Bonding Notes

Types of bonds we will see:

1. Ionic

2. Covalent

3. Metallic

4. Intermolecular

5. The outermost electrons are the _____ electrons

6. The outermost electron orbital is the _____ _____.

7. Bonds always form when atoms or ions end up with _____, like the noble gases.

To draw LEWIS DOT DIAGRAMS

8. Dots represent _____

9. Lewis Dot diagrams show only _____

10. Electron orbitals: the first orbital is _____ and holds only _____ electrons

11. The second orbital is larger, and holds up to _____electrons.

12. Fill in this chart (and keep going)

Atom number	Atom symbol	Lewis Dot (atom)	Ion Symbol	Lewis Dot (ion)
1	H		H^{+1}	
2	He		X	X
3	Li			
4	Be			

Atom number	Atom symbol	Lewis Dot (atom)	Ion Symbol	Lewis Dot (ion)
5			X	X
6			X	X
7				
8				
9				
10			X	X
11				
12				
13				

Atom number	Atom symbol	Lewis Dot (atom)	Ion Symbol	Lewis Dot (ion)
14			X	X
15				
16				
17				
18			X	X
19				
20				

20. When sodium chloride forms from sodium metal and chlorine non-metal, the atoms form ions first. To do this, the sodium _____ an electron to a chlorine atom .

21. The sodium becomes a sodium cation with a _____ charge

22. The chlorine becomes a chloride anion, with a _____ charge

23. Let's draw the Lewis dot diagrams for the atoms, the ions, and then the compound.

Atom	Ion	Compound

24. It's important to note here, the sodium atom at 2-8-1 electron configuration becomes _____ as it loses one electron, becoming isoelectric to neon.

25. It loses enough electrons to get a perfect outer orbital, as defined by noble gases having the most perfect, or _____ electron orbitals of all.

26. The chlorine atom has a 2-8-7 configuration, gains one electron, and becomes _____, making it isoelectric to the noble gas _____.

27. Both ions end up with perfect outer orbitals, both end up _____.

28. Almost all ions follow the _____ rule.

29. This is described as:

30. This is a rule, not the law. An exception is _____ which is too _____...

31. Fill in this chart.

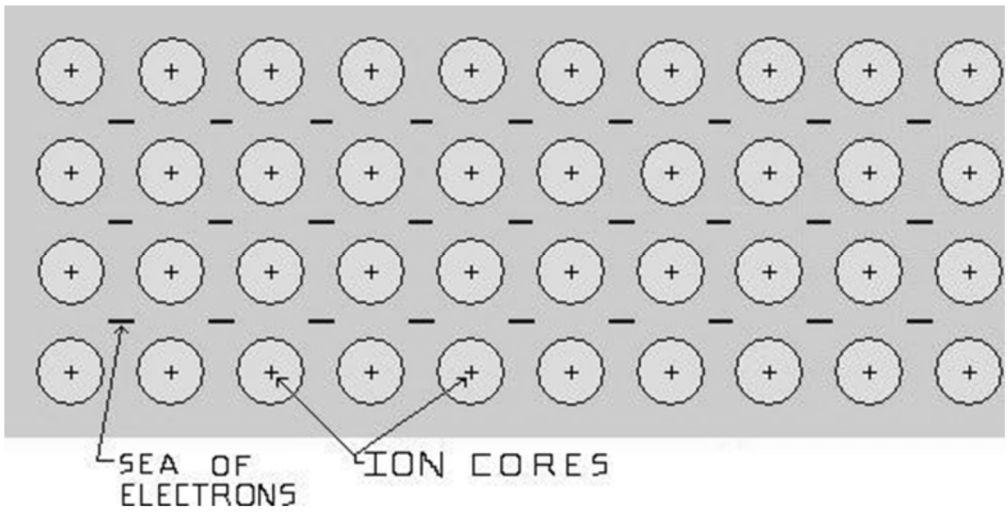
Compound name	Compound Formula	Cation	Anion	Lewis Dot Diagram
Magnesium oxide	MgO	Mg^{+2}	O^{-2}	
	LiF			
	$CaCl_2$			
Sodium…			S^{-2}	
Cesium oxide				

26. Why is the formula for aluminum oxide Al_2O_3 and not some other ratio?

33. Draw the (ugly) Lewis Dot diagrams for Magnesium Nitride and Aluminum Oxide

34. Metallic Properties that you should remember include…

35. Metals are understood to be…



36. Metals are made up of…

37. Smashing a piece of metal with a hammer:

38. The flow of electrons…

39. In metals, the…

40. Covalent Bonding:

41. They do not…

42. With Ionic Bonding, there is a

43. In Covalent Bonding..

44. No…

45. Covalent Bonds…

46. Molecules form with…

47. Draw Lewis Dot diagrams for H_2 and F_2

48. In covalent bonds, all atoms get _____.

49. These bonds for H_2 and F_2 are all _____ BONDS because they only share _____ AND _____

50. $F_2 + H_2$ have _____ bonds.

