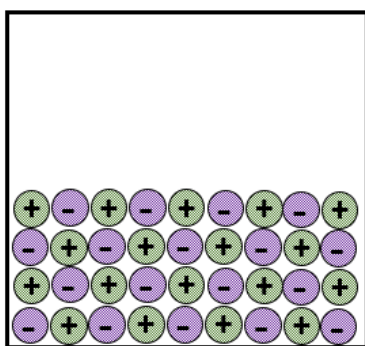


## Unit 7 Problem Set

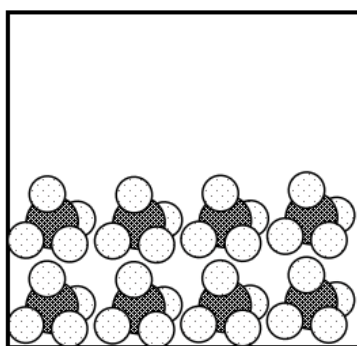
**Learning Objective:** Describe the difference between ionic and covalent bonding and differentiate between ionic and covalent compounds

Read more about this topic: [Section 7.1](#), [Section 7.2](#), and [Section 7.5](#)

1. Select all of the ionic compounds
  - a.  $\text{MnCl}_2$
  - b.  $\text{SO}_2$
  - c.  $\text{H}_2\text{O}$
  - d.  $\text{Be}(\text{NO}_3)_2$
  - e.  $\text{NH}_4\text{Cl}$
2. Select all of the covalent compounds
  - a.  $\text{CS}_2$
  - b.  $\text{KNO}_3$
  - c.  $\text{FeO}$
  - d.  $\text{NH}_3$
  - e.  $\text{HC}_2\text{H}_3\text{O}_2$
3. Consider the following diagram:

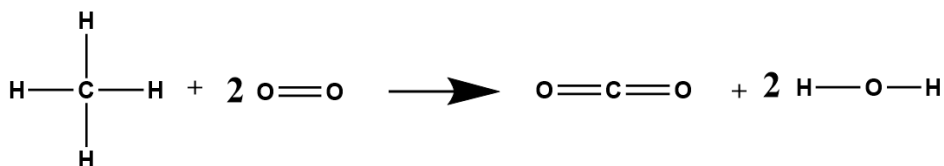


**A**



**B**

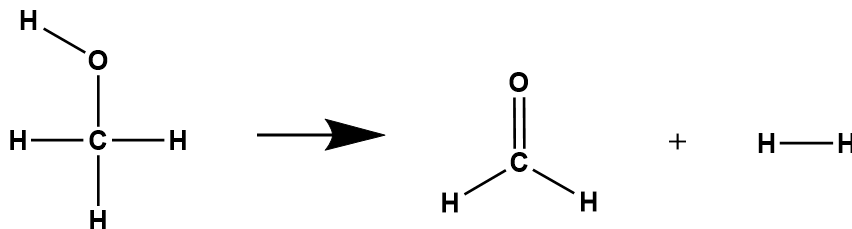
- a. Which of the diagrams depicts the bonding in a covalent solid?
  - b. Which of the diagrams depicts the bonding in an ionic solid?
4. Consider each of these ionic compounds:  $\text{MgO}$ ,  $\text{CaO}$ ,  $\text{RbCl}$ , and  $\text{CsCl}$ 
    - a. Which compound will have the largest lattice energy?
    - b. Which compound will have the smallest lattice energy?
  5. Calculate the  $\Delta H_{\text{rxn}}$  in kJ for the following reaction using the bond energies in [Table 7.2](#)



[Watch a video of a similar problem](#)

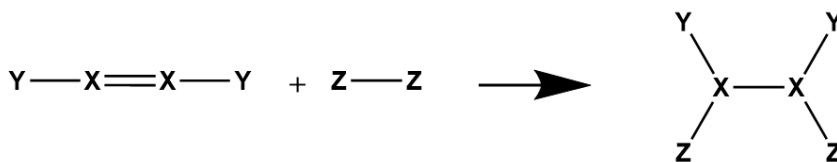
## Unit 7 Problem Set

6. Calculate the  $\Delta H_{\text{rxn}}$  in kJ for the following reaction using the bond energies in [Table 7.2](#)



[Watch a video of a similar problem](#)

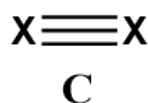
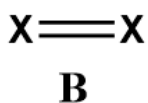
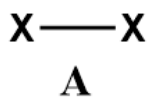
7. The enthalpy of reaction for the following reaction is 183 kJ/mol. Given the bond energies below, what is the bond energy of the X=X bond?



