## Properties of Common Molecular Substances

### Directions:
1. You may work individually or in a pairs to complete this activity.
2. The following table contains the name and common use of 10 common compounds.
3. For each of them fill in the empty columns: write the chemical formula, draw the Lewis Structure, draw and name the molecular shape using VSEPR theory and list all of the bond angles present in the molecule, identify all of the intermolecular forces (LD, DD, HB), and identify the molecule as polar (P) or nonpolar (NP). NOTE: Do not worry about identifying shape name and bond angle for organic molecules.
4. When the table is complete, use the information to answer the follow-up questions.

<table>
<thead>
<tr>
<th>Ammonia is colorless gas that has a strong, suffocating odor. It is a common chemical compound that is used in fertilizers, and cleaners, and as a refrigerant.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
</tr>
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<td>Carbon dioxide is a gas at room temperature that is used during photosynthesis and is produced during hydrocarbon combustion, respiration, and fermentation.</td>
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<td>Carbon tetrachloride is a colorless, sweet smelling liquid at room temperature. It is nonflammable and is commonly used in fire extinguishers.</td>
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<td>Chloroform (trichloromethane) is a sweet-smelling, colorless liquid at room temperature. It is a strong anesthetic that was once referred to as the “knockout drug”.</td>
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**Hydrogen sulfide** is a colorless gas at room temperature. It has a foul odor similar to that of rotting eggs. It is produced in swamps, sewers, volcanos, and during digestion.

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<th>Lewis Structure</th>
<th>Molecular Shape/Name/Bond Angels</th>
<th>IMFs</th>
<th>P/NP</th>
</tr>
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</table>

**Isopropanol** (2-Propanol) is a colorless, flammable liquid at room temperature. It is used in antiseptics and disinfectants, most commonly in hand sanitizers.

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**Nitrogen trifluoride**, is a colorless, odorless gas at room temperature. In addition to being used in microelectronics, it is considered to be a strong greenhouse gas.

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**Ozone** is a colorless, unstable gas at room temperature. It is present in the Earth’s “ozone layer” and helps shield the earth from the sun’s ultraviolet radiation.

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**Propane** is a gas a room temperature. It is commonly used in home grills because it readily vaporizes from liquid to gas as it leaves the tank, making it easy to combust.

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Water is a liquid at room temperature. It is thought that water is the only substance known to exist as a solid, liquid, and gas on the Earth’s surface.

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Use the information from the table to answer the following questions about the properties of covalent substances. Be sure to include information about molecular shape, polarity, and intermolecular forces in your explanations.

Which substance would you predict to have a greater vapor pressure and a lower boiling point, ozone or carbon dioxide?

Why water is a liquid at room temperature and hydrogen sulfide a gas even though they are very similar in structure?

Explain why ammonia is 20 times more soluble than nitrogen trifluoride.

Why is the boiling point of propane (-42°C) so much lower than that of isopropyl alcohol (86°C)?

Explain why chloroform has a higher solubility and lower vapor pressure than carbon tetrachloride.