

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

## Answer Key: Dissect Molecular Ties: A 9th Grade Bonding Battle

Synthesize data on electronegativity and lattice energy to predict substance behavior in this high-stakes analytical challenge.

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**1. An unknown crystalline solid is found to be soluble in water, has a high melting point, and conducts electricity only when molten. Which interaction best describes the bonding in this substance?**

**Answer:** B) Electrostatic attraction between a localized cation and an anion

High melting points and conductivity only in liquid/aqueous states characterize ionic compounds, which rely on strong electrostatic forces between ions.

**2. In a molecule of Nitrogen (N<sub>2</sub>), the atoms are held together by a \_\_\_\_\_ covalent bond, which accounts for its high bond dissociation energy.**

**Answer:** C) Triple

Nitrogen atoms share three pairs of electrons (six total) to satisfy the octet rule, creating an exceptionally strong triple bond.

**3. The polarity of a bond is determined solely by the total number of electrons shared between two atoms.**

**Answer:** B) False

Bond polarity is determined by the difference in electronegativity between the two atoms, not the quantity of electrons.

**4. Examine the electronegativity values: H (2.1), C (2.5), O (3.5), F (4.0). Which of the following bonds exhibits the highest degree of ionic character?**

**Answer:** B) H-F

Ionic character increases with the electronegativity difference ( $\Delta EN$ ). H-F has the largest difference (1.9) among the provided pairs.

**5. The property of metals that allows them to be hammered into thin sheets without shattering is known as \_\_\_\_\_, facilitated by the non-directional nature of metallic bonds.**

**Answer:** D) Malleability

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Malleability allows metal atoms to slide past one another in the 'electron sea' without breaking the bond.

**6. Which scenario would likely result in the formation of a coordinate covalent bond (dative bond)?**

**Answer:** B) An ammonium ion ( $\text{NH}_4^+$ ) forming when  $\text{H}^+$  bonds to the lone pair of  $\text{NH}_3$ .

In a coordinate covalent bond, one atom provides both electrons for the shared pair, as seen when the Nitrogen in ammonia shares its lone pair with a proton.

**7. Lattice energy is the energy required to separate one mole of a solid ionic compound into its gaseous ions; higher lattice energy generally leads to higher melting points.**

**Answer:** A) True

Stronger electrostatic attractions result in higher lattice energies, making it more difficult to break the crystal lattice structure.

**8. Why does Silicon Dioxide ( $\text{SiO}_2$ ) have a much higher melting point than Carbon Dioxide ( $\text{CO}_2$ ), despite both being in the same chemical family?**

**Answer:** A)  $\text{SiO}_2$  forms a giant covalent network lattice, while  $\text{CO}_2$  forms discrete molecules.

Network solids like  $\text{SiO}_2$  require breaking actual covalent bonds to melt, whereas molecular solids like  $\text{CO}_2$  only require overcoming weak intermolecular forces.

**9. The \_\_\_\_ rule suggests that atoms tend to gain, lose, or share electrons to achieve a stable configuration of eight valence electrons.**

**Answer:** B) Octet

The Octet Rule is the driving principle behind most main-group chemical bonding to reach a noble-gas-like stability.

**10. A metallic bond is characterized by a specific, directional attraction between one nucleus and two specific shared electrons.**

**Answer:** B) False

Metallic bonds are non-directional; electrons are delocalized and free to move throughout the entire metal structure.