

Chapter 9 Review (Honors Chemistry)

Vocabulary:

- Coordinate Covalent
- Double Covalent
- Single Covalent
- Structural Formula
- Polyatomic Ion
- Triple Covalent
- Covalent Bond
- Molecule
- Unshared Pairs
- Resonance
- Diatomic
- Octet Rule
- Polar Bond
- Hydrogen Bond

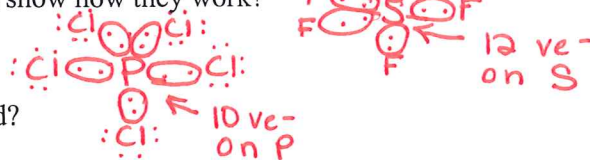
Concept Questions:

1. What are the differences between ionic and covalent bonds?
Ionic - metals + non-metals, transfer electrons, formula units
Covalent - non-metals only, share electrons, molecular formulas
2. What are the properties of molecular compounds?
non-metals only, share electrons,
poor conductors, lower melting + boiling points, likely to be
liquid or gas at room temperature
3. Explain how H^+ forms with NH_3 and H_2O to form polyatomic ions.
Nitrogen (or oxygen in H_2O) form coordinate covalent bonds
with H^+ since H^+ does not have any e^- to bond with

4. Explain how and why hydroxide and cyanide form negative polyatomic ions.

They gain an electron from a metal to complete the octet of one of the atoms $\text{Na} \cdot \rightarrow \cdot \ddot{\text{O}} \cdot \cdot \text{H}$

5. What are the two examples of expanding the octet? Explain and show how they work?



6. What are the 7 diatomic molecules? How and why do they bond?

$\text{H}_2, \text{N}_2, \text{O}_2, \text{F}_2, \text{Cl}_2, \text{Br}_2, \text{I}_2$

7. Are diatomic molecules polar or nonpolar? Explain your answer.

Non-polar. Each atom has the same electronegativity so they must share the electrons equally.

8. What are the examples in which atoms that are exceptions to the octet during covalent bonding?

$\text{BH}_3, \text{SF}_6, \text{PCl}_5$

9. Which three atoms can expand the octet? Explain how this is done?

S, P, Xe Electrons will fill into the empty "d" sublevel of the atom

10. Why are metals unlikely to form covalent bonds?

There are not enough electrons to share to complete a metal's octet.

11. Explain how a coordinate covalent bond works and how it compares to regular covalent bonds.

One atom donates both electrons to a shared pair. Once formed it behaves like any other covalent bond.

12. Why do atoms form covalent bonds? Hint: what are they trying to achieve when bonding?

To achieve an electron configuration that is stable like a noble gas.

13. Explain the difference between a shared pair and an unshared pair.

- Shared pair - one electron is shared by each atom to make a pair
- Unshared pair - electron pairs not involved in bonding.

14. Explain what happens to carbon's electron configuration when it is able to form 4 covalent bonds.

Carbon excites an electron from the 2s to the 2p, to make 4 unpaired e-
 $1s^2 2s^1 2p^3 \cdot \dot{\text{C}} \cdot$

15. What is the VSEPR theory?

Valence shell Electron Pair Repulsion

16. Compare sp^1 , sp^2 , and sp^3 hybridization in different molecules. Which types of bonds are not hybrid bonds? π bonds

sp^1 - involves 2 sp hybridized orbitals
 sp^2 - involves 3 sp hybridized orbitals
 sp^3 - involves 4 sp hybridized orbitals
} σ bonds or lone pairs

17. Why do some molecules such as water have a bent shape?

The unshared pairs of electrons on the oxygen atom repel against the shared pairs of electrons.

18. Compare a polar bond with a nonpolar bond.

Polar - unequal sharing of electrons due to electronegativity differences
Non polar - equal sharing of electrons between two identical atoms

19. How can you determine whether one bond is more polar than another?

The higher the difference in electronegativity values the more polar the bond.

