

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

## Molecular Architecture: A 10th Grade Bonding Blueprint Expedition

Perfect for formative assessment of lattice energy, orbital hybridization, and VSEPR theory as students design stable chemical structures.

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**1. Which transition metal complex geometry is most likely to result from  $d^2sp^3$  hybridization in an octahedral field?**

- A. Trigonal bipyramidal
- B. Square planar
- C. Octahedral
- D. Tetrahedral

**2. In the Born-Haber cycle, the energy released when gaseous ions combine to form one mole of an ionic solid is known as \_\_\_\_\_.**

- A. Ionization energy
- B. Lattice energy
- C. Electron affinity
- D. Enthalpy of sublimation

**3. According to Molecular Orbital Theory, a bond order of zero indicates that the molecule is energetically stable and likely to exist under standard conditions.**

- A. True
- B. False

**4. Analyze the molecule Xenon Tetrafluoride ( $XeF_4$ ). Based on VSEPR theory, what is its electron domain geometry and its molecular shape?**

- A. Octahedral / Square Planar
- B. Tetrahedral / Tetrahedral
- C. Trigonal bipyramidal / See-saw
- D. Square planar / Octahedral

**5. The paradox where certain molecules like Benzene exhibit intermediate bond lengths between single and double bonds is explained by the concept of \_\_\_\_\_.**

- A. Electronegativity
- B. Resonance
- C. Polarizability
- D. Catenation

**6. Which of the following substances would you expect to have the highest boiling point based on its predominant intermolecular forces?**

- A.  $H_2S$  (Hydrogen sulfide)

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- B. PH<sub>3</sub> (Phosphine)
- C. NH<sub>3</sub> (Ammonia)
- D. CH<sub>4</sub> (Methane)

**7. Sigma ( $\sigma$ ) bonds are formed by the side-to-side overlap of p-orbitals, while pi ( $\pi$ ) bonds are formed by head-on orbital overlap.**

- A. True
- B. False

**8. An atom's ability to attract shared electrons in a chemical bond is defined as \_\_\_\_\_.**

- A. Electron affinity
- B. Atomic radius
- C. Electronegativity
- D. Effective nuclear charge

**9. The 'Sea of Electrons' model in metallic bonding explains why metals are both malleable and ductile.**

- A. True
- B. False

**10. Consider the formal charge on the central atom in the Nitrate ion (NO<sub>3</sub><sup>-</sup>). What is the calculated formal charge for Nitrogen when drawn with one double bond and two single bonds to oxygen?**

- A. 0
- B. +1
- C. -1
- D. +2