**Activity Oriented Lesson Plan 4 C**

**I Preliminary Details**

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

Name of the Institution : JHSS Thandakkad Time : 45 minutes

Subject : Chemistry

Unit : IV

Chapter : Chemical bonding & molecular structure

Topic : VSEPR theory shape of molecules, 3-D molecular geometry.

**II Types of Knowledge**

**i)Factual Knowledge**

Terms: VSEPR theory, 3-D molecular geometry, shapes of molecules.

Facts:1) The pairs of electrons repel each other and affect the shape of molecule.

2)The shape of a molecule is determined by the location of the nuclei and its electrons.

3)The lone pair of electrons in a molecule occupy more space as compared to bonding pairs of electrons.

**ii) Conceptual knowledge**

Concepts: VSEPR Theory and its shapes of molecules.

Main postulates of VSEPR Theory are

1) The shape of molecule depends upon the valence shell electron pairs around central atom

2) Electron pair try to stay as far apart as possible to acquire a state of minimum energy and maximum stability

3)The repulsive interaction decreases in the order lp lp > lp b.p > bp bp

4)The presence of lone pair in addition to bond pair will result in change in the shape of the molecule.

5)Repulsive force decrease with increasing bond angle between electron pairs.

**iii)** **Procedural Knowledge**

1)Shape of Methane molecule based on VSEPR rules as has only bond pair of electrons. Same steps as in PCl5, SF6.

**Steps**

i) Identify the central atom. In methane, carbon is the central atom

ii)Count valence electrons of carbon. Carbon (2=6) 2,4. It has four valence electrons.

iii) Draw the Lewis structure of Methane.

iv)Count the total number of Bond pair of electrons in Methane. B.P of CH4 is 4.

vi)Use the bond pair of electrons to determine shape of molecule. Bond pair is 4. Hence Tetrahedral shape.

2) Shape of molecule based on VSEPR rules has bond pair and Lone pair of electrons. Eg. NH3, H2O

**Steps**

i)Identify the central atom. In ammonia, nitrogen is the central atom.

ii)Count the valence electrons of Nitrogen N(Z=7) 2,5. It has five valence electrons.

iii)Draw the Lewis structure of Ammonia.

iv)Count the bond pair and lone pair of electrons in ammonia. B.p of NH3 is 3. L.p of NH3 is 1. Total electron pair in NH3 is 4. Hence expected shape is Tetrahedral.

v)The presence of lone pair in NH3 will result in the change of shape of molecule. Hence actual shape of NH3 is pyramidal in shape.

**iv) Meta cognitive Knowledge**

i) The student can evaluate their own knowledge about factual, conceptual and procedural knowledge.

**Awareness of Knowledge**

The student can acquire the awareness of knowledge in VSEPR theory and its shape of molecules.

ii)The student can identify by themselves the steps involved in the task of above-mentioned procedural knowledge.

**Awareness of thinking**

The students can acquire the awareness of thinking in expected, predicted and actual molecule using VSEPR rules.

iii)The student can use the above mentioned factual, conceptual and procedural knowledge to learn the different types of knowledge

**Awareness of learning strategies**

The students can acquire the awareness of learning strategies in 3-D molecular geometry and shape of molecules using VSEPR theory.

**III Instructional objectives and learning outcomes**

i)Define the above-mentioned facts and concepts.

ii)Describes, summarizes, explains the main postulates of VSEPR theory.

iii)Draw the structure of CH4, NH3, H2O, PCl5, SF6

iv)Differentiating and analyzing the structure or shape of BF3, Triangular planar and NH3, Triangular pyramidal shape

v)Assess the shape of BF3, only bond pair electrons and NH3, three bond pair and one lone pair electron

vi) Predict and create the shape of different molecule if the central atom has only bond pairs and bond pairs - lone pairs.

**IV Previous knowledge**

The students have the knowledge about the valence electron, bond pair electrons, lone pair electrons and molecular formulae of compounds.

**V Learning Aids**

i)Postulates of VSEPR theory in the chart

ii)Structure or shape of CH4, NH3, H2O, PCl5, SF6 in the chart.

iii)Geometry of molecules in which the central atom has no lone pair of electrons. Photo of NCERT Text p-110 class XI Chemistry

iv)Shape of some simple molecules with central atom having one or more lone pair of electrons. Photo of NCERT Text p-111 class XI Chemistry

