Name: _______________ **Date:** _______________

Answer Key: Bonding Escape Room: 7th Grade Chemical Chaos Quiz

Challenge assumptions about atomic structures; this mix of synthesis questions requires justifying why specific elements form unique electrostatic or shared connections.

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1. An unknown substance 'X' has a high melting point and conducts electricity only when dissolved in water. Predict the bonding mechanism based on these properties.

Answer: C) Electrostatic attraction between ions freed in a liquid state.

High melting points and conductivity in solution are hallmarks of ionic compounds, where the crystal lattice breaks into mobile ions in water.

2. When Nitrogen (N) bonds with another Nitrogen atom to form N_2, they must achieve a full valence shell. To do this, they form a ______ bond.

Answer: B) Triple Covalent

Each Nitrogen atom has 5 valence electrons and needs 3 more to reach a stable octet; therefore, they share three pairs of electrons.

3. True or False: In a metallic bond, the positive nuclei of metal atoms are held together by a shared 'sea' of valence electrons that are not attached to any single atom.

Answer: A) True

Metallic bonding is uniquely characterized by delocalized electrons, which explains properties like malleability and thermal conductivity.

4. Aluminum (Group 13) reacts with Oxygen (Group 16). Based on their valence electron count, what is the most likely chemical formula for the resulting compound?

Answer: C) Al_2O_3

Aluminum loses 3 electrons (Al^{3+}) and Oxygen gains 2 (O^{2-}). To balance the charges, two Al ions and three O ions are needed (6+ and 6-).

5. The property of a metal that allows it to be hammered into thin sheets without breaking the metallic bond is called ______.

Answer: D) Malleability

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Malleability is the ability of a material to deform under compressive stress, facilitated by the flexible sea of electrons in metals.

6. Why does Diamond (pure Carbon) have an incredibly high melting point compared to Sulfur (S_8), even though both involve covalent bonds?

Answer: B) Diamond forms a continuous giant covalent network of atoms.

Network covalent solids like diamond require breaking strong covalent bonds throughout the entire structure to melt, unlike simple molecular solids.

7. True or False: An atom that loses an electron becomes a negatively charged ion called an anion.

Answer: B) False

Losing a negatively charged electron leaves the atom with more protons than electrons, resulting in a positively charged cation.

8. In a molecule of Hydrogen Chloride (HCl), the chlorine atom pulls the shared electrons more strongly than hydrogen. This creates a ______ covalent bond.

Answer: C) Polar

Unequal sharing of electrons due to differences in electronegativity results in a polar covalent bond with partial charges.

9. Identify which of the following pairs is most likely to form a covalent bond based on their positions in the Periodic Table.

Answer: C) Phosphorus (P) and Chlorine (Cl)

Covalent bonds typically form between two non-metals. Phosphorus and Chlorine are both non-metals, while the others are metal/non-metal or metal/metal.

10. True or False: Noble gases like Neon (Ne) rarely form chemical bonds because they already possess a stable configuration of eight valence electrons.

Answer: A) True

The 'octet rule' explains that atoms bond to achieve stability; Noble gases are already stable (low energy) and thus chemically inert.