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| **Date**: October 7, 2025 |
| **Subject**: Chemistry |
| **Grade**: 12 |
| **Duration**: 80 Minutes |
| **Topic**: Forces of Attraction |
| **Subtopic:** Molecular Geometry and Bond angles |
| **Number of Students**: 12 [Girls: 10] [Boys: 2] |
| **General Objectives**:  *On Completion of this lesson, students will be able to*:   * Appreciate that the forces of attraction between particles influence the properties and behaviour of matter.   **Specific Objectives**:  *By the end of the lesson, students will be able to:*   1. State the principles on which the VESPR theory is based. 2. Predict the shapes of, and bond angles in simple molecules and ions using the VSEPR theory. |
| **Key Scientific Attitudes:**  Critical thinking, communication, collaboration, cooperation, open-mindedness |
| **Content**   * ***Tenets of VSEPR Theory*:**   + Electron pairs around a central atom repel each other and try to get as far apart as possible.   + The arrangement that minimizes repulsion determines the molecular geometry.   + Lone pairs repel more strongly than bonding pairs, slightly reducing bond angles. |
| **Instructional Sequence**  ***Engage:***   * **Purpose**: Capture interest and activate prior knowledge on bonding and electron pairs. * **Activity**:   Display models or drawings of different molecules (e.g., H2O, CO2, CH4, NH3).   * Ask**:**   + “Why do these molecules have different shapes even though they are all made of atoms bonded together?”   + “What determines whether a molecule is straight, bent, or tetrahedral?” * Have students brainstorm possible reasons (e.g., number of bonds, lone pairs, size of atoms). * Transition Question:   “Could the way electron pairs arrange themselves around the central atom explain molecular shape?”  ***Explore:***   * **Purpose:** Allow students to discover patterns through guided activity. * **Activity**: * Give students a set of molecular models (ball-and-stick or 3D software like MolView) for simple molecules:   BeCl2, BF3, CH4, NH3, H2O, SF6   * Have them count:   + The number of bonding pairs around the central atom.   + The number of lone pairs on the central atom. * Ask them to record observations on:   + The 3D shape observed.   + The approximate bond angles. * Guiding Questions:   + “What happens to the shape as the number of electron pairs increases?”   + “What effect do lone pairs seem to have on bond angles?”   ***Explain:***   * Purpose: Formalize understanding of the observed patterns using the VSEPR model. * ***Teacher Explanation***:   Present the three tenets of the VSEPR theory:   * + Electron pairs around the central atom repel each other and try to get as far apart as possible.   + The arrangement that minimizes repulsion determines the molecular geometry.   + Lone pairs repel more strongly than bonding pairs, slightly reducing bond angles. * **Instructional Input:**   + Explain how to use the AXnEm notation:     - A = central atom     - X = number of atoms bonded to A     - E = number of lone pairs on A   + Show examples:     - BeCl2 (AX2) → Linear → 180°     - BeF3 (AX3) → Trigonal planar → 120°     - CH4 (AX4) → Tetrahedral → 109.5°     - NH3 (AX3E) → Pyramidal → 107°     - H2O (AX2E2) → Bent → 104.5°     - SF6 (AX6) → Octahedral → 90°   ***Elaborate:***   * **Purpose**: Apply and extend understanding to predict shapes and bond angles. * **Activities**:  1. ***Worksheet Exercise***:   Students predict the shapes and bond angles for given species:   * NH4+, H3O+, CH3, SO2, PCl5, XeF4   (Encourage them to draw Lewis structures first, then determine AXnEm type.)   1. ***Challenge Discussion***:   “How would the shape change if you add or remove a lone pair?”  “Why are bond angles in H2O smaller than in NH3?”   1. ***Real-world Connection***:   Discuss how molecular shape affects polarity and properties such as solubility or boiling point (e.g., H2O vs CO2).  ***Evaluate:***   * Purpose: Assess student understanding through formative and summative checks.   Formative Assessment:   * Exit Ticket / Quick Quiz:   + State the three tenets of the VSEPR theory.   + Predict the shape and bond angle of:     - CH4     - H2O     - SF6   Summative Extension:   * Explain how VSEPR theory accounts for the difference in bond angle between CH4, NH3, and H2O.   **Evaluation 2**:  -------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------- |