

הדגמות, סימולציות, וכלי חישוב דיגיטליים

ד"ר ענבל צרפתי-ברעד

המחלקה להנדסת ביוטכנולוגיה, מרכז חוסידמן לנוער שוחר מדע.

מטעם היחידה לקידום איכות ההוראה והלמידה.

הדגמות וסימולציות

• מה?

• דרכים דיגיטליות אינטראקטיביות להמחשה של עקרונות מדעיים.

• איך? מתי?

• בזמן השיעור (פרונטלי/מקוון)

• לפני השיעור (הכנה)

• אחרי השיעור


• חומר עזר

• חלק מתרגילי בית.

• איפה?

• נדגים במהלך הסדנה. קבצי הפעלה מלאים יפורסמו באתר היחידה

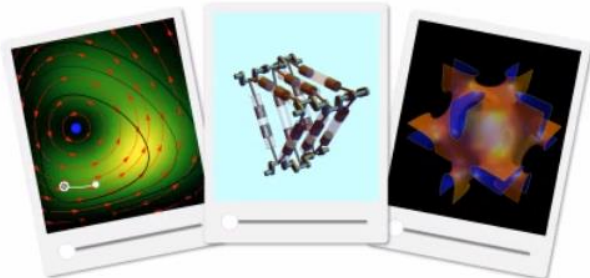
[HTTPS://DEMONSTRATIONS.WOLFRAM.COM/](https://demonstrations.wolfram.com/)

**WOLFRAM Demonstrations Project**12,000+ Open Interactive Demonstrations
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[TOPICS](#) [LATEST](#) [ABOUT](#) [PARTICIPATE](#) [AUTHORING AREA](#)













Bringing Ideas to Life

12,000+ Interactive Wolfram Notebooks for education, research, recreation and more
Selected and curated by Wolfram Research



