

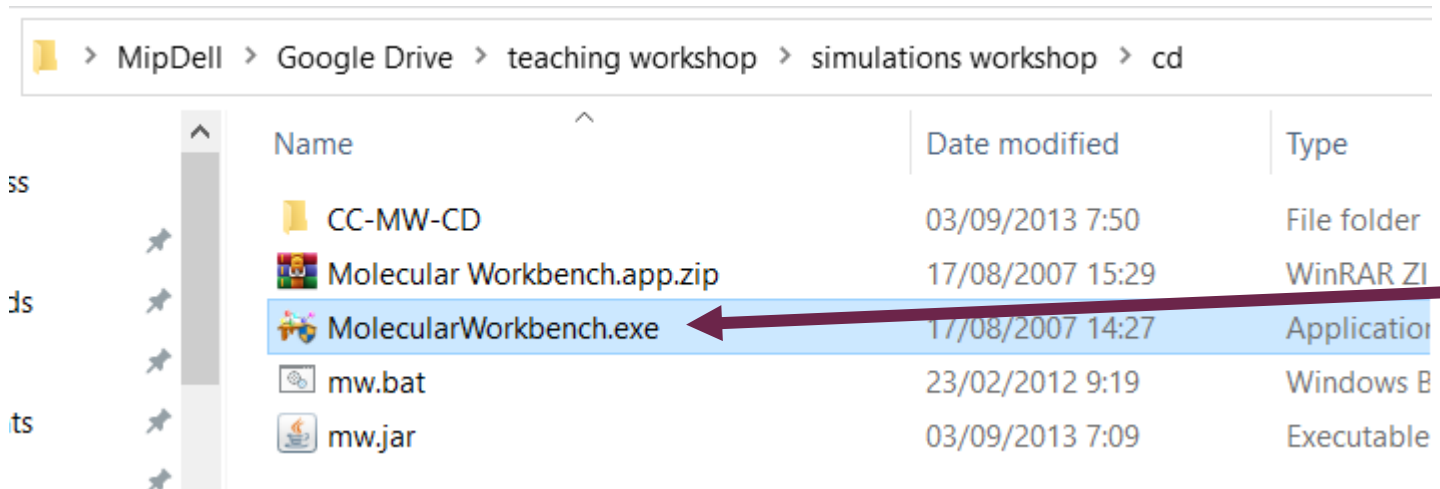


הפעלת תכנת MOLECULAR WORKBENCH



התקנה התכנה

- יש להוריד את התכנה מהלינק הבא <http://mw.concord.org/modeler/cd.zip>
- לאחר הורדת התוכנה יש לפתוח את הקובץ המכווץ באמצעות תכנה יעודית (דוגמת winrar, 7zip וכו...). לתיקיה במיקום ידוע, שם היא תשמר.
- על מנת להפעיל את התוכנה יש להכנס לתיקיה וללחוץ לחיצה כפולה על `molecularworkbench.exe`



MOLECULAR WORKBENCH – עמוד כניסה

The screenshot shows the Molecular Workbench V3.0 web interface. At the top, there is a browser window with the title "Computational Experiments for Your Science Class - Molecular Workbench V3.0 (cd.cml)". The browser's address bar shows the URL "aching workshop\simulations workshop\cd\CC-MW-CD\cd.cm". The interface features a navigation menu with "File", "Edit", "Insert", "View", "Options", "Bookmarks", "Webpace", "Window", and "Help". The main content area is divided into several sections:

- Getting Started:** Labeled "1. 2. 3." and "Getting Started".
- Library of Models:** Labeled "Library of Models".
- Activity Center:** Labeled "Activity Center".
- Demo Simulations:** A section with a list of simulation topics under two categories: "Molecular Dynamics" and "Quantum Mechanics".
- Electromagnetism:** Labeled "Electromagnetism".

Three Hebrew annotations with arrows point to the "Getting Started", "Library of Models", and "Activity Center" sections:

- הסברים על תפעול התכנה (Explanations on the software operation) points to "Getting Started".
- רשימת מודלים קיימים (List of existing models) points to "Library of Models".
- פעילויות מוכנות – מספר מודלים ברצף הבנויים על מנת לתאר עקרון מסויים (Ready-made activities – a number of models built in a row to describe a certain principle) points to "Activity Center".

