**Activity Oriented Lesson Plan 5 C**

1. **Preliminary Details**

Name of the Teacher : Shanavas K.E Standard: XI Science

Name of the Institution : JHSS Thandekkad Time: 45 minutes

Subject : Chemistry

Unit : IV

Chapter : Chemical bonding and Molecular structure

Topic : Directional properties of Bonds, overlapping of atomic orbitals and

valence bond theory.

1. **Types of Knowledge**

i) **Factual Knowledge**

Terms: Overlapping of Atomic orbitals, positive overlap, negative overlap, zero overlap, sigma and pi bond, s-s overlapping, s-p and p-p overlapping, valence bond theory (VBT)

Facts: The covalent bond is formed by overlapping of atomic orbitals.

ii) **Conceptual knowledge**

Concepts: valence bond theory (VBT), positive, negative and zero overlap, sigma and pi bond, s-s, s-p and p-p overlapping

Definitions:

1. VBT used to explain bonding and structure of the molecule. Covalent bond is formed by overlapping of half-filled atomic orbitals

1. The wave functions in the same directions and orientations is called Positive overlap.
2. The different phase overlapping is knowns as Negative overlap.
3. The different orbitals are out of phase due to different orientation and not help in the formation of the bond is known as Zero overlap.
4. When two half-filled atomic orbitals overlap along the internuclear axis, the bond formed is known as Sigma bond.
5. When two half-filled atomic orbitals overlap perpendicular to internuclear axis, the bond formed is known as Pi bond.
6. The mutual overlap of half-filled S orbitals of two atoms is known as s-s overlapping.
7. When half-filled S orbital of one atom overlap with half-filled P orbital of another atom to from s-p overlapping.
8. When two half-filled p orbitals overlap to form p-p overlapping.

iii) **Procedural Knowledge:**

1. positive, negative and zero overlap

**Steps**

a) Give the shape of p orbitals namely Px, Py, Pz

1. Mixing of Pz-Pz in same or different directions and orientations.
2. s-s, s-p and p-p overlapping.

**Steps**

1. Write half-filled atomic orbital of S and P orbitals
2. Draw the overlapping of s-s, s-p, p-p orbitals

**iv)Meta cognitive Knowledge**

The student can acquire the awareness of knowledge, thinking and learning strategies in valence bond Theory (VBT), positive, negative and zero overlap, s-s, s-p and p-p overlapping, sigma and pi bonds.

**III Instructional objectives and learning out comes**

Defines, describes, explains, draws, differentiating, solve, analyzing, predict and create the above-mentioned facts and concepts

**IV) Previous knowledge**

The students have the knowledge about the shape of s, p and d orbitals.

1. **Learning Aids**
2. Chart showing definitions of positive, negative and zero overlap, s-s, s-p and p-p overlapping, sigma and pi bonds
3. Structures of above-mentioned facts and concepts in the chart

