Name: _____ **Date:** _____

Bonding Beyond the Basics: Conquer Chemical Complexity for Grade 12

Analyze molecular geometry and orbital hybridization to predict how advanced chemical structures behave in industrial synthesis and pharmacological design.

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1. In the coordination complex [Ni(CN)4]2-, the nickel center exhibits dsp2 hybridization. Based on Crystal Field Theory and hybridization, what is the predicted geometry and magnetic property of this ion?

A. Tetrahedral and Paramagnetic
B. Square Planar and Diamagnetic
C. Square Planar and Paramagnetic
D. Tetrahedral and Diamagnetic

2. The molecule Xenon Tetrafluoride (XeF4) contains two lone pairs on the central atom. According to VSEPR theory, these lone pairs occupy the _____ positions to minimize repulsion.

A. Axial
B. Equatorial
C. Adjacent
D. Terminal

3. According to Molecular Orbital Theory, the O2 molecule is diamagnetic because all of its electrons are paired in the pi-bonding and sigma-bonding orbitals.

A. True
B. False

4. Which of the following molecules transitions from sp3 to sp2 hybridization at the central carbon atom during a nucleophilic substitution (SN2) transition state?

A. Ethene
B. Ethyne
C. Chloromethane
D. Benzene

5. In the context of Metallic Bonding, the transition from a conductor to an insulator as temperature increases in certain oxides is often explained by the _____ model.

A. Sea of Electrons
B. Lattice Energy
C. Band Theory
D. VSEPR

6. Which molecule possesses a formal charge of zero on the central atom but violates the octet rule by having an expanded valence shell?

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A. BF_3
B. SF_6
C. NH_4^+
D. CO_3^{2-}

7. A sigma (σ) bond is generally stronger than a pi (π) bond because the orbital overlap in a sigma bond occurs along the internuclear axis, creating a higher electron density between the nuclei.

A. True
B. False

8. The concept used to describe molecules like ozone (O_3) where a single Lewis structure cannot accurately represent the electron distribution is known as _____.

A. Resonance
B. Ionization
C. Polarization
D. Electronegativity

9. When comparing Lattice Energy (U), which of the following ionic solids would be expected to have the highest magnitude of lattice energy?

A. LiF
B. CsI
C. CaO
D. ScN

10. The bond angle in NF_3 is larger than the bond angle in NH_3 because Fluorine is more electronegative than Hydrogen.

A. True
B. False