20. What are Van der Waals forces?

Intermolecular forces

21. Under normal situations, are polar or nonpolar molecules attracted to one another? Explain why.

Polar molecules are attracted to each other because of the attractions between slight negative and slight positive charges.

22. What factors would cause a bond to have a high bond dissociation energy?

Double or triple bonds

23. What causes each of the following interactions? Are polar or nonpolar molecules involved?

a. Ion-Dipole

Polar molecule + Ion

c. Hydrogen Bonding

Polar molecules where H is bonded to O, Cl, or F

b. Dipole Interactions

2 Polar molecules

d. Dispersion Forces

2 Non-polar molecules

24. For each of the following, give the number of unpaired electrons and the number of bonds that can form:

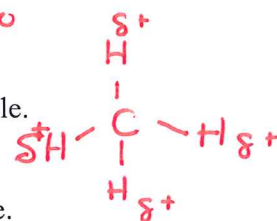
○ Oxygen:	<u># Unpaired</u>	<u># Bonds</u>	○ Sulfur:	<u># Unpaired</u>	<u># Bonds</u>
	2	2		2	2
○ Carbon:	4	4	○ Phosphorus:	3	3
$1s^2 2s^2 2p^3$					
○ Nitrogen:	3	3	○ Fluorine:	1	1
○ Hydrogen:	1	1	○ Iodine:	1	1
○ Chlorine:	1	1	○ Bromine:	1	1

25. What is a network solid? Explain why they are so strong.

All atoms are covalently bonded to each other to form a crystal. No intermolecular attractions.

26. Can a molecule be non-polar even if it has polar bonds? If so give an example.

Yes, if there is no dipole. CH_4



27. For each of the following, determine the most important intermolecular force.

○ H_2O & H_2O

Hydrogen Bonding

○ CCl_4 & S_8

Dispersion

○ H_2O & Ca^{2+}

Dipole-Ion

○ NF_3 & CO

Dipole

28. What is the difference between a polar molecule and a nonpolar molecule?

Polar molecules contain dipoles

Non-polar molecules do not contain dipoles

29. In an ion-dipole interaction, explain how a positive or negative ion would be attracted to a water molecule.

positive ion attracted to Oxygen end of H₂O

negative ion attracted to Hydrogen end of H₂O

30. Which intermolecular force is the weakest? Which is the strongest? Explain.

Dispersion is weakest

H-bonds are strongest

31. What physical state do molecules exhibiting hydrogen bonding usually take? Explain.

Liquid, strong enough attraction to keep the molecules close, but

not strong enough to move into a solid

32. What determines the bond length between two covalently bonded atoms?

The distance between the nuclei.

The more shared electrons between 2 atoms, the shorter the bond length

33. Give the bond angle and an example for the 5 primary shapes:

Shape	Bond Angle	Example
Linear	180°	H-H :O=C=O:
Trigonal Planar	120°	<pre> H B / \ H H </pre>
Pyramidal	107.3°	<pre> H N / \ H H </pre>
Tetrahedral	109.5°	<pre> H C / \ H H </pre>
Bent	104.5°	<pre> O / \ H H </pre>

Formula	Dot Formula	Structural Formula	Unshared Pairs
H ₂ O			2
C ₃ H ₈			0
N ₂			2
NH ₃			1
CO ₂			4
C ₂ H ₆ O ₂			4
C ₂ H ₇ N			2
CO			2

Formula	Dot Formula	Structural Formula	Unshared Pairs
NH_4^+			0
C_2H_2		$\text{H}-\text{C}\equiv\text{C}-\text{H}$	0
OH^-		$[\text{:}\ddot{\text{O}}-\text{H}]^-$	3
BH_3			0
NF_3			10
H_2O_2		$\text{H}-\ddot{\text{O}}-\ddot{\text{O}}-\text{H}$	4
H_3O^+			1
C_4H_6		$\text{H}-\text{C}=\text{C}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\text{H}}{\text{C}}-\text{H}$	0