3-D Molecular Designs
...where molecules become real ™

MSOE UNIVERSITY Center for BioMolecular Modeling

Linking laboratory observations and changes at the molecular level using hand-held models

3-D Molecular Designs ...where molecules become real™ | MSOE University Center for BioMolecular Modeling

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20th year teaching chemistry at MSOE:

- general chemistry
- nanotechnology
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- general, organic and biochemistry for nursing students

PhD in Inorganic Chemistry from the UW-Madison
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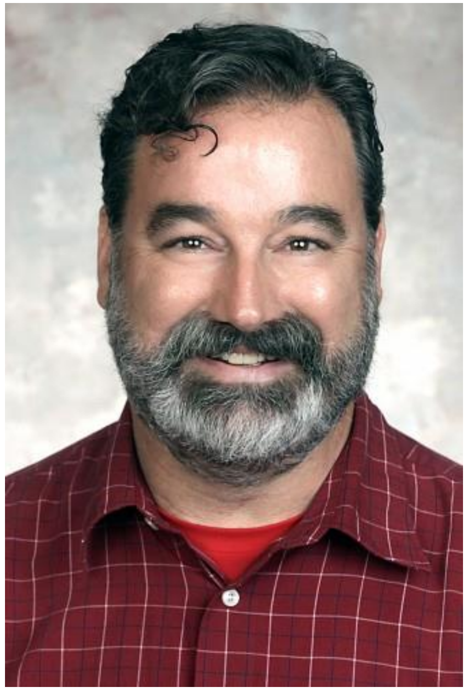

Michael Navin, PhD
Chemistry Technician and
Adjunct Faculty Member at MSOE

Workshop Learning Goals

- Guided-inquiry learning activities to use with students
- Discuss extensions of the activity to real-world applications
- Evaluate hand-held model representations for their impact on learning
- Experience activities first-hand that could be used in a virtual or in-person setting
- Discuss connections to NGSS standards such as HS-PS1-3 and MS-PS1-2

Goals for Activity

- Link observations of pure substances and mixtures to attractive forces between molecular models

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- Link observations of pure substances and mixtures to attractive forces between molecular models

Let’s Play

Current Version

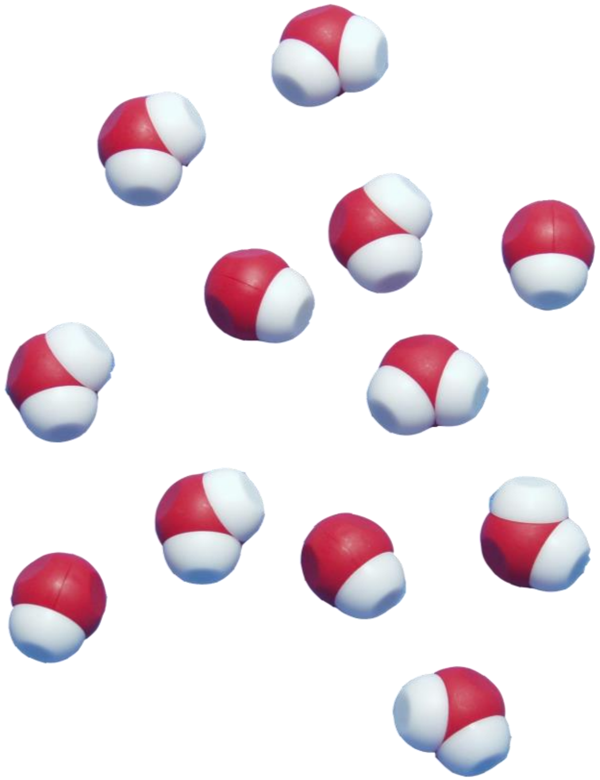
Students:
engineering
nursing
business

Duration:
30 - 40 minutes

Implementation:
class or lab

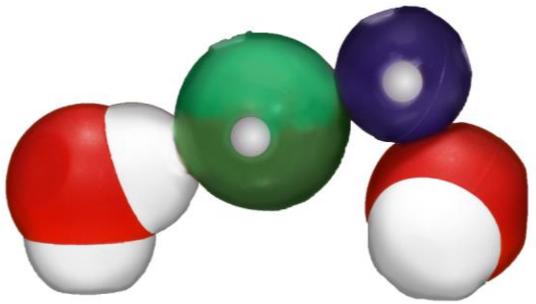
Models:
water
ethanol
ethane

Learning Outcomes (Current Version)