Bond	Energy (kJ/mol)
X-Y	392
Z-Z	252
X-Z	274
X-X	259

[Watch a video of a similar problem](#)

8. Consider a series of bonds, which statement is most likely to be true



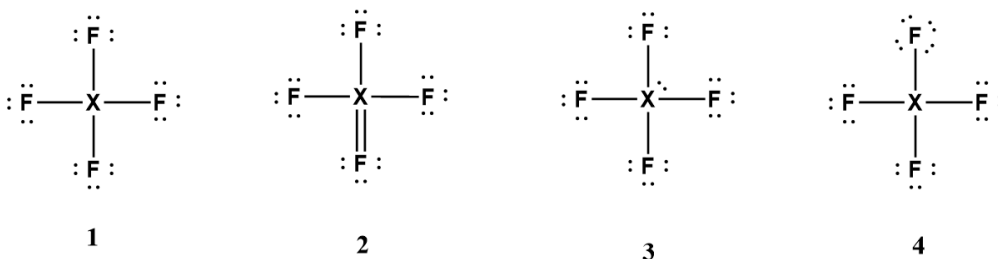
- A is the shortest bond, A is the weakest bond
- A is the shortest bond, A is the strongest bond
- A is the longest bond, A is the weakest bond
- A is the longest bond, A is the strongest bond

## Unit 7 Problem Set

**Learning Objective:** Draw Lewis symbols, structures and resonance structures; use formal charge to rank likely Lewis structures

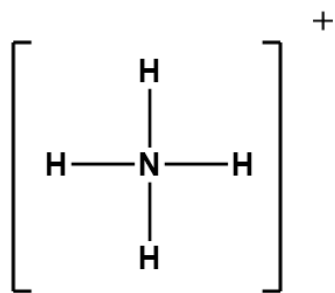
Read more about this topic: [Section 7.3](#) and [Section 7.4](#)

9. Consider the following unknown compound  $\text{XF}_4$ , where X is an element with six valence electrons and an electronegativity of 2.7. What is the most likely Lewis Structure for this compound



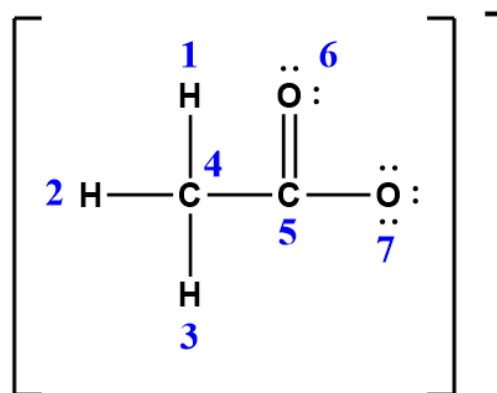
[Watch a video of a similar problem](#)

10. Assign the formal charge for each atom in the following structure.



[Watch a video of a similar problem](#)

11. Assign the formal charge for each atom in the following structure



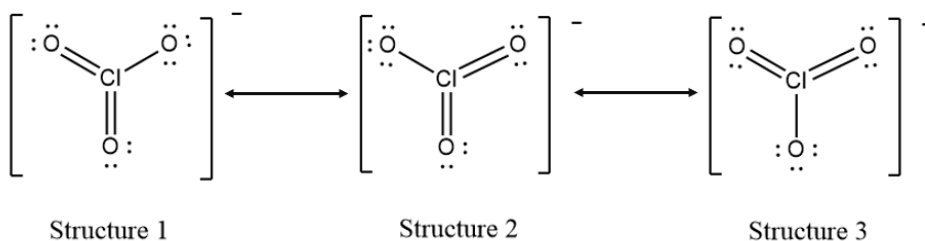
[Watch a video of a similar problem](#)

## Unit 7 Problem Set

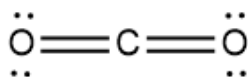
12. How many lone pairs are on the central atom in  $\text{CH}_2\text{O}$ ?