The "Demo Simulations" section lists the following topics:

- Molecular Dynamics:** [Gas dynamics](#), [States of matter](#), [The collision theory of reaction](#), [Chemical equilibria](#), [Homogenous catalysis](#), [Molecular self-assembly](#), [DNA replication](#), [Translation](#), [Glycoen phosphonifase](#), [Lipid monolayer](#), [DNA hybridization](#), [Docking](#), [Crack propagation and fracture](#), [Segregating particles by shaking](#), [Osmosis](#), [Desalination: reverse osmosis](#), [Water in nanotubes](#), [Molecular planetary gears](#), [Nano conveyor belt](#).
- Quantum Mechanics:** [Quantum states and wave functions](#), [A particle in a box](#), [Quantum harmonic oscillator](#), [Double-slit electron diffraction](#), [Quantum tunneling](#), [Scanning tunneling microscopy](#).
- Electromagnetism:** [A maze game](#).

LIBRARY OF MODELS

חיפוש מודל על פי מילות מפתח לא עובד
בתכנה שאינה מחוברת לאינטרנט



חיפוש ידני בין המודלים לפי תחומי עניין.

Library of Models - Molecular Workbench V3.0 (index.cml)

File Edit Insert View Options Bookmarks WebSpace Window Help

Back Home Reload shop\simulations workshop\cd\CC-MW-CD\student\index.cml

Edit Open Save Snapshots

 **Model Library** 

Search the Library Search

(You must be online in order to use the above search functionality.)

The following categories contain *hundreds* of "raw" models we have designed primarily to demonstrate the capacity of the simulation engines and the authoring system. You are invited to explore them.

Physics:

- [Classical mechanics](#)
- [Quantum mechanics](#)
- [Mechanisms](#)
- [Waves](#)
- [Fluids](#)
- [Electromagnetism](#)
- [Gas laws](#)
- [Heat transfer](#)
- [Light and radiation](#)

Chemistry:

- [Interactions and motion](#)
- [Organic molecules](#)
- [States of matter](#)
- [Water molecules and solution](#)
- [Chemical reaction kinetics](#)
- [Electrochemistry](#)
- [Quantum chemistry](#)

Biology:

- [Molecular biology models](#)
- [Protein and DNA code](#)

Nanotechnology:

- [Nano fabrication and machinery](#)
- [Materials science](#)


Miscellaneous:

- [Seeing molecules with Jmol](#)
- [Lab techniques](#)


Technology-enhanced:

- [Molecular Rover](#)
- [Games](#)

Credit: All the models in this library, unless otherwise specified, were designed by Dr. Charles Xie.



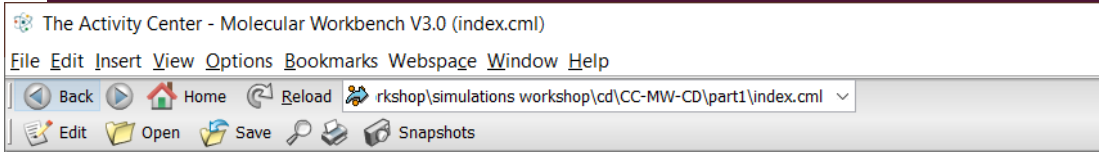
The development of this free, open-source software was funded by the National Science Foundation of the United States. Any opinions, findings, and conclusions or recommendations expressed in this material, however, are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



For help, press F1

99 XML elements read

שימוש בלומדות



Activities for the Electron Technologies Project

These activities were developed for teaching nanoscience and nanotechnology.

Concepts	Phenomena	Technology
<ul style="list-style-type: none"> ★ How electrons move ★ Quantum basics ★ Electrons in atoms and molecules 	<ul style="list-style-type: none"> ★ Semiconductors ★ Quantum tunneling ★ LEDs ★ Electrical conduction ★ Plasmas 	<ul style="list-style-type: none"> ★ Transistors ★ Scanning tunneling microscopy ★ How batteries work ★ Fluorescence activated cell sorting

Activities for the Science of Atoms and Molecules Project

These activities were developed to support teaching the science of atoms and molecules across disciplines.