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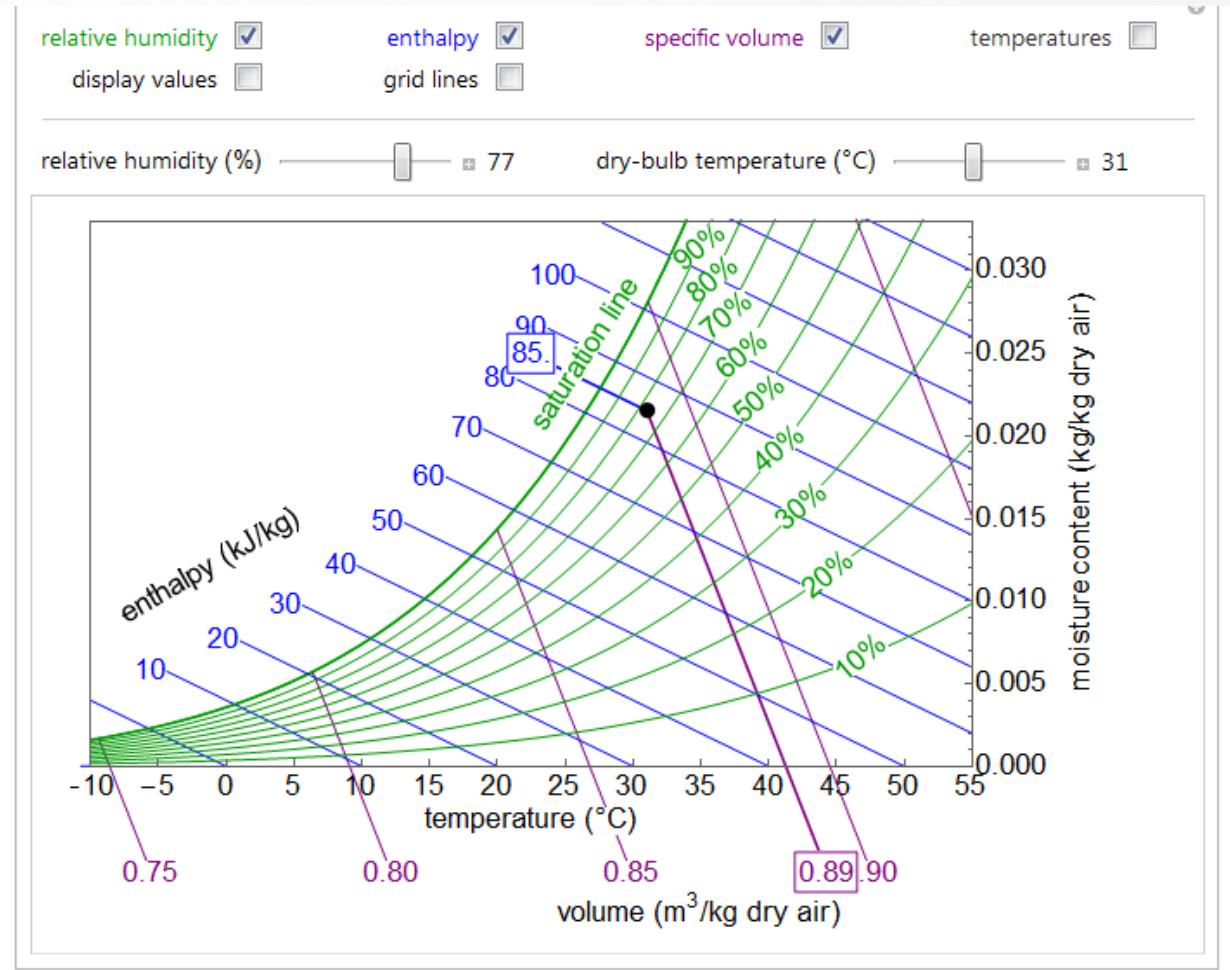
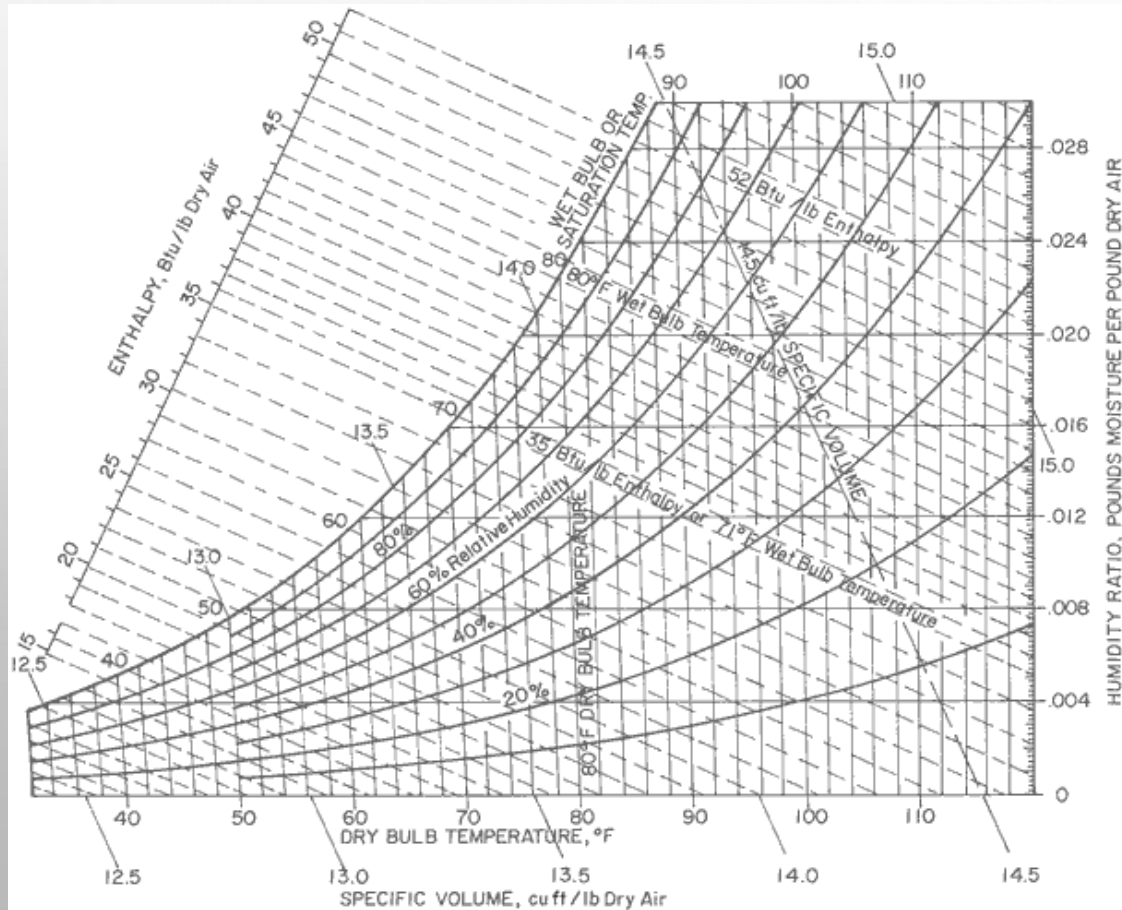
BROWSE TOPICS

