**Name: Date:**

**A Penny’s Worth: A Study of Intermolecular Forces**

**Introduction:**

Covalently bonded substances exist as discrete molecules with various shapes and polarities. The distribution of charges in a molecule determines how polar or nonpolar a molecule is. If the molecule has asymmetrical distribution of charge, it is considered a polar molecule. If it has a symmetrical distribution of charge, it is considered nonpolar.

Depending on the polarity of a molecule, certain intermolecular forces of attraction can be present. These intermolecular forces can be present as hydrogen bonds, dipole-dipole interaction, molecule-ion attractions and weak dispersion (van der waal) forces. Hydrogen bonding is a strong intermolecular force between polar molecules. It causes substances to have a higher boiling point that expected.

The following three liquids are all covalently bonded and exhibit intermolecular forces between their molecules. Draw in their chemical structure. Be sure to indicate the lone pairs!

|  |  |  |
| --- | --- | --- |
| **Water** | **Ethanol** | **Lamp Oil** |
|  |  |  |

**Purpose:**

**Procedure:**

1. In your lab groups, place as many drops of water on the penny (specify heads or tails) until it overflows onto the paper towel. Repeat this procedure five times and collect all data.
2. Complete step one using ethanol. Record all data below.
3. Complete step one using lamp oil. Record all data below.
4. If time permits, test with various pipettes or on a different side of the penny.
5. Clean the penny by drying thoroughly, wipe the lab table down with water and a sponge. Wash your hands.

**Data:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Trial**  **One** | **Trial**  **Two** | **Trial Three** | **Trial**  **Four** | **Trial**  **Five** | **Shape of Molecule** | **Polarity of Molecule** | **Type of IMF** | **Weak or Strong IMF** |
| **Water** |  |  |  |  |  |  |  |  |  |
| **Ethanol** |  |  |  |  |  |  |  |  |  |
| **Lamp Oil** |  |  |  |  |  |  |  |  |  |

**Questions:**

1. Classify each of these substances as either ionic or covalent.
2. What is electronegativity?
3. Describe the chemical structure and polarity of each of these substances.
4. Draw a Lewis Dot structure for each of these substances.
5. Indicate on the Lewis Dot structure the polarity of each of these molecules.
6. Identify the type of intermolecular force present in each substance.
7. Which substance had the most drops?
8. What relationship can you describe between intermolecular forces and the number of drops held on the penny?
9. Predict how this will change the boiling point if intermolecular forces get stronger? What about weaker? Explain.