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| **Constructivisit Learning Design** | |
| **Activity**  **Phase I Situation**  Showing the pictures of Hydrogen atoms. (Puzzling problems).  Picture 1 separate atoms of H  Chemical Bonds  Picture 2 Approaching H atoms  Simulations & Videos for Lesson 4.4: Energy Levels, Electrons, and Covalent  Bonding - American Chemical Society  Picture 3 (Bonded atoms  Chemical Bonds  9.4: Covalent Bonding and Orbital Overlap - Chemistry LibreTexts  **Phase II grouping**  Who proposed valence bond theory (VBT)  The students are grouped into 3. The first group is Heitler, second group is London and the third group is Pauling.  What happens when atoms should come very close with same orientations.  **Phase III Bridging**  What is VBT?  How covalent bond formed by atoms?  What is orbital overlap concept and valence bond theory?  **Phase IV questions**  What are the directional properties of covalent bond?  What is positive overlap or in phase overlap?  Wave functions in the same directions and orientations.  Can you draw positive overlap using Pz orbitals?  What is Negative overlapping or out of phase overlap?  What is zero overlapping?  What is sigma (σ) and pi (п) bond in overlapping of orbitals?  What is internuclear axis?  Give an example?  Give the definition of pi (п) bond?  Which bond sigma or pi is strong. Give the reason.  What are the types of overlapping?  What is s-s overlapping? Gove an example?  What type of bond present in s-s overlapping? sigma or pi bond?  What is s-p overlapping. Gives an example.  What is p-p overlapping? Give an example. Which type of bond present in Pz overlapping?  **Phase V exhibit**  Assign group activities  Identify the positive, negative and zero overlap formed when   1. Mixing Pz with S orbitals 2. Mixing Px with S orbital 3. Mixing Px with Px orbitals 4. Mixing Py orbitals with Py orbitals. 5. Mixing Px orbitals with Py orbitals.   Each group is asked to analyses the orientation of electron cloud with respect to the internuclear axis and the strength of bonds formed.  **Phase VI reflections**  The different types of orbitals overlapping leading to the formation of sigma and pi bonds.  The bond present in s-s and pz-pz overlapping  The bond present in Px-S overlap, Px-Px overlap, Py-Py overlap and Pz-s overlap  **Follow up activities**   * Distinguish between sigma and pi bonds? * Cite more examples of positive, negative and zero overlap of s and p orbitals. | **Student response with Assessment**  No interactions between H atoms  Interaction begins  A bond if formed. H2 molecule is formed. Overlapping of orbitals of H atoms.  Greater the overlapping, the stronger is the bond formed.  Overlapping of orbitals results in pairing of electrons. The extent of overlap decides the strength of covalent bond.  Heitler, London and Pauling in 1927.  Covalent bond is formed by overlapping of half-filled orbitals.  Valence bond theory  Only half-filled orbitals with electrons of opposite spin overlap.    **3.1: Electron Configurations - Chemistry LibreTexts +** 3.1: Electron Configurations - Chemistry LibreTexts **→** Electronic Structure of Atoms (Electron Configurations) (3.4) – Chemistry  110  Overlapping of atomic orbitals results in decrease of energy and formation of covalent bond.  Each group in discussion and present the concepts in the chart.  Heitler groups present their views.   * Pauling and Slater used VBT to explain bonding and structure of molecule. * Strength of covalent bond and overlapping of atomic orbitals. * Orbitals having some energy participate in overlapping * Direction of overlapping = direction of bond (shape of the molecule)   The same phase overlapping is known as positive overlapping.  Explain overlapping of atomic orbitals with diagram.  The different phase overlapping is known as Negative overlapping. The same orbitals Pz same orientation, and different phase. Hence negative overlapping.  Explain overlapping of atomic orbitals with diagram.  The different orbitals are out of phase due to different orientation direction of approach. This overlapping not help in the formation of bonds. Hence zero overlapping.  How zero overlapping is formed , draw diagrams and give examples NO LINKS -  Chemistry - Chemical Bonding and Molecular Structure - 13100797 |  Meritnation.com  Sigma (σ) bond is Head on overlap or Axial overlap  When two half-filled atomic orbitals overlap along the internuclear axis, the bond formed in sigma bond.  Pi (п) bond is sidewise or end to end overlapping.  The line passing through the centers of nuclei of the two atoms is called internuclear axis.  H-H bond  When two half-filled atomic orbitals overlap perpendicular to internuclear axis, the bond formed is pi bond  Sigma bond is strong due to maximum overlapping. It is single bonded atoms.  Pi bond is weak due to minimum overlapping. It contains multiple bond (double or triple bond)  s-s, s-p and p-p overlapping  The mutual overlap of half-filled s orbitals of two atoms is known as s-s overlapping H2 molecule  Sigma bond  When half-filled s orbital of one atom overlaps with half-filled p orbital of another atom to form s-p overlapping. H-F molecule  When two half-filled p orbitals overlap to form p-p overlapping. F-F molecule (sigma bond)  Each groups exhibit the charts for others.  Groups present their finding by charting s-s, s-p and p-p overlapping and prepare a comparative account of the sigma and pi bonds in their suggested activity log.   1. Positive and Negative overlap 2. Zero overlap 3. Positive and Negative overlap 4. Positive and Negative overlap 5. Zero overlap   Sigma bond.  Px-s overlap σ bond  Px-Px overlap п bond  Py-Py overlap п bond  Pz-s overlap σ bond  Groups present their findings in the charts |