

Name

**Exploring Valence Bond Theory**

Total questions: 15

Worksheet time: 8mins

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Class

Date

1. What is Valence Bond Theory?

- a) Valence Bond Theory is a method for predicting molecular shapes based on atomic sizes.
- b) Valence Bond Theory explains the behavior of ionic bonds through electron transfer.
- c) Valence Bond Theory focuses on the repulsion between electrons in a molecule.
- d) Valence Bond Theory describes the formation of covalent bonds through the overlap of atomic orbitals and the pairing of electrons.

2. How does the H<sub>2</sub> molecule form according to Valence Bond Theory?

- a) The H<sub>2</sub> molecule forms through the fusion of hydrogen nuclei.
- b) The H<sub>2</sub> molecule forms when hydrogen atoms lose their electrons completely.
- c) The H<sub>2</sub> molecule forms through the overlap of 1s orbitals from two hydrogen atoms, allowing their electrons to pair and create a covalent bond.
- d) The H<sub>2</sub> molecule is created by the reaction of hydrogen gas with oxygen.

3. What type of bond is formed in the HF molecule?

- a) Hydrogen bond
- b) Ionic bond
- c) Polar covalent bond
- d) Metallic bond

4. Describe the formation of the F<sub>2</sub> molecule using Valence Bond Theory.
- a) The F<sub>2</sub> molecule forms when fluorine atoms share three pairs of electrons.
  - b) The F<sub>2</sub> molecule is formed by the overlap of two 3s orbitals from each fluorine atom.
  - c) The F<sub>2</sub> molecule is created through ionic bonding between fluorine atoms.
  - d) The F<sub>2</sub> molecule is formed by the overlap of two 2p orbitals from each fluorine atom, creating a sigma bond through the sharing of one pair of electrons.
5. What are sigma bonds and how do they differ from pi bonds?
- a) Sigma bonds are formed by side-to-side overlap of orbitals, while pi bonds are formed by head-on overlap.
  - b) Sigma bonds are stronger and formed by head-on overlap of orbitals, while pi bonds are weaker and formed by side-to-side overlap.
  - c) Sigma bonds can exist without pi bonds, but pi bonds cannot exist without sigma bonds.
  - d) Pi bonds are stronger and formed by head-on overlap of orbitals, while sigma bonds are weaker and formed by side-to-side overlap.
6. Explain the concept of hybridization in chemistry.
- a) Hybridization is the alignment of electrons in a magnetic field.
  - b) Hybridization refers to the formation of ionic bonds between atoms.
  - c) Hybridization is the mixing of atomic orbitals to form new hybrid orbitals for bonding.
  - d) Hybridization is the process of splitting atomic orbitals into smaller parts.
7. What is the hybridization of the central atom in the H<sub>2</sub>O molecule?
- a) sp<sup>3</sup>
  - b) sp
  - c) s
  - d) sp<sup>2</sup>
8. How does the formation of O<sub>2</sub> involve sigma and pi bonds?
- a) O<sub>2</sub> contains only one sigma bond and no pi bonds.
  - b) O<sub>2</sub> is formed by three pi bonds only.
  - c) The formation of O<sub>2</sub> involves one sigma bond and one pi bond.
  - d) The formation of O<sub>2</sub> involves two sigma bonds.

9. What is the significance of overlapping atomic orbitals in Valence Bond Theory?
- a) Overlapping atomic orbitals are irrelevant in bond formation.
  - b) Overlapping atomic orbitals only affect ionic bonds.
  - c) Overlapping atomic orbitals decrease electron density between nuclei.
  - d) Overlapping atomic orbitals enable the formation of covalent bonds by increasing electron density between nuclei.
10. List one limitation of Valence Bond Theory.
- a) It explains the behavior of ionic compounds.
  - b) It accurately predicts molecular shapes.
  - c) It provides a detailed description of electron delocalization.
  - d) It cannot explain the magnetic properties of molecules.
11. How does hybridization affect the geometry of molecules?
- a) Hybridization has no effect on molecular geometry.
  - b) Hybridization affects molecular geometry by determining the arrangement of hybrid orbitals, which influences bond angles and shapes.
  - c) Hybridization only affects the color of molecules.
  - d) Hybridization determines the mass of the molecule.
12. What hybridization occurs in methane (CH<sub>4</sub>)?
- a) sp<sup>3</sup>
  - b) sp<sup>2</sup>
  - c) sp<sup>3</sup>d
  - d) sp
13. Explain the role of lone pairs in determining molecular shape.
- a) Lone pairs affect molecular shape by repelling bonded pairs, altering bond angles and overall geometry.
  - b) Lone pairs only influence the color of molecules.
  - c) Lone pairs have no effect on molecular shape.
  - d) Lone pairs increase the number of bonds in a molecule.
14. What is the hybridization of the nitrogen atom in ammonia (NH<sub>3</sub>)?
- a) sp<sup>3</sup>d
  - b) sp<sup>2</sup>
  - c) sp
  - d) sp<sup>3</sup>

15. How does Valence Bond Theory explain the bond angles in molecules?

- a) Bond angles are explained by hybridization and electron pair repulsion.
- b) Bond angles are determined solely by molecular weight.
- c) Bond angles are explained by the number of protons in the nucleus.
- d) Bond angles are fixed and do not change with different molecules.

## Answer Keys

1. d) Valence Bond Theory describes the formation of covalent bonds through the overlap of atomic orbitals and the pairing of electrons.
2. c) The H<sub>2</sub> molecule forms through the overlap of 1s orbitals from two hydrogen atoms, allowing their electrons to pair and create a covalent bond.
3. c) Polar covalent bond
4. d) The F<sub>2</sub> molecule is formed by the overlap of two 2p orbitals from each fluorine atom, creating a sigma bond through the sharing of one pair of electrons.
5. b) Sigma bonds are stronger and formed by head-on overlap of orbitals, while pi bonds are weaker and formed by side-to-side overlap.
6. c) Hybridization is the mixing of atomic orbitals to form new hybrid orbitals for bonding.
7. a) sp<sup>3</sup>
8. c) The formation of O<sub>2</sub> involves one sigma bond and one pi bond.
9. d) Overlapping atomic orbitals enable the formation of covalent bonds by increasing electron density between nuclei.
10. d) It cannot explain the magnetic properties of molecules.
11. b) Hybridization affects molecular geometry by determining the arrangement of hybrid orbitals, which influences bond angles and shapes.
12. a) sp<sup>3</sup>
13. a) Lone pairs affect molecular shape by repelling bonded pairs, altering bond angles and overall geometry.
14. d) sp<sup>3</sup>
15. a) Bond angles are explained by hybridization and electron pair repulsion.