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Constructivist learning design** | | | | |
| **Activity**  **Phase I Situation**  Can you give the number of bond pair and lone pair of electrons in N2  Draw the Lewis structure of N2 molecule  **Phase II Grouping**  Students are grouped on the basis of VSEPR Theory.  **Phase III Bridging**  What is VSEPR Theory?  Who proposed it?  **Phase IV Question**  What are the main postulates of VSEPR Theory?  The shape of molecule depends upon the valence shell electron pairs around central atom.  Electron pair try to stay as far apart as possible to acquire a state of minimum energy and maximum stability.  The repulsive interaction decreases in the order Lp Lp > Lp Bp > Bp Bp  The presence of Lp in addition to Bp will result in change in the shape of the molecule.  Repulsive force decreases with increasing bond angle between electron pairs. | **Student response with Assessment**  Student Share their experiences  Bp = 3  Lp = 2 (one from each N atom)  Students are grouped in to 4 groups as sidwick, powell, bond pair and lone pair group.  Valence shell electron pair repulsion theory. Sidwick and powell in 1940.  VSEPR Theory explains the shape or geometry of molecule  Sidwick group hang the chart of postulates of VSEPR Theory. | | | |
| **Conceptual Knowledge**  Student identifies the VSEPR theory | | | | |
| What is the shape of BeCl2 as per VSEPR Theory?  How many bond pair and lone pair on the central atom, Be | | BeCl2 Lewis Structure, Molecular Geometry, Hybridization, Polarity, and MO  Diagram - Techiescientist  The shape is Linear. Bond angle is 180.  Bp = 2 Lp = 0 (on the central Be atom | | |
| **Factual Knowledge**  Student list the bond pair and lone pair electrons. Facts 1, 2 and 3 | | | | |
| Can you predict the shape of molecule, if the central atom has only bond pair?  What is the shape of molecule   1. if the Bp is 3 2. if the Bp is 4 3. if the Bp is 5 4. if the Bp is 6   Can you explain the shape of methane, CH4?  What is the central atom in methane?  What is the valence electron of carbon?  **Phase V Exhibit**  What is the structure of Methane?  How many bond pairs and lone pairs in Methane?  Is this structure being correct?  How methane molecule would prefer in 3 D dimensional space. Explain?  What is the bond angle of Methane?  The bond angle of methane is not 90. But it is 109.28l or 109.5  that is 28l = =0.467 | | | Yes  Triangular planar. Bond angle is 120°  Tetrahedral. The bond angle is 109° 28  Triagonal bipyramidal. The bond angle is 90°, 120°  Octahedral. The bond angle is 90°  Yes  Carbon  C (Z= 6) 2,4  Four valence electrons  Students group exhibit the structure of CH4 for others.    Draw the Lewis structure for CH4 and state its molecular ...  No, it is two-dimensional structure of Methane.  VSEPR postulates 2: Electron pair try to stay apart as possible. The shape of CH4 molecule is Tetrahedral  Chart showing structure of methane      All C-H bond angles are 109.5 | |
| **Procedural knowledge**  Student develop the shape of CH4 | | | | |
| How many Bp and Lp in NH3?  What is the structure or shape and bond angle of Ammonia?  Is NH3 is Triangular planar in shape?  Is BF3 is Triangular planar in shape?  **Phase VI Reflections**  What is the central atom in PCl5 and SF6 and howmany valence electrons?  Could you explain using VSEPR theory and predict the shape of PCl5 and SF6  What is the bond angle in PCl5  PCl5 is more reactive. Why?  In PCl5 axial bonds is longer than equatorial bonds?  What is the shape and bond angle in SF6 | | | 3 BP, 1 Lp out of four electron pairs, 4 EP  Triangular pyramidal shape due to presence of one lone pair. Bond angle of NH3 is 107  No, but N-H bonds are not in one plane due to one lone pair.  Yes, 3 B-F bonds are in same plane.  In PCl5, P is the central atom and has 5 valence electrons.  In SF6, S is the central atom and has 6 valence electrons.  The student group predict the shape of PCl5 and SF6 in the chart.  PCl5 Hybridization - Trigonal Bipyramidal With sp3d Hybridization On BYJU�S  In PCl5, 5 P-Cl bonds acquire Triagonal bipyramidal shape.  3 P-Cl bonds are same plane making bond angle 120 are equatorial bonds.  2 P-Cl bonds making bond angle 90 are axial bonds.  In PCl5, axial bond pairs suffer more repulsion. Hence longer bonds and make PCl5 more reactive.  Octahedral shape. Bond angle in SF6 is 90    Explain VSEPR theory. Applying this theory to predict the shapes of F7 and  SF6. - Sarthaks eConnect | Largest Online Education Community | |
| **Meta cognitive Knowledge**  The students acquire the awareness of knowledge, thinking and learning strategies in postulates of VSEPR theory and the shape or geometry of molecules. | | | | |
| **Follow up activities**  Problem related to dipole moment  Postulates of VSEPR theory  Fajan’s rules | | | | | Work sheet based on dipole moment.  Activity log and Portfolio.  Chart of Postulates of VSEPR theory  Chart of Fajan’s rules |