

## Molecular Geometry Quiz Questions and Answers PDF

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**Which molecular geometry is characterized by a central atom with five bonding pairs?**

- Trigonal Bipyramidal** ✓
- Octahedral
- Square Planar
- Linear

The molecular geometry characterized by a central atom with five bonding pairs is known as trigonal bipyramidal. This arrangement allows for optimal spatial distribution of the bonding pairs around the central atom.

**What is the molecular geometry of carbon dioxide (CO<sub>2</sub>)?**

- Bent
- Trigonal Planar
- Linear** ✓
- Tetrahedral

Carbon dioxide (CO<sub>2</sub>) has a linear molecular geometry due to its two double bonds with oxygen atoms and the absence of lone pairs on the central carbon atom.

**Describe the difference between electron pair geometry and molecular geometry.**

The difference between electron pair geometry and molecular geometry is that electron pair geometry includes all electron pairs (bond and lone pairs) around the central atom, whereas molecular geometry only considers the arrangement of the bonded atoms.

In VSEPR theory, what is the effect of lone pairs on bond angles?

- Lone pairs increase bond angles
- Lone pairs have no effect on bond angles
- Lone pairs decrease bond angles ✓
- Lone pairs double bond angles

Lone pairs of electrons repel more strongly than bonding pairs, which can lead to a decrease in bond angles between the bonded atoms. This results in bond angles that are smaller than the ideal angles predicted by VSEPR theory for molecules without lone pairs.

Which of the following molecules has an octahedral geometry?

- SF<sub>6</sub> ✓
- PCl<sub>5</sub>
- XeF<sub>4</sub>
- CH<sub>4</sub>

An octahedral geometry is characterized by six bonding pairs of electrons arranged symmetrically around a central atom. Common examples include molecules like SF<sub>6</sub> (sulfur hexafluoride) and transition metal complexes such as [Co(NH<sub>3</sub>)<sub>6</sub>]<sup>3+</sup>.

Discuss how molecular geometry affects the polarity of a molecule.

The polarity of a molecule is significantly affected by its molecular geometry, as the shape determines how bond dipoles are oriented and whether they cancel each other out.

Which of the following are considered when determining molecular geometry? (Select all that apply)

- Number of bonding pairs ✓
- Number of lone pairs ✓
- Electronegativity ✓
- Atomic mass

When determining molecular geometry, factors such as the number of bonding pairs, lone pairs of electrons, and the arrangement of atoms around a central atom are considered. These elements help predict the shape of the molecule based on VSEPR theory.

#### What are the effects of lone pairs on molecular geometry? (Select all that apply)

- They increase bond angles
- They cause deviations from ideal geometry ✓
- They have no effect on geometry
- They reduce bond angles ✓

Lone pairs of electrons can affect molecular geometry by repelling bonding pairs, leading to altered bond angles and overall shape. This can result in geometries that differ from those predicted by the VSEPR theory based solely on bonding pairs.

#### Which molecules have a bent shape? (Select all that apply)

- H<sub>2</sub>O ✓
- CO<sub>2</sub>
- SO<sub>2</sub> ✓
- NH<sub>3</sub>

Bent shape molecules typically include water (H<sub>2</sub>O) and sulfur dioxide (SO<sub>2</sub>), which have lone pairs of electrons that cause the bond angles to be less than 180 degrees. Other examples include ozone (O<sub>3</sub>) and certain organics with specific geometries.

#### Which theory is primarily used to predict molecular geometry?

- Quantum Theory
- VSEPR Theory ✓
- Molecular Orbital Theory
- Kinetic Molecular Theory

The Valence Shell Electron Pair Repulsion (VSEPR) theory is used to predict the molecular geometry of molecules based on the repulsion between electron pairs around a central atom.

Which of the following shapes does water (H<sub>2</sub>O) have?

- Linear
- Bent ✓
- Trigonal Planar
- Tetrahedral

Water (H<sub>2</sub>O) has a bent or V-shaped molecular geometry due to the two hydrogen atoms being bonded to the oxygen atom at an angle of approximately 104.5 degrees.

What is the bond angle in a tetrahedral molecule?