| | | |
|---|--|--|
|  Mathematics Algebra Calculus & Analysis ... |  Business & Social Systems Economics Finance |  Creative Arts Art Architecture Music ... |
|  Computation Algorithms Computer Science ... |  Systems, Models & Methods Discrete Models Networks ... |  Kids & Fun For Kids Puzzles Optical Illusions |
|  Physical Sciences Physics Earth Science ... |  Engineering & Technology Machines Electrical Engineering ... |  Programming Functionality Short Programs 3D Graphics ... |
|  Life Sciences Biology ... |  Our World Everyday Life Geography ... |  US Common Core State Educational Standards |

- משאב קוד פתוח המשתמש בכלים חישוביים כדי להדגים מושגים מורכבים במגוון תחומים.

שימוש לדוגמא, הגרף הפסיכרומטרי

<https://demonstrations.wolfram.com/ReadingAPsychrometricChart/>



[HTTPS://DEMONSTRATIONS.WOLFRAM.COM/](https://demonstrations.wolfram.com/)

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|---|--|--|
| Mathematics Algebra Calculus & Analysis ... | Business & Social Systems Economics Finance | Creative Arts Art Architecture Music ... |
| Computation Algorithms Computer Science ... | Systems, Models & Methods Discrete Models Networks ... | Kids & Fun For Kids Puzzles Optical Illusions |
| Physical Sciences Physics Earth Science ... | Engineering & Technology Machines Electrical Engineering ... | Programming Functionality Short Programs 3D Graphics ... |
| Life Sciences Biology ... | Our World Everyday Life Geography ... | US Common Core State Educational Standards |

- משאב קוד פתוח המשתמש בכלים חישוביים כדי להדגים מושגים מורכבים במגוון תחומים.

- חיפוש לפי מילות מפתח

- סריקה לפי תחומי עניין

- בעלי רקע בתכנות –

- תכנות סימולציות פשוט

[HTTPS://PHET.COLORADO.EDU/](https://phet.colorado.edu/)

PhET
INTERACTIVE SIMULATIONS

University
of Colorado
Boulder

Go to the PhET home page

SIMULATIONS TEACHIN

Simulations

Browse Filter

SUBJECT

× 106 Results

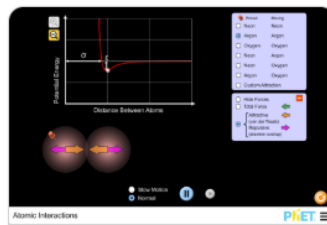
- Physics
 - Motion
 - Sound & Waves
 - Work, Energy & Power
 - Heat & Thermo
 - Quantum Phenomena
 - Light & Radiation
 - Electricity, Magnets & Circuits

Chemistry

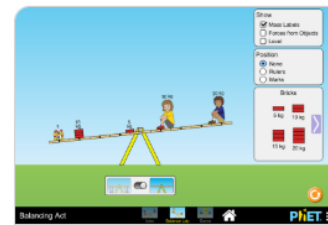
Physics ×



Alpha Decay



Atomic Interactions



Balancing Act

- סימולציות במגוון תחומי דעת
- מיועדות לחקירה עצמית
- מבוסס ג'אווה.

