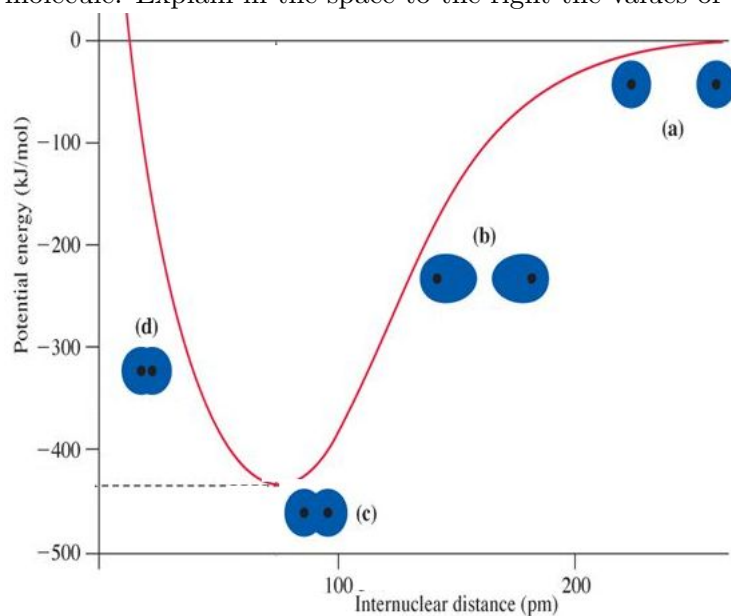


Name: \_\_\_\_\_

Date: \_\_\_\_\_

- [5 pt] 1. In the figure below label (1) the bond-length (and value) and (2) the bond energy (and value) of the molecule. Explain in the space to the right the values of the Potential Energy at each letter (a-d).



- [2 pt] 2. What are 2 flaws in Lewis Structures that lead to the development of Valence Bond Theory

- [3 pt] 3. What are the three key idea's of Valence Bond Theory?

- [4 pt] 4. Define the following terms: (1) Promotion of an electron (2) Hybridization. For each include a sketch of an energy level diagram illustrating the term for a C-C single bond.

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- [3 pt] 5. Illustrate the concept of hybridization using (atomic orbitals like, s,p,d,f) showing the results of an  $sp^3$  hybridization below. What is the shape **and** bond angle of the resulting orbitals?
- [6 pt] 6. Answer the following questions about  $sp^2$  hybridization:
- (a) Draw the energy level diagrams associated with the promotion and hybridization of the orbitals.
  
  
  
  
  
  
  
  
  
  
  - (b) Show the hybridization using orbitals (s,p,d,f). Properly label each orbital.
  
  
  
  
  
  
  
  
  
  
  - (c) What shape **and** bond angle are predicted.
- [6 pt] 7. Answer the following questions about  $sp$  hybridization:
- (a) Draw the energy level diagrams associated with the promotion and hybridization of the orbitals.
  
  
  
  
  
  
  
  
  
  
  - (b) Show the hybridization using orbitals. Properly label each orbital.
  
  
  
  
  
  
  
  
  
  
  - (c) What shape **and** bond angle are predicted.

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[4 pt] 8. In Valence Bond Theory, what is the difference in the spatial distribution of the electrons in a  $\sigma$  bond and a  $\pi$  bond? (Sketch a picture illustrating each).

[5 pt] 9. Draw a picture illustrating the bonding in  $\text{CH}_2=\text{CH}_2$  using Lewis structures **AND** using Valence Bond Theory. For the VBT picture label the orbitals. Also draw an arrow pointing out which bonds are  $\sigma$ -bonds and which are  $\pi$ -bonds

[6 pt] 10. Complete the following table: for example 4 charge clouds is - (1) Hybridization:  $sp^3$ , (2) Geometry: Tetrahedral and (3) Orbital Energy Sketch: 4 equal energy orbitals.

Charge Clouds	Hybridization	Geometry	Orbital Energy Sketch
2			
3			
4	$sp^3$	Tetrahedral	
5			
6			

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[10 pt] 11. What hybridization would you expect for the central atom in each of the following molecules. Draw the Lewis Structure of each molecule.

(a)  $\text{H}_2\text{CO}$  11(a) \_\_\_\_\_

(b)  $\text{BH}_4^-$  11(b) \_\_\_\_\_

(c)  $\text{XeOF}_4$  (violates octet rule) 11(c) \_\_\_\_\_

(d)  $\text{SO}_3$  11(d) \_\_\_\_\_

(e)  $\text{BrO}_3^-$  11(e) \_\_\_\_\_

[6 pt] 12. Given the following skeletal structure ( $\text{H}_2\text{N}-\text{CH}_2-\text{CO}-\text{OH}$ ), draw the lewis structure for glycine.

(a) What is the bond angle for H-C-H? 12(a) \_\_\_\_\_

(b) What is the bond angle for H-N-H? 12(b) \_\_\_\_\_

(c) What is the bond angle for O-C-O? 12(c) \_\_\_\_\_

(d) What hybridization is the N atom? 12(d) \_\_\_\_\_

(e) What hybridization is the left C atom? 12(e) \_\_\_\_\_

(f) What hybridization is the right C atom? 12(f) \_\_\_\_\_