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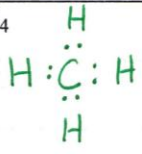
Chemical Bonding Review

1. Explain the importance of valence electrons.
   They are usually the only electrons used in the formation of chemical bonds. They define chemical properties of an element
2. What is the relationship between the electron dot structure of an element and the location of the element in the Periodic Table?
   The # of e- in the dot structure of an element is the same as the Family (Group) # for group A elements.
3. How many electrons must be gained or lost by each atom to achieve a stable electron configuration?
   a. N 3 gained
   b. Cl 1 gained
   c. S 2 gained
   d. Mg 2 lost
   e. Al 3 lost
   f. P 3 gained

4. Complete the table by drawing the Lewis dot structures

Al	N	O	KCl
			
O_2	H_2S	CH_4	HCN
			

5. Why do elements form chemical bonds?
   To achieve the stable electron configuration of a noble gas

6. Matching.

B Perfect electron sharing	A. polar covalent
C Total transfer of electrons	B. nonpolar covalent
A Unequal electron sharing	C. ionic
D Sea of electrons	D. metallic

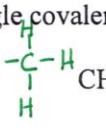
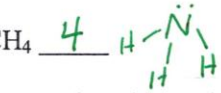
7. Use your electronegativity table to characterize each bond as nonpolar covalent, polar covalent, or ionic.

a. K – O (.8, 3.5) Ionic (2.7)
b. Li – F (1.0, 4.0) Ionic (3.0)
c. C – H (2.5, 2.1) NPC/PC (.4)
d. N – N (3.0, 3.0) NPC (0.0)
e. Cl – F (3.0, 4.0) PC (1.0)

8. Arrange the bonds above in order of increasing ionic character.

Nonpolar covalent → N-N, C-H, Cl-F, K-O, Li-F ← Ionic

9. How many single covalent bonds are in a molecule of each?

H_2O 2  CH_4 4  NH_3 3  O_2 0

10. Give the number of electrons shared in each bond below.

S_2 4  F_2 2 N_2 6 

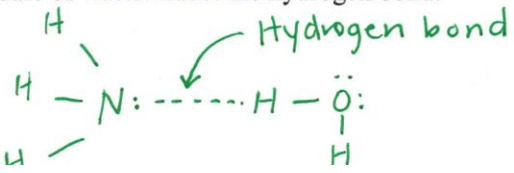
11. What determines which atom monopolizes the shared electron pair(s) involved in a bond?

The electronegativity values of the two atoms in a bond. The greater the electronegativity of an atom in a bond, the stronger it attracts the electrons in a covalent bond

12. For both CH_4 and CH_2Cl_2 identify the following:

CH_4		CH_2Cl_2
tetrahedral	Molecular shape	tetrahedral
109.5°	Bond angle between the terminal atoms	109.5°
C-H is questionable (diff of .4)	Bond character (Are there any polar bonds?)	yes - 2 C-Cl bonds
nonpolar (symmetrical)	Molecular Polarity (Is the overall molecule polar or nonpolar?)	polar (asymmetrical)

13. Ammonia molecules undergo hydrogen bonding with water. Diagram the formation of the hydrogen bond between one molecule of ammonia (NH_3) and one molecule of water. Label the hydrogen bond.



14. Would you expect methane (CH_4) to participate in hydrogen bonding? Why?

No. The hydrogen atoms are not bonded to a very electronegative element (F O N)

15. Of the following attractive forces: covalent bond, hydrogen bond, ionic bond, van der Waals forces

    a. Which is strongest? ionic

    b. Which is weakest? van der Waals

16. How does the molecular polarity influence the ability of a substance to dissolve in another substance?

Polar and ionic substances dissolve in polar solvents; nonpolar substances dissolve in nonpolar substances

17. Predict whether or not carbon tetrafluoride (CF_4) would be expected to dissolve in each of these solvents. Justify your prediction.

    a. Ammonia (NH_3) NO. CF_4 nonpolar, NH_3 polar

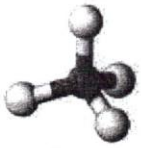
    b. Water (H_2O) NO. CF_4 nonpolar, H_2O polar

    c. Carbon Tetrachloride (CCl_4) Yes. both are nonpolar. Like dissolves like!

18. Would your predictions remain the same if methane (CH_4) were used instead of carbon tetrafluoride? Explain.

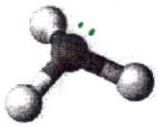
Yes because methane is also nonpolar (symmetrical)

19. Determine the shape and bond angle of each molecule given below. X and Y are used to represent elements.

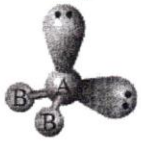


Shape: tetrahedral
Bond angle: 109.5°

Shape: trigonal planar
Bond angle: 120°



Shape: pyramidal
Bond angle: 107°



Shape: bent
Bond angle: <109°

Read each of the following statements below. Decide if the statement is true or false; if the statement is false, change the underlined word or phrase to make the statement true. Write the correct answer above the incorrect one.

20. F Ionic (covalent) bonds form as the result of electron sharing.

21. F A barometer (thermometer) is used to measure the melting point of a solid.

22. T Elements form bonds to achieve a stable octet.

23. F Molecular compounds (Ionic compounds) generally have high melting points and conduct electricity when dissolved in water.

24. F The degree of polarity between any two atoms can be determined by consulting the periodic table for atomic radius (electronegativity) values.

25. F Two (Four) electrons are shared in a double covalent bond.

26. T When atoms are joined by a covalent bond and the bonding electrons are shared equally, the bond is nonpolar.

27. F VSEPR Theory states that molecules adjust their 3-D shapes so valence electron pairs around the central atom are uniformly distributed. (as far apart as possible)

28. F Crayon, a nonpolar substance, is soluble (insoluble) in water.

29. T Boron trifluroide, BF_3, is nonpolar molecule containing polar bonds.