ניתן לסינון

- תחומי דעת
- רמות הוראה

Fourier: Making Waves (3.06)

File Options Help

Discrete Wave Game Discrete to Continuous

A_1 1.00 A_2 0.00 A_3 0.00 A_4 0.00 A_5 0.00 A_6 0.00 A_7 0.00 A_8 0.00 A_9 0.00 A_{10} 0.00 A_{11} 0.00

Amplitudes

Drag me

Harmonics

Sum

Preset Functions

Function: sine/cosine

Harmonics: 11

Function with infinite number of harmonics

Graph controls

Function of: space (x)

sin cos

Measurement Tools

Wavelength tool: λ_1

Period tool: T_1

Math Mode

Math form:

Wavelength (λ)

Expand sum...

Sound controls

Sound

Reset All

Help!

דוגמה – התמרת פורייה

מה המשמעות הויזואלית של
התמרת פוריה?

<https://phet.colorado.edu/en/simulation/legacy/fourier>



ABOUT PHET
OUR TEAM

OFFLINE ACCESS
HELP CENTER

SOURCE CODE
LICENSING

[HTTP://MW.CONCORD.ORG/MODELER/](http://mw.concord.org/modeler/)

Computational Experiments for Your Science Class - Molecular Workbench V3.0 (cd.cml)

File Edit Insert View Options Bookmarks WebSpace Window Help

Back Home Reload aching workshop\simulations workshop\cd\CC-MW-CD\cd.cm

Edit Open Save Snapshots

MOLECULAR WORKBENCH

Getting Started

Library of Models

Activity Center

Demo Simulations

Molecular Dynamics

- [Gas dynamics](#)
- [States of matter](#)
- [The collision theory of reaction](#)
- [Chemical equilibria](#)
- [Homogenous catalysis](#)
- [Molecular self-assembly](#)
- [DNA replication](#)
- [Translation](#)
- [Glycogen phosphorylase](#)
- [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](#)

הסברים על תפעול התכנה

רשימת מודלים קיימים

פעילויות מוכנות –

מספר מודלים ברצף

המשולבים על מנת

לתאר עקרון מסויים.

תוכנה ישנה

חינמית

עדיף להוריד למחשב

עבודה מקוונת תדרוש

החרגת אבטחה של ג'אווה.

מכילה לומדות

רצף נושאים מסודר.

שאלות הכוונה

בשיעורי בית – לבקש להגיש

לשאלות.

דוגמא ללומדה – אפקט המנהור

Quantum Tunneling: Crossing a Barrier at the Macroscopic Scale

< PREV NEXT >

PAGE index 1 2 3 4 5 6 7



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.

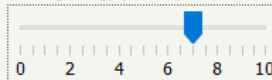
Climbing up a hill

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

< PREV NEXT >

PAGE index 1 2 3 4 5 6 7



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

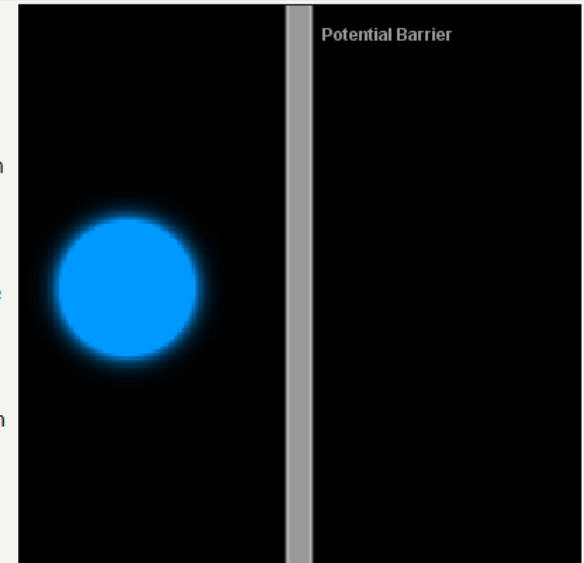
The behavior of electrons is governed by quantum mechanics. This is an entirely different world than the one you are familiar with in everyday life. To understand the world of electrons, you have to accept the following rules: ❶ The position of an electron cannot be precisely determined until it is measured. 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:

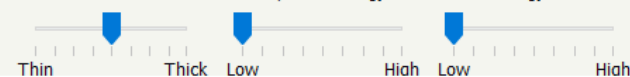
1. Click the "Run" button to start the simulation and observe what happens. To observe it again, click the "Reset" button and then the "Run" button again.
2. Click the "Reset" button. You can change the thickness or [potential energy](#) of the barrier using the corresponding sliders. Then run the simulation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

[HTTP://MW.CONCORD.ORG/NEXTGEN/](http://mw.concord.org/nextgen/)



Welcome, Anonymous

How Do Cells Make Proteins?

Explore how an mRNA copy is made of the DNA. The nucleotide binding is very specific; only complementary nucleotides will bind to each other, ensuring a correct copy.

Use the A, U, G and C buttons to place the correct RNA nucleotide with each DNA nucleotide.

Start with the first non-green pair of nucleotides. You'll be done when you reach the red nucleotides.

Click **Prepare for transcription** to separate DNA strands.

Then click on the button representing the correct complementary RNA nucleotide to proceed to the next step in the transcription process:

A U G C Reset

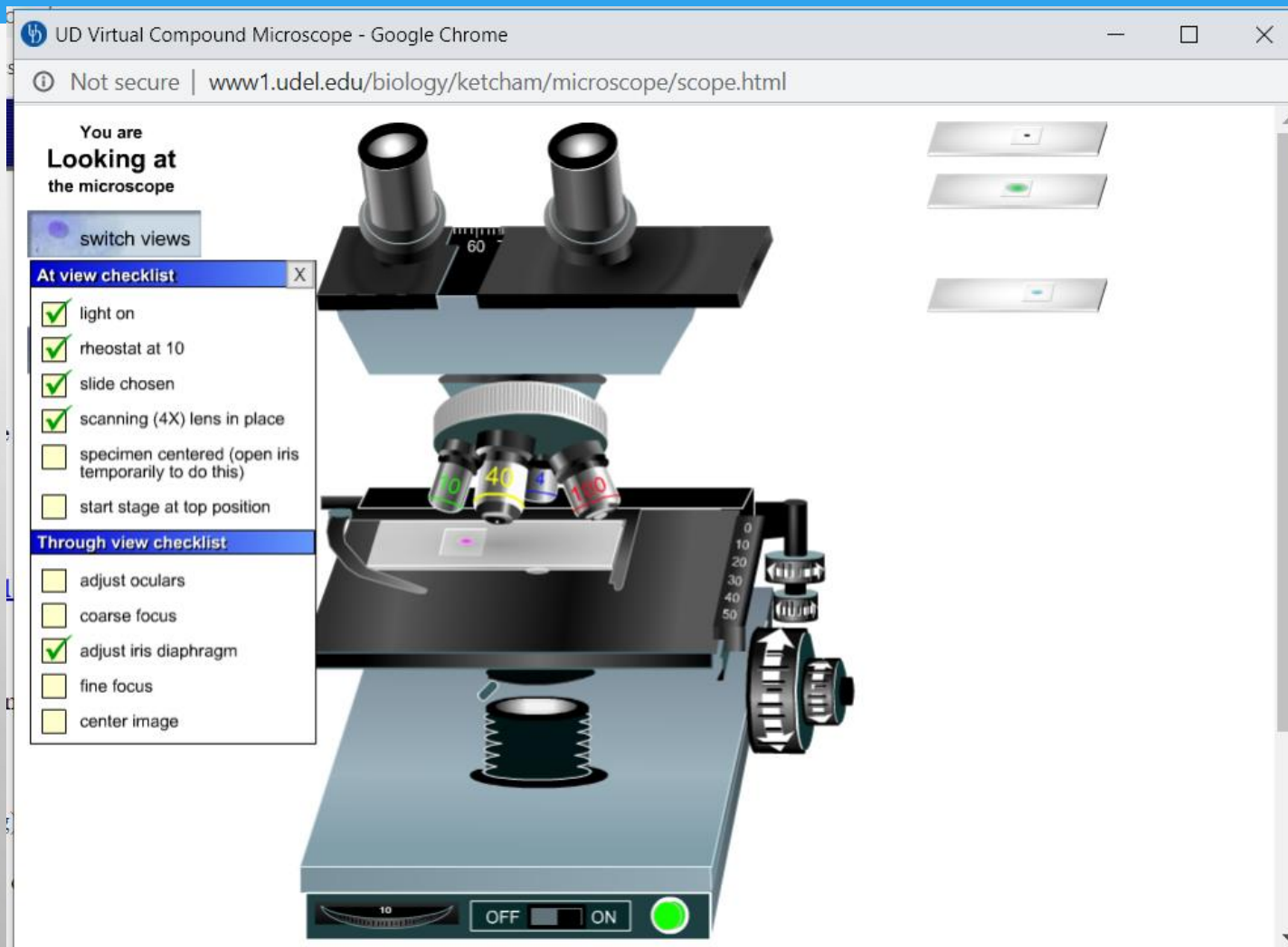
Question #1

Which RNA nucleotide binds with adenine (A) on the DNA?

thymine (T)

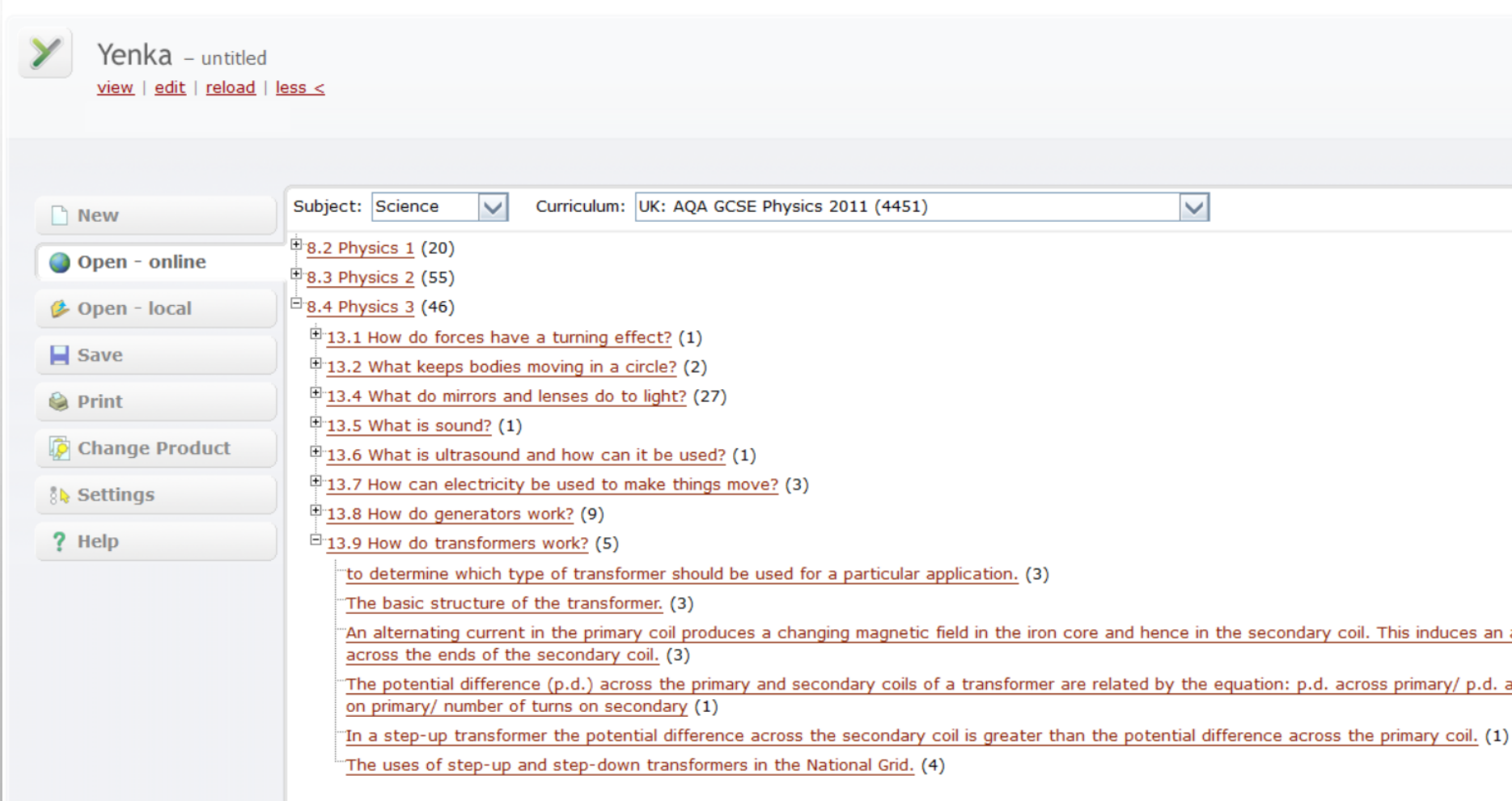
- גרסה מחודשת מקוונת לחלוטין של MOLECULAR WORKBENCH
- רק עכשיו התחילו את המעבר
- מבחר משמעותית יותר נמוך.
- שווה לעקוב אחר התפתחויות חדשות