51. Draw Lewis Dot Diagram for HCl, and name the bond present.

52. Draw the Lewis Dot Diagram for H_2O, and name the bond present (there are 2 identical bonds in water)

53. Draw STRUCTURAL diagrams for HCl and water. (one dash = one pair of electrons being shared in a bond)

54. Draw the Lewis Dot Diagram, and the Structural diagram for AMMONIA, NH_3.

55. Draw the Lewis Dot Diagram, and the Structural diagram for METHANE, CH_4.

56. The greater the difference in electronegativity values between two atoms, the greater the polarity of the bond. Some polarities are stronger (a greater EN difference) and some polarities are weaker (a lesser EN difference).

Fill in this chart

Molecule formula + name	EN #1	EN #2	EN diff	Polarity rank	Structural diagrams
H_2 hydrogen	2.2	2.2	0		H—H
PCl_3					
OF_2					
HBr					
HI					

57. Draw 2 Lewis Dot Diagrams of atoms of oxygen.

58. How many electrons does EACH atom of oxygen need to complete the octet? _____
Can they do this for each other? _____

59. Draw the Lewis Dot Diagram for the Molecule of oxygen in the box MEMORIZE THIS ONE.

The O_2 molecule. Makes a _____ bond. Why is it nonpolar?

60. Draw structural diagrams and name the types of bonds in these HONClBrIF twins (leave N_2 for last)

H_2	O_2	F_2
Cl_2	Br_2	I_2

61. Draw a Lewis Dot Diagram for a nitrogen atom	How many electrons does each atom need to meet the octet rule?	Draw a Lewis Dot Diagram for another nitrogen atom

62. Draw a nitrogen molecule in the box Memorize this one also!

63. Nitrogen molecules have a triple nonpolar covalent bond because...

	Dot diagram	Structural diagram	name all bonds present
64 C_2H_6			
65 C_2H_4			
66 C_2H_2			
67 C_3H_8			
68 CO_2			
69 $AsCl_3$			
70 C_4H_{10}			
71 OBr_2			
72 CCl_4			

73. Draw a Lewis Dot diagram for CaO calcium oxide, and tell what sort of bond or bonds are present.

74. Alloys:

75. Alloy examples:

76. In this NaCl model, each Na^{+1} is surrounded by 6 Cl^{-1} anions.

The _____ number for sodium cations is _____

The _____ number for chloride anions is _____

77. With this _____ coordination number ratio, the shape of NaCl crystals is _____

78. With a _____ coordination number, $CaCO_3$ ends up with a very different _____

79. Coordination number is…

80. What's the big deal about a coordination number?

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82. CO forms a…

81. Draw the Lewis dot diagram for a carbon atom	Draw the Lewis dot diagram for an oxygen atom	Draw the Lewis dot diagram for carbon monoxide, CO

83. Shorthand notation for this looks like: _____ no atoms make this bond alone. There is always a "real bond" forming first, then this exceptional bond allows both atoms to get an octet.

84. Phosphorous Pentachloride (PCl5) is another weirdo compound. It breaks the octet rule also. Attempt it here:

85. How does this break the octet rule?

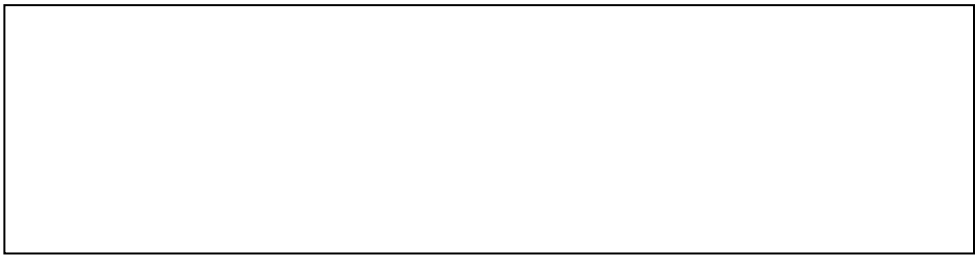
Lewis dot diagram	Structural diagram

86. Oxygen and Ozone are both PURE FORMS of oxygen. Their formulas are: _____ + _____

87. Ozone is an _____ of oxygen.

88. Allotropes are:

89. Let's bond 3 oxygen atoms here

90. These bonds 

_____, they are not stable one way or the other,
but they are stable "both ways at the same time"!

Another name for this is a _____ bond

91. Because they literally resonate back and forth all of the time, each bond is really: _____

92. Intermolecular bonds are:

93. Ionic bonds form between a _____ and a _____

These bonds _____ electrons. Examples include: _____

94. Covalent bonds form between a _____ and a _____

These bonds do not transfer electrons, they _____ electrons. Examples include: _____

