**ACTIVITY ORIENTED LESSON PLAN - 6**

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| **I 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 & Molecular Structure Topic : Hybridisation |

**II Types of Knowledge**

(i) **Factual Knowledge: Terms:** sp3, sp2, sp, sp3d, sp3d2Hybridisation. Facts:

(1) Pauling introduced the concept of Hybridisation.

(2) The orbitals present in the valence shell of the half-filled atom are hybridised and have almost equal energy.

(3) In some cases, even filled orbits of valence shell take part in hybridisation.

**(ii) Conceptual Knowledge:**

**Concepts:** Hybridisation, Salient features of Hybridisation sp3, sp2, sp, sp3d, sp3d2 hybridisation. **Definitions**:

(1) Hybridisation is defined as intermixing of pure atomic orbitals of slightly different energies and shapes to form new hybrid orbitals of same energies and same shapes.

(2) One 2s and three 2p atomic orbitals intermix to form four sp3 hybrid orbitals. One 2s and two 2p orbitals to form three sp2 hybrid orbitals. One 2s and one 2p orbitals to form two sp hybrid orbitals.

**(iii) Procedural Knowledge:**

(1) sp3 Hybridisation of CH4, sp2 Hybridisation of CH2 = CH2 and sp Hybridisation of CH ≡ CH

**Steps**

1. Write the excited state of Central carbon atom.

C (z=6)1s2 2s12px1 2py12pz1 Hence there are four half-filled orbitals.

1. Draw the shape of 2s, 2px,2py and 2pz orbitals.
2. Hybridised orbitals form sigma bond.
3. Unhybridized orbitals form Pi bond.

(2) Sp3d hybridisation in PCl5 and sp3d2 hybridisation in SF6

**Steps**

1. Write P and S in excited state

P(z=15)1s22s2 2p6 3s1 3px1 3py1 3pz1 3d1 That is, Five half-filled orbitals.

S(z=16)1s2 2s2 2p6 3s1 3px1 3py1 3pz1 3d2 That is,six half-filled orbitals.

1. PCl5 have five hybridised orbitals. Triagonal bipyramidal shape. Sp3d hybridisation. Bond angle 900 and 1200.
2. SF6 have six hybridised orbitals. Octahedral shape. Bond angle 900.

**(iv) Meta Cognitive Knowledge**  The students can acquire the awareness of knowledge, thinking and learning strategies in various types of Hybridisations.

**III Instructional objectives and Learning Outcomes**

Defines, explain, draws, analyses, predict and create the different forms of hybridisation.

**IV Previous knowledge**

The students have the knowledge about the molecular formulae of organic compounds and inorganic compounds.

**V Learning aids**

Chart showing shape of sp3, sp2, sp, sp3d, and sp3d2 hybridisations.

