

**The ChemWiki and Free, Open-Access, Web-based, 3-D Molecular Exercises,
Worksheets, and Problems for Lower Division College Chemistry**



<http://chemwiki.ucdavis.edu/>

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The ChemWiki is an Open Access On-line collection of over 6,000 college chemistry topic modules, which are incorporated into a customizable set of course links that follow the chapter organization of widely used conventional textbooks. Module development is collaborative. The modules are authored and revised by students and faculty, and subsequently edited and authenticated by teaching faculty. Course specific collections of modules supplement conventional paper-based books and currently support General and Organic lower division courses, plus several upper division and graduate courses. They are freely available to anyone through the Internet. Participation in the development of the modules and materials through a *freely available* account is encouraged and open to anyone who registers. The ChemWiki is part of the Dynamic Textbook Project (DTP) which consists of interconnected "STEMWikis" that focus on augmenting and connecting education in separate STEM fields (Science, Technology, Engineering, and Mathematics) .

ChemWiki	BioWiki	MathWiki	StatWiki	PhysWiki	GeoWiki	SolarWiki
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The core ChemWiki modules used respectively in each of the 2-semester courses in lower division General Chemistry and Organic Chemistry have been augmented with a variety of problems and exercises that employ visual 3-D molecular models and jmol, a free Web-based 3-D molecular viewer.

Spatial acuity and three-dimensional conceptualization are important to the understanding of chemical structure and reactivity, which are essential to a student's success in lower division college chemistry courses. These are skills that are not taught formally in K-12 classrooms, and many first and second year college chemistry students are underprepared and challenged when dealing with molecules in 3-dimensions. There are but a few digital resources specifically aimed at this issue, and none have open-access. A number are proprietary, password protected, and sold as textbook ancillaries. The commercial materials tend to be relatively expensive and have limited flexibility in adapting to individual instructor's needs and courses. Physical model kits are alternatives, but these add costs to students that some cannot afford, and many of the kits are cumbersome, difficult and time consuming to use. There is a need for digital materials, which can be easily and freely used by students and adaptable to particular course needs and work equally as well or better than physical models.

Modular exercises were developed at Diablo Valley College for each of the respective courses in the 2-semester course sequence in lower division General Chemistry and Organic Chemistry: (*Greenhouse Gas Molecules, Global Climate Change, VSEPR, Transition metal complexes, Introduction to organic molecular shapes, symmetry and chirality, molecular structures in olfaction/chemical communication, and the Diels Alder reaction*). Much of the instructional objectives, design, and development were guided, assisted, and tested by students, who are currently enrolled in Organic Chemistry II and had successfully completed all of the other courses. The exercises and materials are available in fixed form on:

<http://chemconnections.org/COT/>)

and

<http://dvcchem.org/COT/>

They are also available as open source materials through the ChemWiki where they can be revised and adapted to specific course needs.

<http://chemwiki.ucdavis.edu/xApproaches/COT>