

Ch 7-9 Review: Trends and Molecules



Your test will cover the following:

22 Multiple Choice Conceptual Questions

3 BIG questions on 3 different molecules. Determine the lewis structure, steric #, molecular shape, overall polarity, formal charge, hybrid orbitals, predicted bond angle, # sigma and pi bonds, paramagnetic or diamagnetic

A few more short answer questions

Topics from Chapters 7-9

1. Effective Nuclear Charge
2. Put atoms in order increasing size
3. Change in size when atoms turn into ions
4. Change in size with loss of electron shell
5. Ionic radius trends
6. Which of the following are isoelectric
7. Compare ionization energy
8. Electron affinities
9. What is a free radical
10. Is it? Paramagnetic or diamagnetic
11. Which one is attracted to a magnet
12. Draw Lewis Structures
13. Resonance structures
14. Draw structures with octet rule exceptions
15. Use electronegativity to determine polarity of bonds and overall polarity
16. Write formal charges
17. Determine which structure is more stable (from formal charges)
18. Use bond enthalpies (from book) to calculate ΔH_{rxn}
19. Compare bond length of single, double and triple bonds
20. Steric #
21. Molecular Shape
22. Bond Angle
23. Hybrid Orbital
24. Recognize hydrogen bonding
25. Determine number of sigma and pi bonds
26. Recognize shape of pi and sigma bonding
27. Fill in molecular orbital (MO) diagram
28. Recognize shape of bonding and antibonding orbitals
29. Determine Bond Order
30. Determine if bond is possible and how many bonds

To help you in studying, the following review guide will guide you through the topics covered on the test. You will still need to study items from your notes (especially your molecular geometry)

1. Distinguish between the following: Electron Affinity, Ionization Energy, & Electronegativity

attraction for e^- by single atom

Energy to remove 1st e^-

attraction for e^- in bond

2. Find the effective nuclear charge of the following atoms: B, P, Ca, Na.

$$+3 \quad +5 \quad +2 \quad +1$$

3. What is the rule for finding effective nuclear charge?

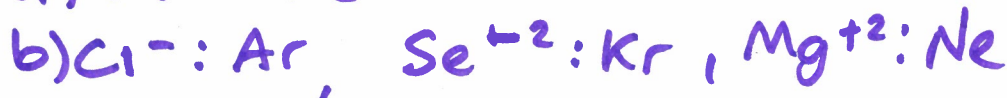
$$Z_{\text{eff}} = Z - S$$

(protons) (shielding e^-)

4. Redo #17 on pg. 267 (2 pts)



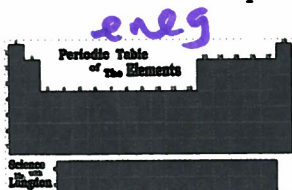
5. Redo #23 on pg. 267 (1 pts)



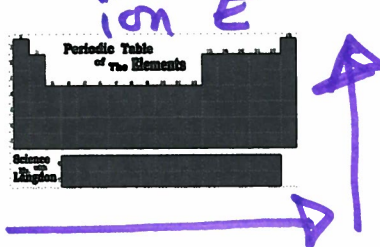
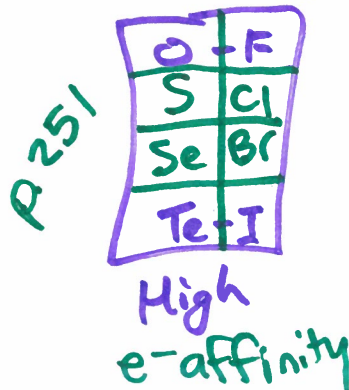
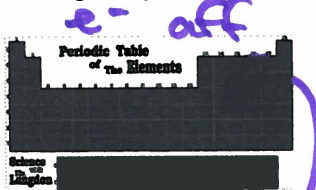
6. Redo #27 on pg. 267 (4 pts)