○ [Introduction to modeling](#)

	Physics	Chemistry	Biology
Motion & Energy	<ul style="list-style-type: none"> ★ Atoms & energy ★ Heat & temperature 	<ul style="list-style-type: none"> ★ Phase change ★ Gas laws 	<ul style="list-style-type: none"> ★ Diffusion & active transport ★ Cellular respiration
Charge	<ul style="list-style-type: none"> ★ Electrostatics ★ Electric current 	<ul style="list-style-type: none"> ★ Intermolecular attractions ★ Molecular geometry ★ Solubility 	<ul style="list-style-type: none"> ★ Protein structure ★ Protein partnering & function
Atoms & Molecules	<ul style="list-style-type: none"> ★ Atomic structure ★ Newton's Laws 	<ul style="list-style-type: none"> ★ Chemical bonds ★ Chemical reactions 	<ul style="list-style-type: none"> ★ Intro to macromolecules ★ Lipids & carbohydrates ★ Nucleic acids & proteins ★ DNA to proteins

לחיצה על הנושא תוביל ללומדה בנושא, המורכבת מאוסף של חומר רקע, סימולציות ושאלות מנחות בנושא מסויים

Electron technologies

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Quantum Tunneling: Table of Contents

This module introduces the basic concepts of quantum tunneling. Real-world examples are given to demonstrate the importance of this effect to modern technologies.

Level: College

1. [Introduction](#)
2. [Crossing a barrier at the macroscopic scale](#)
3. [Crossing a barrier at the microscopic scale](#)
4. [Tunneling leakage in computer chips](#)
5. [Tunnel injection and release in flash memory](#)
6. [DNA sequencing](#)
7. [Summary](#)

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The Concord Consortium NSF

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דוגמא ללומדה – אפקט המנהור

Quantum Tunneling: Crossing a Barrier at the Macroscopic Scale

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Whether or not a macroscopic object can cross a barrier is a matter of energy. If it has enough energy, it will cross. Otherwise, it will not.

Let us review how macroscopic objects cross barriers with an example.

Climbing up a hill

Consider rolling a ball up a hill. Play with a simulation to the right to see if how much energy is needed to roll the ball over the hill top.

Use the slider to adjust the starting energy.



Starting energy (arbitrary unit)



Run Stop Reset

Which of the following is the minimum energy needed for the ball to go over the hill top?

- A. 4
- B. 6
- C. 8
- D. 10

Check Answer

Which of the following will make it harder for the ball to surmount the hill? (Check all that apply.)

- A. Increasing the slope of the left side.
- B. Decreasing the slope of the left side.
- C. Increasing the height of the hill.
- D. Decreasing the height of the hill.

Check Answer

Quantum Tunneling: Crossing a Barrier at the Microscopic Scale

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Because electrons are very tiny, the rules that govern balls do not apply to them. They behave differently when they encounter barriers.

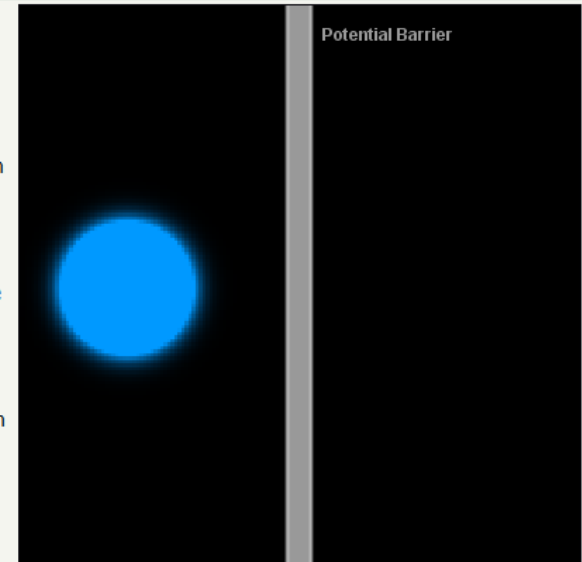
The behavior of electrons is governed by quantum mechanics. This is an entirely different world than the one you are familiar with in everyday life. To understand the world of electrons, you have to accept the following rules: ❶ The position of an electron cannot be precisely determined until it is measured. We can only say how probable it is to find an electron at a given position. ❷ The probability distribution of an electron in space can change over time like waves (scientists call this an **electron wave**).

A tunneling experiment

To the right is a simulation that shows what happens when an electron wave (the bluish haze) smashes into a barrier (the gray slab in the middle).

Instructions:

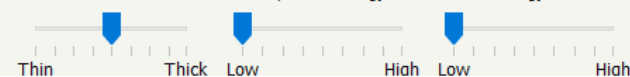
1. Click the "Run" button to start the simulation and observe what happens. To observe it again, click the "Reset" button and then the "Run" button again.
2. Click the "Reset" button. You can change the thickness or [potential energy](#) of the barrier using the corresponding sliders. Then run the simulation again.
3. Reset the simulation and adjust the "Electron energy" slider. Observe what happens.



Barrier thickness

Barrier potential energy

Electron energy



Run Stop Reset Snapshot

