \text{C} \equiv \text{C} - \text{H}$$

 The molecule is
 A) symmetrical and polar
 B) asymmetrical and nonpolar
 C) asymmetrical and polar
 D) symmetrical and nonpolar
12. Why is a molecule of CO₂ nonpolar even though the bonds between the carbon atom and the oxygen atoms are polar?
 A) The CO₂ molecule has a deficiency of electrons.
 B) The shape of the CO₂ molecule is asymmetrical.
 C) The shape of the CO₂ molecule is symmetrical.
 D) The CO₂ molecule has an excess of electrons.

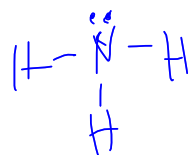
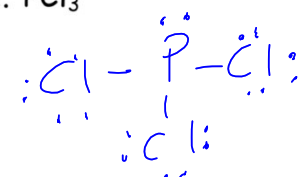
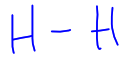
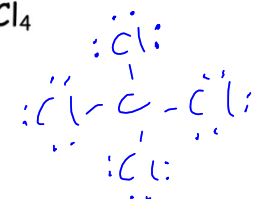
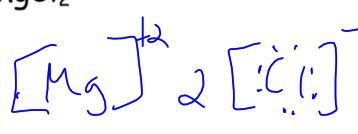
Polarity & IMF's

13. The four single bonds of a carbon atom in CH_4 are directed toward the corners of a
- A) parallelogram B) rectangle
C) square D) tetrahedron
14. Which statement explains why low temperature and high pressure are required to liquefy chlorine gas?
- A) Chlorine molecules have strong covalent bonds.
B) Chlorine molecules have weak covalent bonds.
C) Chlorine molecules have strong intermolecular forces of attraction.
D) Chlorine molecules have weak intermolecular forces of attraction.
15. At STP, fluorine is a gas and bromine is a liquid because, compared to fluorine, bromine has
- A) weaker covalent bonds
B) weaker intermolecular forces
C) stronger covalent bonds
D) stronger intermolecular forces
16. Which diagram best represents a polar molecule?
- A)  NaCl B)  HCl
C)  Cl₂ D)  H₂
17. Which of the following compounds has the highest boiling point?
- A) H_2O B) H_2Te
C) H_2S D) H_2Se
18. In a nonpolar covalent bond, electrons are
- A) shared unequally by two atoms
B) shared equally by two atoms
C) transferred from one atom to another
D) located in a mobile "sea" shared by many atoms
19. The degree of polarity of a chemical bond in a molecule of a compound can be predicted by determining the difference in the
- A) densities of the elements in the compound
B) atomic masses of the bonded atoms in a molecule of the compound
C) melting points of the elements in the compound
D) electronegativities of the bonded atoms in a molecule of the compound
20. Two atoms of element A unite to form a molecule with the formula A_2 . The bond between the atoms in the molecule is
- A) ionic
B) polar covalent
C) nonpolar covalent
D) electrovalent
21. At STP, fluorine is a gas and iodine is a solid. This observation can be explained by the fact that fluorine has
- A) stronger intermolecular forces of attraction than iodine
B) lower average kinetic energy than iodine
C) weaker intermolecular forces of attraction than iodine
D) higher average kinetic energy than iodine
22. Which molecule is polar and contains polar bonds?
- A) N_2 B) CCl_4
C) NH_3 D) CO_2
23. The diagram below represents a water molecule.
- 
- This molecule is best described as
- A) polar with nonpolar covalent bonds
B) polar with polar covalent bonds
C) nonpolar with nonpolar covalent bonds
D) nonpolar with polar covalent bonds

For each of the bonds below, determine the electronegativity difference (SHOW ALL WORK) and the type of bond that results (ionic, polar covalent, or nonpolar covalent).

Bond	Electronegativity Difference	Bond Type
H---O	$3.4 - 2.2 = 1.3$	Polar covalent
C---C	$2.6 - 2.6 = 0$	Non polar covalent
K---F	$4.0 - 0.8 = 3.2$	Ionic
N---H	$3.0 - 2.2 = 0.8$	Polar covalent
Na---F	$4.0 - 0.9 = 3.1$	Ionic
H---H	$2.2 - 2.2 = 0$	Non polar covalent

Draw Lewis Dot Structures for the following compounds. Indicate the type of bond by using either brackets and charges (ionic) or dashes (covalent).

1. NH ₃ 	2. PCl ₃ 
3. H ₂ 	4. CCl ₄ 
5. MgCl ₂ 	6. KBr 