- 90°
- 109.5° ✓
- 120°
- 180°

In a tetrahedral molecule, the bond angle is approximately 109.5 degrees. This geometry arises from the repulsion between four electron pairs around a central atom, leading to a three-dimensional arrangement.

Which of the following molecules have a linear geometry? (Select all that apply)

- CO<sub>2</sub> ✓
- HCN ✓
- H<sub>2</sub>O
- BeCl<sub>2</sub> ✓

Linear geometry is characterized by a bond angle of 180 degrees, typically seen in molecules with two bonding pairs and no lone pairs on the central atom. Common examples include carbon dioxide (CO<sub>2</sub>) and acetylene (C<sub>2</sub>H<sub>2</sub>).

Provide an example of a molecule with a seesaw geometry and explain the factors that lead to this shape.

Sulfur tetrafluoride (SF<sub>4</sub>) is an example of a molecule with a seesaw geometry, which is caused by one lone pair of electrons on the central sulfur atom that repels the bonding pairs, resulting in a distorted tetrahedral shape.

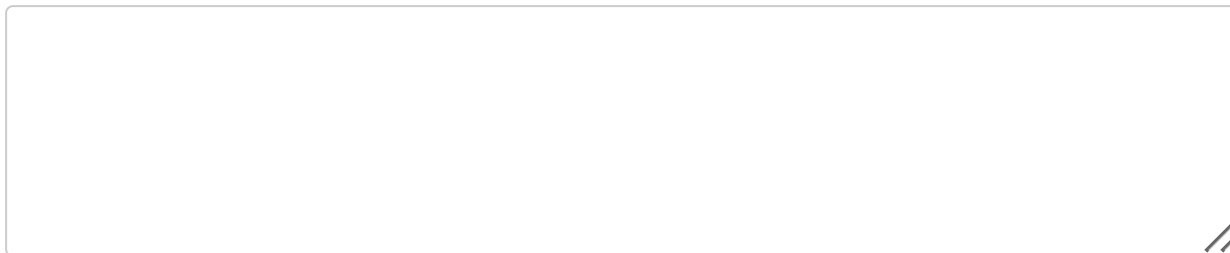
**Why do lone pairs have a greater repulsive effect on bond angles compared to bonding pairs?**

Lone pairs have a greater repulsive effect on bond angles compared to bonding pairs because they are localized around a single atom and occupy more space, resulting in increased repulsion.

**How does the presence of lone pairs influence the physical properties of a molecule, such as boiling point?**

The presence of lone pairs generally increases the boiling point of a molecule due to enhanced intermolecular forces, such as hydrogen bonding.

**Explain how VSEPR theory is used to predict the shape of a molecule.**



VSEPR (Valence Shell Electron Pair Repulsion) theory is used to predict the shape of a molecule by analyzing the number of bonding and lone pairs of electrons around the central atom, which arrange themselves in a way that minimizes repulsion, resulting in specific molecular geometries.

Which of the following molecules exhibit trigonal bipyramidal geometry? (Select all that apply)

- PCl<sub>5</sub>** ✓
- SF<sub>4</sub>** ✓
- ClF<sub>3</sub>
- XeF<sub>2</sub>

Trigonal bipyramidal geometry is typically exhibited by molecules with five bonding pairs of electrons around a central atom. Common examples include phosphorus pentachloride (PCl<sub>5</sub>) and sulfur hexafluoride (SF<sub>6</sub>).

What are the characteristics of a trigonal planar molecule? (Select all that apply)

- 120° bond angles** ✓
- Three bonding pairs** ✓
- One lone pair
- Flat shape** ✓

Trigonal planar molecules have a central atom bonded to three other atoms, with bond angles of approximately 120 degrees. They exhibit a flat, triangular shape due to the arrangement of electron pairs around the central atom.

Which of the following molecules has a trigonal pyramidal shape?

- BF<sub>3</sub>
- NH<sub>3</sub>** ✓
- CH<sub>4</sub>
- H<sub>2</sub>O

A molecule with a trigonal pyramidal shape has a central atom bonded to three other atoms and one lone pair of electrons, resulting in a three-dimensional structure that resembles a pyramid. An example of such a molecule is ammonia ( $\text{NH}_3$ ).