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| **Constructivist Learning Design** | |
| Activity | Student response with Assessment |
| **Phase I Situation**  General discussion to elicit the concept of Hybridisation and its different possibilities.  What is molecular formula of Methane?  Give the shape or structure of Methane?  Is it correct or not ?  Is Methane molecule is oriented in 2- or 3-dimensional shape?  In order to explain the geometrical shape of Methane, Pauling introduced the concept of Hybridisation.  **Phase II Grouping**  Who proposed first hybridisation theory and in which year?  The students are grouped into two. The first group is Linus and second group is Pauling.  What is Hybridisation?  **Phase III Bridging**  What are salient features of Hybridisation? Assign group activities.  How many Hybrid orbitals formed when two atomic orbitals are mixed? | CH4  What is the structural formula for methane? | Socratic  It is two-dimensional shape and is incorrect.  Three-dimensional shape.    Linus Pauling in 1931  Linus group define Hybridisation in the chart.  It is intermixing of Pure atomic orbitals of slightly different energies and shapes to form new hybrid orbitals of same energies and same shapes.  Pauling group define salient features of hybridisation in the chart.  Two Hybrid orbitals same energy and same shapes. |
| **Factual Knowledge**  The students recognise the half-filled atom form Hybridised orbitals. | |
| What is the meaning of the word ‘Hybrid’ ?  What are the salient features and conditions of hybridisation?  What is the need for applying the concept of Hybridisation in the case of orbitals? | A hybrid orbital is an orbital formed by the by the combination of 2 or more atomic orbitals.  Each group discuss about the salient features of Hybridisation and present their findings in the chart.  The number of hybrid orbitals formed is equal to the number of atomic orbitals intermixed.  The hybrid orbitals have same energy and shape.  The hybrid orbitals are more effective in forming stable bonds than pure atomic orbitals. The hybrid orbitals are directed in space in some preferred direction to have stable arrangement.  Hybridisation give the geometry of the molecule. |
| **Conceptual Knowledge**  Students define the concept of hybridisation | |
| **Phase IV Questions**  What is the different type of Hybridisation?  What are the possibilities of hybridisation of s, p and d orbitals?  How to designate the hybrid orbitals?  What is the shape of s and p orbitals?  What is the shape of Hybrid orbitals?  When 2s, 2px, 2py, and 2pz atomic orbitals intermixed?    What is sp3 Hybridisation.  Give an example.  Draw the shape of methane?  How many sigma bonds in Methane?  Give another name of sp3Hybridisation and its bond angle?  Is it being 109.50.  What is Sp2 or Trigonal hybridisation with an example.  What are the atomic orbitals intermixed in Sp2 hybridisation?  What is the hybridisation in the formation of Ethane. Explain  Draw the shape of ethene ?  How many sigma and pi bonds in ethene?  What is SP or Diagonal Hybridisation? Give an example?  What are the atomic orbitals intermixing to form SP hybridisation?  Draw the shape of ethyne?  How many sigma and pi bonds in ethyne or acetylene? | sp3, sp2, sp are the main types of hybridisations.  sp3d, sp3d2, Hybridisation  All Hybrid orbitals have same energy and same shape.  Spherical, dumbbell shape  Four Hybrid orbitals formed have same shape.    Methane, CH4 molecule.  In the formation of Methane, the four sp3 hybrid orbitals of carbon atom overlap with the four 1s orbital of four hydrogen atoms located at the corner of a tetrahedron.    Four C-H sigma bonds or single bonds. Sp3 Hybridisation. The central carbon atom has one 2s, three 2p orbitals intermix to form four sp3 hybridisation. All four C-H bonds are hybridised orbitals.  Tetrahedral hybridisation.  109.28’. Yes  28 Minutes = 28/60 = 0.4670 = 50  Ethane H2C = CH2  Hybridised orbitals of 2S, 2Px and 2Py.    Non-hybridised orbital 2Pz    Sp2 Hybridisation  The sigma and pi bond in ethene as    In the formation of ethane, each carbon atom to form three Sp2 hybrid orbitals. Two hybrid orbitals of each carbon atom overlap with 1s orbital of two hydrogen atoms to form strong C-H sigma bonds. The third Sp2 hybrid orbitals of each carbon atom to form a strong C-C sigma bond. The pure PZ orbitals of each carbon atoms overlap laterally to form pi bond. The double bond in ethane is made up of one sigma bond and pi bond.  Two C-H Sigma bonds  One C-C Sigma bond  One C-C pi bond  In this type of hybridisation, only 2S and one 2P orbitals intermix to form two SP hybridised orbitals.  Acetylene H-C=C-H  The hybridised orbital are 2s and 2Px.  The Non-hybridized orbital are 2Py and 2Pz.    Two C-H sigma bonds  One C-C sigma bonds  Two C-C pi bonds |
| **Procedural Knowledge**  Students identifies the different steps in Hybridisation | |
| Write the electronic configuration of phosphorus in excited state.  Write the electronic configuration of sulphur in state.  **Phase V Exhibit**  Can you give the Hybridisation of PCl5 and exhibit it for others? | Pauling group write it on the chart P(z=15) 1s22s22p63s13px13py13pz13d1  Five half-filled orbitals.  Linus group write it on the chart  S(z=16)1s22s22p63s13px13py13pz13d2  Six half-filled orbitals  Pauling group give the hybridisation of PCl5 in the chart.  Pauling group give the hybridisation of PCl5 in the chart.  P (z =15) in excited state is    Shape Trigonal bipyramid shape bond angle 900 and 1200  Sp3d hybridisation. |
| **Procedural knowledge**  The students create Sp3d hybridisation of PCl5 in proper steps. | |
| **Phase VI Reflection**  Can you give the Hybridisation of SF6? Predict the shape and bond angle of SF6 ? | Linus group present it on the chart. S(z=16) in excited state is  Discuss the shape of: on the basis of hybridization. from Chemistry  Chemical Bonding and Molecular Structure Class 11 Haryana Board - English  Medium  Octahedral shape. Bond angle 900  Hybridization |
| **Meta cognitive knowledge** The students can acquire the awareness of knowledge, thinking and learning strategies in different forms of hybridisation. | |
| **Follow up Activities**  Explain the hybridisation in NH3 and H2O | Assign to Pauling and Linus groups.  **What is the hybridization of N atom in NH_3 ?spsp^2sp^3dsp^3**  Nitrogen has five valence electrons.  Bond angle 1070  Pyramidal shape.  Oxygen has six valence electrons.  **Hybridization of Water (H2O): Understanding the Formation, Geometry & Bond  Angles**  Sp3 hybridisation. Bond angle 104.50  V shaped. |