9.3 Balloon Bouquet - Molecular structure

Subjects: Molecular structure, hybrid orbitals, VSEPR theory

Description: Balloons are used to illustrate the geometry of molecules with two to six valence shell electron pairs.

Materials: (Shared bin with 9.4)
6 Balloons – four of one color and two of another
String
Pin for popping
Air tap (In any lab in ISB)

Pre-Class Preparation
1. Blow up six balloons using an air tap. Do not fill too much or they will be difficult to tie together.
2. Fasten the balloons together into a bouquet of balloons (When tying off the balloons, leave extra material to use to tie two balloons together). Tie the balloons together and then use string to secure them.
3. Blow up six extra loose balloons.

Procedure:
1. Start by holding two of the loose balloons to demonstrate the molecule will naturally form linearly.
2. Continue to add balloons one at a time to show the naturally formed structures.
3. Once you have reached 6 balloons use the balloon bouquet to show when you pop one at a time the balloon structure with shift back to the natural structure.

Discussion:
Valence shell electron-pair repulsion (VSEPR) is a model used to predict the shapes of covalent molecules and polyatomic ions. This model is useful for predicting geometries of molecules with single covalent bonds around at a central atom. It is based on the idea that bonding and lone electron pairs in the valence shell of an element repel each other and want to be as far apart as possible.[1] The positions assumed by the valence shell electrons determine the bonding angles. This can be illustrated by using balloons of similar shape and size. If two to six balloons are tied together at a central point, the balloons will naturally form certain configurations:

Two balloons: Linear (Bond angle 180°)
Three balloons: Trigonal planar (Bond angle 120°)
Four balloons: Tetrahedral (Bond angle 109.5°)
Five balloons: Trigonal bipyramidal (Bond angle 120°)
Six balloons: Octahedral (Bond angle 90°)

Starting with a bouquet of six balloons with an octahedral configuration, a balloon is popped. It will rearrange to form the five-coordinate geometry. With each

successive balloon that is popped, the bouquet will rearrange to form its natural geometry.

Safety: None

Disposal: None

References:
1. J. Kotz, P. Treichel, J. Townsend. Chemistry and Chemical Reactivity; 7th Ed; Teachers Ed; Thomson Brooks/Cole; 2009; p. 368
2. Prof. Botch