



**UNIT TITLE:** The Dance of the Molecules: Visualization and "Real"ization of Molecular Motion

**Unit goal:** This unit explores molecular motion from both within and between molecules using a number of tools such as Chime, Excel, and PowerPoint.

**Grade Level (K-16):** college or advanced high school

**General Subject Area(s):** general chemistry

**Minimum time required for the unit:** 20-25 hours

**Concepts learned across all unit modules:** molecular motion

**Standards addressed by unit modules**

1. National Science Education Standards for content standards (9-12)
  - content standard A science as inquiry
  - content standard B in physical sciences
2. National Educational Technology Standards
  - standard 3 - technology productivity tools
  - standard 5 - technology research tools
3. Praxis II
  - chemistry content knowledge
4. Maryland High School Core Learning Goals
  - goal 1 - skills and process
  - goal 4 - chemistry

**Technology needed in unit modules** (computer software, scanners, CD-ROM's, digital video, handheld computers, etc.):

Internet, Chime, Excel, Stella, and PowerPoint 2002 for animations (could be done using a browser and having the files on CD without a live Internet connection).

Chime, available free from [MDL Information Systems](#), is molecular structure rendering software or freeware that operates in a browser (best in Netscape). You will need Chime installed as a plug-in in your browser to use this unit.

**Technology-enhanced instructional strategies employed:**

Web-based learning using Chime to enhance molecular structure visualization and Excel for data handling and graphing.

**Title of Each Module:**

Module 1 - [Discovering Intramolecular Interactions](#)

(discovering the flexibility of molecules and forces/interactions within a molecule)

Post Module 1 Assessment - [Helical Structures](#)

Module 2 - [An Introduction to Molecular Motion](#)

(animated PowerPoint 2002 introduction to the discovery of terms needed)

Module 3 - [Molecules in Motion](#)

(translational, rotational and vibrational motion)

Module 4 - [Studying Vibrations in Molecules](#)

(integrating the motion to its measurement, influence of molar mass)

Module 5 - [Molecular Vibrations and IR Spectroscopy](#)

(putting it all together via PowerPoint 2002)

**Unit Culminating Activity:**

Module 6 - [The Dance: A Culminating Assessment](#)

**Unit Author:**

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The Modules of The Dance of the molecules:

Module	Objective	Concepts
Module 1 - <a href="#">Discovering Intramolecular Interactions</a>	To discover the flexibility of molecules and the interactions with a molecule	intramolecular interactions, bond length and bond angle variation, bond rotation and geometry
Post Module 1 Assessment - <a href="#">Helical Structures</a>	To evaluation the concepts from Module 1, which are very important for biological molecules	n/a
Module 2 - <a href="#">An Introduction to Molecular Motion</a>	To discover the three modes of motion that can occur with molecules	translational, rotational, and vibration motions
Module 3 - <a href="#">Molecules in Motion</a>	To investigate the three modes of motion and the states of matter	modes of motion in gases, liquids, and solids, the effect of temperature
Module 4 - <a href="#">Studying Vibrations in Molecules</a>	To examine the behavior of molecular vibrations and the factors that influence the energy of vibrations and measure using IR spectrometer	frequency, energy, wave number, modes of vibrations, IR spectra
Module 5 - <a href="#">Molecular Vibrations and IR Spectroscopy</a>	To summarize via a series of questions posed the concepts involved with molecular motion	effect of molar mass on vibrations, spectral interpretation, plus others from above
Module 6 - <a href="#">The Dance: A Culminating Assessment</a>	To evaluate the concepts in modules 1-5	n/a

Module	Technology/Materials	Student Grouping	Estimated time	The 5E's
Module 1 - <a href="#">Discovering Intramolecular Interactions</a>	Internet with Chime, Excel, Stella, molecular model kits	small group	3-4 hours	all five
Post Module 1 Assessment - <a href="#">Helical Structures</a>	Internet with Chime, Excel, molecular model kits	individual	3-4 hours	evaluation
Module 2 - <a href="#">An Introduction to Molecular Motion</a>	PowerPoint 2002 for animations	whole class active discussion	1 hour	exploration and explanation
Module 3 - <a href="#">Molecules in Motion</a>	Internet with Chime, Excel, molecular model kits	small group	3-4 hours	all five
Module 4 - <a href="#">Studying Vibrations in Molecules</a>	Internet with Chime, Excel, molecular model kits IR Spectrometer*	small group	3-4 hours	all five
Module 5 - <a href="#">Molecular Vibrations and IR Spectroscopy</a>	PowerPoint 2002 for animations and Internet connection	whole class active discussion	1-2 hours	culminating explanation
Module 6 - <a href="#">The Dance: A Culminating Assessment</a>	Internet with Chime, molecular model kits	individual	2-3 hours	evaluation

\* if instrument is not available, students can be given spectra