[Watch a video of a similar problem](#)

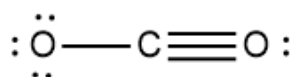
13. Rank the resonance structures below based on how likely they are to contribute to the resonance hybrid



14. Which of the following Lewis structures is less likely?



Structure 1



Structure 2

- Structure 1 is less likely because it breaks the octet rule
- Structure 1 is less likely because it does not minimize formal charge
- Structure 2 is less likely because it breaks the octet rule
- Structure 2 is less likely because it does not minimize formal charge

**Learning Objective:** Use VSEPR to determine atomic orbital hybridization, predict electron pair and molecular geometry for molecules and ions

Read more about this topic: [Section 7.6](#)

15. Rank the following species in terms of increasing N—H bond angle  
 $\text{NH}_4^+$ ,  $\text{NH}_2^-$ ,  $\text{NH}_3$

16. Identify the geometry and bond angles for the following unknown compound:  
 $\text{XF}_5$ , where X is an element below the third period, with seven valence electrons and an electronegativity of 2.9

17. Identify the geometry and bond angles for the following unknown compound:  
 $\text{XF}_4$ , where X is an element below the third period, with six valence electrons and an electronegativity of 2.6

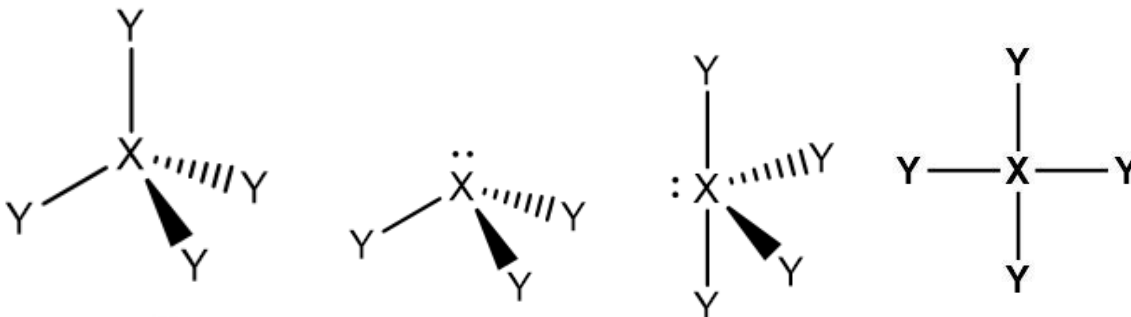
## Unit 7 Problem Set

18. Identify the geometry and bond angles for the following unknown compound:

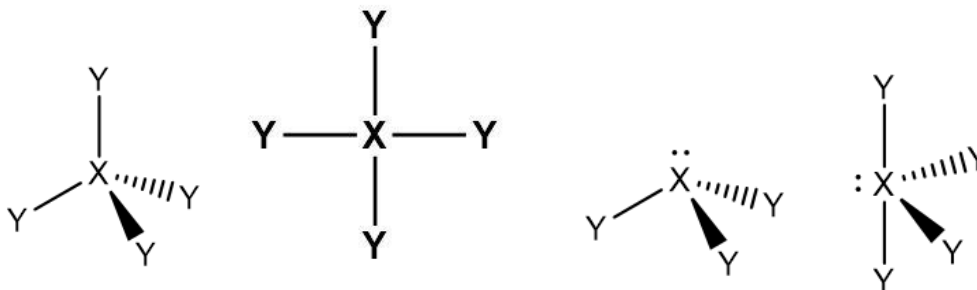
$\text{XOCl}_2$ , where X is an element with four valence electrons and an electronegativity of 2.4

19. Consider the geometry in each of the following cases:

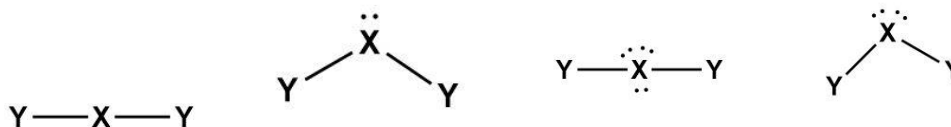
- a. What is the geometry for an unknown molecule,  $\text{XH}_4$ , where X is an element with 4 valence electrons and an electronegativity of 2.6



- b. What is the geometry for an unknown molecule,  $\text{XCl}_4$ , where X is an element with 6 valence electrons and an electronegativity of 2.6



- c. What is the geometry for an unknown molecule,  $\text{XS}_2$ , where X is an element with 4 valence electrons and an electronegativity of 2.4