7. Draw the periodic trend for Electronegativity, electron affinity and ionization energy



p. 285



p. 248

8. What is special about the O_2 molecule that you wouldn't expect unless you drew the molecular orbital diagram?

paramagnetic (unpaired e^- s)

9. Name a few molecules that do not follow the octet rule.

BF_3 , SF_6 , XeF_4

10. Using the Electronegativity table on pg. 285, put the following in order of polarity?
H-C, H-P, H-S or H-N?

$H-N > HS = H-C > H-P$

11. Which of the following structures is polar?

- A. CO_2 NO
B. HBr YES
C. NH_3 YES
D. H_2S YES



12. What creates a very polar structure?

high difference in electronegativity

13. What kinds of bonds are the strongest?

triple bonds (then double bonds)

14. What kinds of bonds are the longest? The shortest?

single triple

15. Which of the following structures has hydrogen bonding?

- A. CH_3OH
B. BF_3
C. SF_6
D. PCl_5

→ must be
 $H-F$
 $H-N$
or
 $H-O$

16. What 3 elements can create a hydrogen bond?

N, O, F

17. What type of bond order means that a bond does NOT form?

0 or negative

18. What is the bond order for a single bond? Double bond? Triple bond?

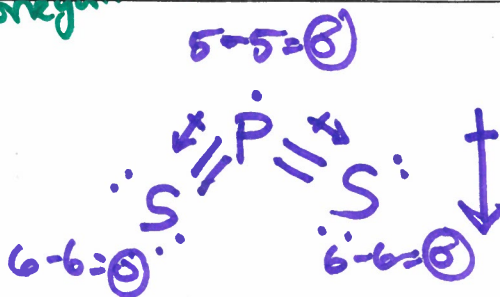
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p. 285 for electronegativity

Short Answer

19. Draw the lewis structure of PS_2 in the box then fill out the chart

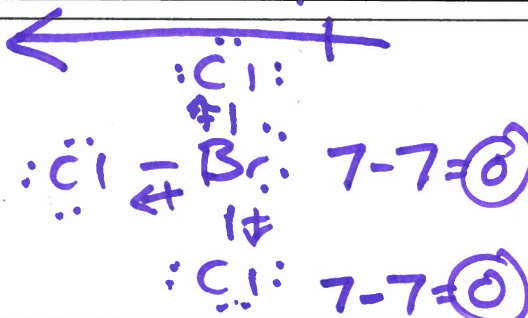
17ve-



| Steric Number | Molecular Shape | Overall Polarity (If polar, draw arrow on structure) | Formal Charge on Central Atom | Predicted Bond Angles | Hybrid Orbitals | # σ bonds | # π bonds | Paramagnetic or Diamagnetic |
|---------------|-----------------|--|-------------------------------|-----------------------|-----------------|------------------|---------------|-----------------------------|
| SN3 | bent | polar \downarrow | 0 | 120° | sp^2 | 2 | 2 | para |

20. Draw the lewis structure of BrCl_3 in the box then fill out the chart

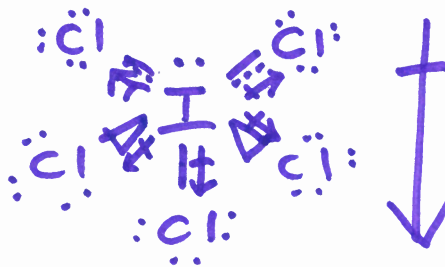
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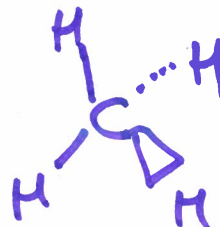
| Steric Number | Molecular Shape | Overall Polarity (If polar, draw arrow on structure) | Formal Charge on Central Atom | Predicted Bond Angles | Hybrid Orbitals | # σ bonds | # π bonds | Paramagnetic or Diamagnetic |
|---------------|-----------------|--|-------------------------------|-----------------------|-----------------|------------------|---------------|-----------------------------|
| SN5 | T-shaped | polar \leftarrow | 0 | $90^\circ, 180^\circ$ | sp^3d | 3 | 0 | Dia |

