A Serendipitous Extension for Illustrating Newman Projections

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The article entitled "Illustrating Newman Projections by Using Overhead Transparencies" by Sylverman and Barbaro (*1*) was well received by our undergraduate students of organic chemistry. They were able to understand the different conformations of ethane more easily than the students in other courses. However, in the middle of the lecture about conformational structures for another group of students, the lamp of the projector broke, and we had to make a quick innovation. We distributed two transparencies about 10 cm × 10 cm, a small piece of chalk, and two thumbtacks for each student. We drew both eclipsed and staggered conformations on the board and suggested that the students prepare the corresponding models in the hope that the process of "doing for understanding" would be much more effective than the experience of the former demonstration.

As a matter of fact, this group of students understood more quickly than another that had only watched the overhead projections. In addition, we noted that the students were excited to use a hand-held Newman projection model. The success in the learning of the conformations of ethane when students manipulate individual models constructed by themselves (*1*) was for us a challenge for developing new models that make the conformations of *n*-butane more comprehensible.

With a piece of chalk, two thumbtacks, and two transparencies, each student symbolizes *n*-butane according to the following rules:

1. Represent the hydrogen atoms with a dot and the bulky methyl groups with a circle.
2. Draw the first transparency in such a way that the carbon number 2 in *n*-butane shows two bonds with hydrogens and one bond with the methyl group (carbon number 1).
3. Draw the other transparency in the classical Newman style: the two hydrogens and the methyl group (carbon number 4) attached to carbon number 3.
4. Prick the first transparency with a thumbtack through the center of the picture that represents the carbon number 2, on one end of a piece of chalk or cork (1 inch in length). Then, prick the second transparency with another thumbtack through the center of the picture that represents the carbon number 3 on the other end of the chalk or cork (Fig. 1).

At the beginning, the two transparencies should be placed in such a way that the bulky groups appear in opposite positions (Fig. 2, left). When the second transparency rotates clockwise around the σ bond that links carbon number 2 and carbon number 3, the model provides the other conformations of *n*-butane (Fig. 2, center and right). The students concluded the task with comments about the nature and action of the Van der Waals repulsion forces, reaching a coherent explanation of the energies of all the conformations of *n*-butane.

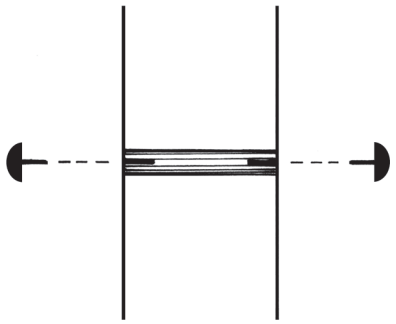

Figure 1. Lateral view of the two transparencies pricked on a little piece of chalk with the thumbtacks.

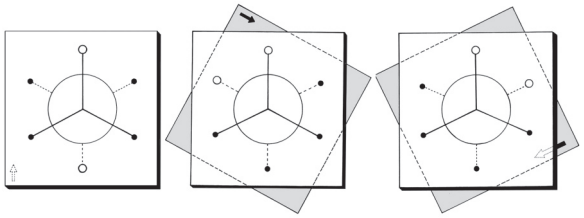

Figure 2. Different conformations of *n*-butane by rotating one of the transparencies in the model.

Acknowledgments

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Literature Cited

1. Silverman, P.; Barbaro, J. *J. Chem. Educ.* **1999,** *76*, 630.