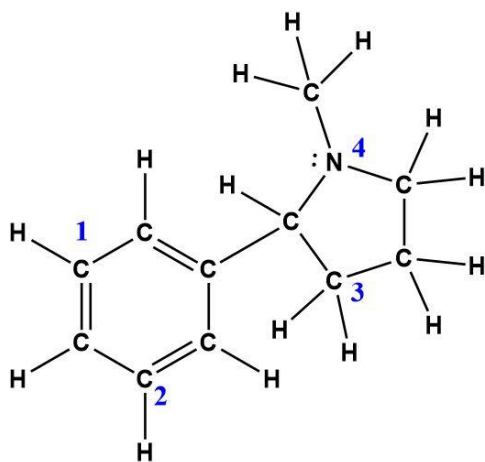


## Unit 7 Problem Set

**Learning Objective:** Describe sigma and pi bonding in hybrid and molecular orbitals. Understand the differences between valence bond and molecular orbital theory

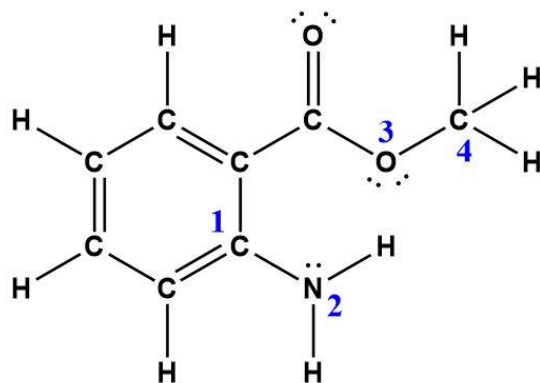
Read more about this topic [Section 8.2](#)

20. Assign the hybridization and bond angles at each of the labelled atoms



nicotine

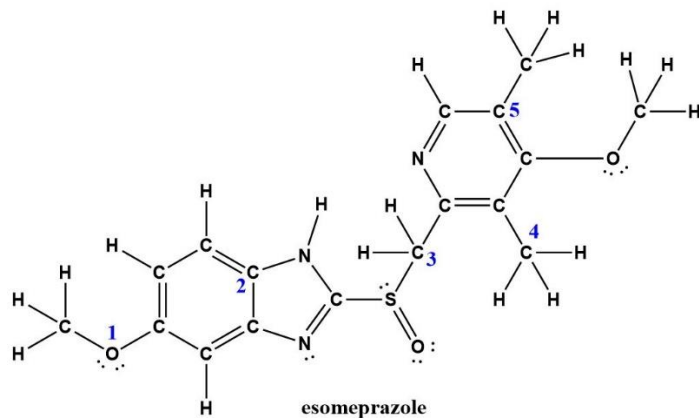
a.



methyl anthranilate

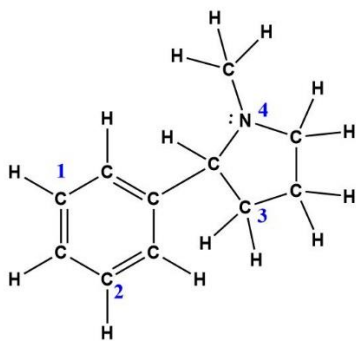
b.

## Unit 7 Problem Set



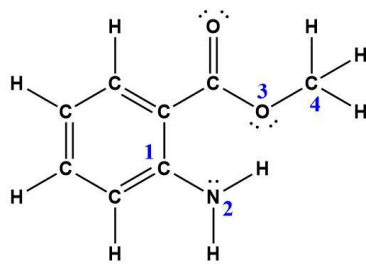
c.

21. How many sigma ( $\sigma$ ) and pi ( $\pi$ ) bonds are in the following molecule?



nicotine

22. How many sigma ( $\sigma$ ) and pi ( $\pi$ ) bonds are in the following molecule?



methyl anthranilate

## Unit 7 Problem Set

*Learning Objective: Use the concept of electronegativity to predict bond covalency, bond polarity, and the dipole moment of molecules*

Read more about this topic: [Section 7.6](#)

23. Consider the following group of bonds: F—F, H—Cl, H—O, C—H, P—H, S—O
- Which bonds are polar?
  - Which bonds are nonpolar?
24. Use [Figure 7.6](#) to indicate which atom in each polar covalent bond would have the partial negative charge and which would have the partial positive charge  
H—Cl; Br—C; P—O; F—N
25. Which of the following molecules will have a dipole moment? XeF<sub>2</sub>, H<sub>2</sub>O, NH<sub>3</sub>, CH<sub>2</sub>O, CH<sub>4</sub>
26. Consider the unknown compound JO<sub>2</sub>, where J is an unknown element with 4 valence electrons and an electronegativity of 2.4. Determine whether this molecule is polar or nonpolar.