21. Draw the lewis structure of ICl_5 in the box then fill out the chart

42ve-



| Steric Number | Molecular Shape | Overall Polarity (If polar, draw arrow on structure) | Formal Charge on Central Atom | Predicted Bond Angles | Hybrid Orbitals | # σ bonds | # π bonds | Paramagnetic or Diamagnetic |
|---------------|------------------|--|-------------------------------|-----------------------|-----------------|------------------|---------------|-----------------------------|
| SN6 | square pyramidal | polar \downarrow | 0 | $90^\circ, 180^\circ$ | sp^3d^2 | 5 | 0 | Dia |



22. What types of molecules are attracted to magnets?

Paramagnetic

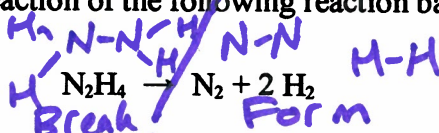
23. What types of molecules are free radicals?

unpaired e^- (paramagnetic)

24. What are some examples of molecules with delocalized pi orbitals?

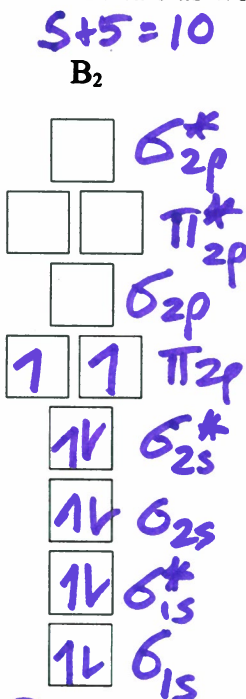
benzene, NO_3^- , any resonance

25. Calculate the enthalpy of reaction of the following reaction based on the bond enthalpies (use pg. 301):



| | | | | |
|-----------|----------------|------|----------------|-----------------------|
| Break (+) | 1 N-N + 1(163) | Form | 1 N-N - 1(163) | Add +692 KJ/mol |
| | 4 N-H + 4(391) | | 2 H-H - 2(436) | |

26. Complete the following molecular orbital diagrams. Label on the right side σ and π orbitals as well as the antibonding orbitals. (pg 350 is helpful)



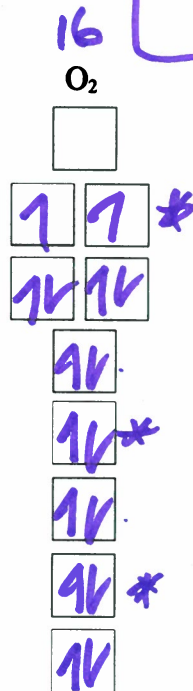
Para



Dia



Dia

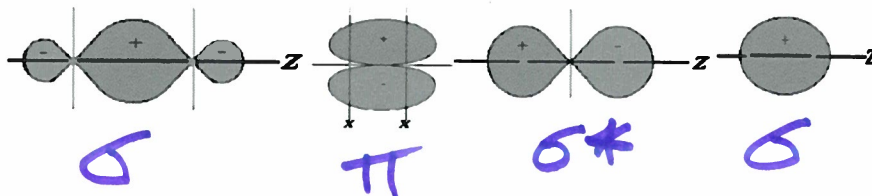


Para

27. What is the bond order of all the molecules in the last question?

$B_2 = \frac{1}{2}(6-4) = 1$ $F_2 = \frac{1}{2}(10-8) = 1$ $N_2 = \frac{1}{2}(10-4) = 3$ $O_2 = \frac{1}{2}(10-6) = 2$

28. Identify sigma orbitals, pi orbitals, bonding orbitals and antibonding orbitals in the following molecules:



p. 347