Getting hands-on with molecular geometry

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2D representations of 3D objects can be confusing.
Feedback

“I found it very helpful to draw the molecules and make them into the molecular shapes because it was easier to conceptualize the angles. I think it would be a good aspect to have added to the lab portion of this class since it is an area that needs to be understood quite well in order for other concepts to make sense”

“I thought it was a very interesting and engaging way for learning about molecules. I found that something about creating and constructing them myself really helped my understanding of the configurations. I think it would be a very worthwhile lab”

“My experience with the pen was that it was slow going and unintuitive. Although by the end we were able to recreate the little machine printed ones, it took a lot of time for little reward. During the actual lab, it took most people almost the entire 3 hours to complete it, and I think without revamping the lab itself, people would run out of time trying to use the pens”
Faster fabrication
Interlocking transparent acrylic models
13 geometries in 5 colours for ~$3/kit

Complete set of laser cut acrylic pieces, color coded by number of electron domains (nED). (a) Red (2ED): linear. (b) Yellow (3ED): bent (120°), trigonal planar. (c) Green (4ED): bent (109.5°), trigonal pyramidal, tetrahedral. (d) Blue (5ED): linear, T-shaped, seesaw, trigonal bipyramidal. (e) Purple (6ED): square planar, square pyramidal, octahedral.
Effective replacements in the lab?

1. Which of the following molecular fragments, when combined (by precisely overlapping the orange atoms) with the one shown on the right would generate an octahedral structure? (Circle one)

2. Of the following three-dimensional structures, which represents a molecular geometry that is different from the others? (Circle one)
## Results

Table 5.4 Average scores, standard deviations, and improvement for pre- and post-exercise surveys

<table>
<thead>
<tr>
<th>Sample</th>
<th>Pre-Exercise</th>
<th>Post-Exercise</th>
<th>Difference between Average Pre- and Post- Score, ( \Delta \bar{x} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n_1 )</td>
<td>( \bar{x}_1 )</td>
<td>( s_1 )</td>
</tr>
<tr>
<td>Year 1</td>
<td>424</td>
<td>60.1%</td>
<td>0.9967</td>
</tr>
<tr>
<td>Year 2</td>
<td>362</td>
<td>59.0%</td>
<td>1.054</td>
</tr>
<tr>
<td>Year 3</td>
<td>522</td>
<td>50.0%</td>
<td>1.149</td>
</tr>
</tbody>
</table>
Did they think they learned a lot?

Figure 5.5 Response distribution for ‘I learned a lot about molecular shape in this laboratory class/take-home exercise’
Did they enjoy the experience?

Figure 5.6. Response distribution for ‘I enjoyed this laboratory class/take-home exercise’
Unexpected bonuses

“I found the models useful for comprehension of the different electron domain and VSEPR configurations; they were effective for learning the spatial concepts in the place of 3D images and made discussing questions much easier with peers and instructors.”

- Quote from visually impaired student in my 2017 class

Mobile made by Chem101 student from models
Acknowledgements

Natalie

Corrina