Learning Outcomes (Original Version)

- Compare and contrast ionic, polar and non-polar molecules
- Compare and contrast effects of hydrogen bonding on evaporation
- Compare and contrast intermolecular interactions between ionic, polar and non-polar molecules
- Evaluate small mixtures and the relevant intermolecular forces
- Identify molecules as polar or non-polar and the appropriate intermolecular forces
- Evaluate the relative strengths of ion-dipole, hydrogen bonding and ionic forces
- Relate mixtures of different solutes in water to their environmental impacts



Reflection Exercise

40 CFR, Protection of Environment

40 CFR 51.100(s)

Volatile organic compounds (VOC) means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions.

https://ecfr.federalregister.gov/current/title-40

Current Version:

- Evaporation: water and ethanol
- Pure substances: water, ethanol and ethane (models)
- Mixtures: water, ethanol, and oil (models and chemicals)

Original Version:

- Evaporation: water and ethanol
- Pure substances: water, ethanol, ethane and NaCl (models)
- Mixtures: water, ethanol, oil, salt and sugar (models and chemicals)

Original Virtual Version:

- Pure substances: water, ethanol and ethane (models)
- Mixtures: water, ethanol, oil, salt and sugar (models and chemicals)

Reflection Exercise

Based on what you have learned about intermolecular forces, specifically as they relate to solvents, describe a situation where your choice of a solvent used in a specific application has or had a positive or negative impact on the environment.

- This situation can be something from your own experience, or it can be a situation that you may encounter in the future based on your anticipated educational or career path.
- Please explain the situation in enough detail to give the reader a clear understanding why you have chosen it as relevant to this activity.
- Be sure to describe what the impact on the environment is/was, include what the intermolecular forces are relevant to your example, the physical properties of the solvent and how those properties led or will lead to the environmental impact you described.

Workshop NGSS Connections

SEPs	CCCs	DCIs
Asking questions	Cause and effect	LS1.A: Structure and function
Developing and using models	Structure and function	PS1.A: Structure and properties of matter
Constructing explanations		PS1.B: Chemical reactions

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Introduction to Intermolecular Forces

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Email me with questions:
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Folders

Instructor notes and documents

Description

Includes:
- Instructor notes: Introduction and background for the activity
-Instructor notes: Considerations for using activity with models or videos
- student activity (in-person with models)
- student activity (for virtual or in-person instruction with videos)
- post-activity reflection
- list of video links (links are embedded in student activity)
- condensed activity (used at WSST conference)

Title	Type	Ext	Date	Size	Download All
IMF Lab Activity - Introduction document.pdf	Instructor Notes	.pdf	12/14/2020	104.1 KB	Download
IMF Lab Activity - Considerations for the instructor.pdf	Instructor Notes	.pdf	12/14/2020	77.8 KB	Download
Introduction to IMF Lab Activity.pdf	Activity / Handout	.pdf	12/14/2020	187.4 KB	Download
Introduction to IMF Lab Activity - with video links.pdf	Activity / Handout	.pdf	12/14/2020	150.6 KB	Download
IMF Lab Activity - Reflection document.pdf	Activity / Handout	.pdf	12/14/2020	69 KB	Download
IMF Lab Activity - List of video links.pdf	Instructor Notes	.pdf	12/14/2020	76.2 KB	Download
Condensed IMF Activity (WSST)	Activity / Handout	.pdf	4/6/2022	101.7 KB	Download

https://engineeringunleashed.com/card/2494

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Center for BioMolecular Modeling

THANK YOU FOR ATTENDING!

Kits and models used in this session:

Purchase kits at **3dmoleculardesigns.com**.

Use discount code **STEM20** to receive 20% off most items in our catalog.

Student Modeling Packs are not eligible for discount.

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This will also enter you into a drawing for this session's prize!