94. Metallic Bonds…

95. All of these bonds (ionic, covalent, and metallic) are …

96. There are ____ kinds of intermolecular bonds. All are _____ _____ than ionic, covalent or metallic bonds.

97. Weakest to strongest, these intermolecular bonds are called:

98. The weakest intermolecular bond is _____ which is caused by

99. Example 1: Fluorine F_2

100. When all of fluorine's _____ electrons move…

101. Example 1: Chlorine Cl_2

102. When all of chlorine's _____ electrons move…

103. Example 3: Bromine Br_2

104. When all of Bromine's _____ electrons move…

105. Example 4: Iodine I_2

106. When all of Iodine's _____ electrons move…

107.At STP, the halogens exhibit…

108. Which is ONLY due to the differences in their _____

109. Dipole Attraction:
(draw 2 molecules)

110. The dipole arrows
DO NOT

111. Molecular polarity is based upon a molecule's _____

112. If the molecule has _____ then it is nonpolar.

113. The only symmetry (or balance) that matters in chem is called _____ symmetry.

114. There are other forms of symmetry, but they don't matter in chem. Humans and gingerbread men have symmetry called _____. It's a type of symmetry, but not important concerning molecules.

115. Draw SCl_2 It does not have radial symmetry. The bonds are…

116. Draw CH_4 It DOES have radial symmetry. The bonds are…

117. Radial symmetry offsets that polarity, and the molecule is nonpolar. SCl_2 will be liquid at room temperature, while CH_4 would be a gas. Why???

118. Draw 5 molecules of SCl_2 Use DOTS to show dipole attraction (intermolecular attraction)

119. Draw 4 molecules of methane, there are NO dipole attractions here.

120. Hydrogen bonding is EXACTLY LIKE _____ but the difference is that atoms of _____ must be present.

121. This matters because H has a much _____ _____, making the bonds much more _____

122. Draw a molecule of SCl_2 and of water.

Electronegativity values and differences: S___ Cl ___ difference _____ H___ O ___ difference _____

Since _____ has a greater electronegativity difference, it has a _____ _____ bond.

This super duper dipole that forms is so strong instead of strong dipole attraction, we call it

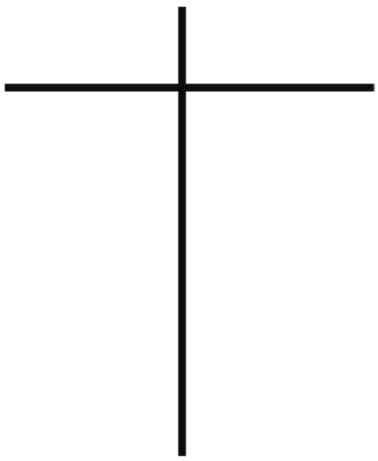
_____

123. Draw 6 water molecules, include DOTS that show the hydrogen bonds (intermolecular attraction)

124. Bond type	example formulas
Ionic	
Single nonpolar covalent	
Single polar covalent	
Double nonpolar covalent	
Double polar covalent	
Triple non polar covalent	
Triple polar covalent	
Coordinate covalent	
Resonant	
Ionic + Covalent at the same time	
Breaks the octet rule (more than $8e^-$)	
Breaks the octet rule (less than $8e^-$)	

125. Oxidation numbers are:

126. Show all of the oxidation numbers for H and O, use the t-chart properly



127. What are the relative oxidation numbers for

HCl

CO_2

$AsCl_3$

☺	Sulfur dioxide	SO_2	S^{+4} O^{-2} O^{-2} (0)
☺	Chromate ion	CrO_4^{-2}	Cr^{+6} O^{-2} O^{-2} O^{-2} O^{-2} (-2)
129	Permanganate ion		
130		NH_3	
131		NaOH	
132		$KClO_3$	
133	Carbon monoxide		
134	Carbon dioxide		
135	Dihydrogen sulfate		
136	Nitrate ion		
137	Nitrogen dioxide		
138	Phosphorus trichloride		

Intermolecular bonding system Jeopardy!

139. It keeps ammonia NH_3 together as a liquid, what is…

140. It keeps Br_2 bromine a liquid, but iodine I_2 a solid, what is...

141. It keeps phosphorus trichloride PCl_3 together as a liquid, what is…

142. What is the difference between bond polarity and molecular polarity?

143. The bonds in ozone…

144. Draw the CO, carbon monoxide molecule properly (dots and structurally). Name the bond or bonds

145. True or False?

Ionic bonds can be double or single bonds

Covalent bonds cannot be nonpolar bonds

Oxygen molecules have double polar covalent bonds

Nitrogen molecules have double nonpolar covalent bonds

Hydrogen atoms can make single or double covalent bonds

Oxygen atoms must make double bonds ONLY

Water is sometimes a straight line molecule by shape

Molecules with polar bonds can never be non polar molecules

Molecules with nonpolar bonds only can never be polar molecules

The weakest intermolecular bond is the dipole force of attraction