Geometry Of Molecules Worksheet

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Part 1: Building a Foundation

Which theory is primarily used to predict the shape of a molecule?

Hint: Think about the theory that focuses on electron pair repulsion.

- ◯ A) Molecular Orbital Theory
- ◯ B) VSEPR Theory
- ◯ C) Quantum Field Theory
- ◯ D) Crystal Field Theory

Which of the following are common molecular geometries? (Select all that apply)

Hint: Consider the basic shapes that molecules can adopt.

- ☐ A) Linear
- ☐ B) Tetrahedral
- ☐ C) Octagonal
- ☐ D) Trigonal Planar

Explain the significance of lone pairs in determining the shape of a molecule.

Hint: Consider how lone pairs affect bond angles and molecular geometry.

List two examples of molecules with a bent geometry.

Hint: Think of common molecules that have lone pairs affecting their shape.

1. Example 1

2. Example 2

What is the molecular geometry of methane (CH4)?

Hint: Consider the arrangement of hydrogen atoms around the carbon atom.

- ◯ A) Linear
- ◯ B) Trigonal Planar
- ◯ C) Tetrahedral
- ◯ D) Bent

Part 2: Comprehension and Application

How does the presence of lone pairs affect the bond angles in a molecule?

Hint: Think about the repulsive forces between electron pairs.

- ◯ A) Increases bond angles
- ◯ B) Decreases bond angles
- ◯ C) Has no effect
- ◯ D) Doubles the bond angles

Which of the following statements about hybridization are true? (Select all that apply)

Hint: Consider the definitions and characteristics of hybridization.

- ☐ A) sp3 hybridization results in a linear geometry.
- ☐ B) sp2 hybridization is associated with trigonal planar geometry.
- ☐ C) Hybridization involves the mixing of atomic orbitals.
- ☐ D) sp hybridization results in a tetrahedral geometry.

Describe how molecular geometry can influence the polarity of a molecule.

Hint: Consider the arrangement of polar bonds and their effects.

Given a molecule with the formula AX3E, what is the most likely molecular geometry?

Hint: Consider the arrangement of atoms and lone pairs.

- ◯ A) Linear
- ◯ B) Trigonal Pyramidal
- ◯ C) Tetrahedral
- ◯ D) Bent

Which of the following molecules are likely to be polar based on their geometry? (Select all that apply)

Hint: Consider the symmetry and arrangement of the molecules.

- ☐ A) CO_2
- ☐ B) H_2O
- ☐ C) BF_3
- ☐ D) NH_3

Predict the molecular geometry of SF_4 and explain your reasoning.

Hint: Consider the number of bonding pairs and lone pairs around the central atom.

Part 3: Analysis, Evaluation, and Creation

Which factor is most responsible for the deviation of bond angles from their ideal values in a molecule?

Hint: Think about the forces acting on the electron pairs.

- ◯ A) Electronegativity differences
- ◯ B) Lone pair repulsion
- ◯ C) Atomic mass
- ◯ D) Molecular size

Analyze the following statements and identify which are correct regarding molecular geometry and hybridization. (Select all that apply)

Hint: Consider the relationships between hybridization and molecular shape.

- ☐ A) A molecule with sp3 hybridization and no lone pairs is always nonpolar.
- ☐ B) Lone pairs occupy more space than bonding pairs, affecting molecular shape.
- ☐ C) The geometry of a molecule can be predicted solely by its hybridization.
- ☐ D) Hybridization affects both the shape and energy of molecular orbitals.

Compare and contrast the molecular geometries of NH3 and CH4, focusing on the role of lone pairs.

Hint: Consider how lone pairs influence the shape and angles in these molecules.

Which molecule would you expect to have the greatest deviation from ideal bond angles due to lone pair repulsion?

Hint: Think about the number of lone pairs and their effects on bond angles.

- ◯ A) CH4
- ◯ B) NH3
- ◯ C) H2O
- ◯ D) CO2

Evaluate the following scenarios and determine which could lead to a change in molecular geometry. (Select all that apply)

Hint: Consider how changes in electron pairs affect molecular shape.

- [ ] A) Addition of a lone pair to a central atom
- [ ] B) Increase in temperature
- [ ] C) Change in the central atom's electronegativity
- [ ] D) Removal of a bonding pair

Design a hypothetical molecule with a new geometry not covered by traditional VSEPR theory. Describe its potential properties and applications.

Hint: Think creatively about molecular shapes and their implications.