[HTTPS://WWW1.UDEL.EDU/BIOLOGY/KETCHAM/MICROSCOPE/](https://www1.udel.edu/biology/ketcham/microscope/)



- מיקרוסקופ וירטואלי
- דוגמא לחומר עזר, למי שרוצה לתרגל את חלקי המיקרוסקופ לפני/אחרי השיעור.

[HTTPS://WWW.YENKA.COM/](https://www.yenka.com/)



Yenka – untitled
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New
Open - online
Open - local
Save
Print
Change Product
Settings
Help

Subject: Science Curriculum: UK: AQA GCSE Physics 2011 (4451)

- 8.2 Physics 1 (20)
- 8.3 Physics 2 (55)
- 8.4 Physics 3 (46)
 - 13.1 How do forces have a turning effect? (1)
 - 13.2 What keeps bodies moving in a circle? (2)
 - 13.4 What do mirrors and lenses do to light? (27)
 - 13.5 What is sound? (1)
 - 13.6 What is ultrasound and how can it be used? (1)
 - 13.7 How can electricity be used to make things move? (3)
 - 13.8 How do generators work? (9)
 - 13.9 How do transformers work? (5)
 - to determine which type of transformer should be used for a particular application. (3)
 - The basic structure of the transformer. (3)
 - An alternating current in the primary coil produces a changing magnetic field in the iron core and hence in the secondary coil. This induces an alternating e.m.f. across the ends of the secondary coil. (3)
 - The potential difference (p.d.) across the primary and secondary coils of a transformer are related by the equation: $\frac{\text{p.d. across primary}}{\text{number of turns on primary}} = \frac{\text{p.d. across secondary}}{\text{number of turns on secondary}}$ (1)
 - In a step-up transformer the potential difference across the secondary coil is greater than the potential difference across the primary coil. (1)
 - The uses of step-up and step-down transformers in the National Grid. (4)

- לשימוש בהוראה -
תכנה בתשלום
חד פעמי
- להתנסות ביתית –
ניתן להוריד גרסת נסיון
ל15 יום להתנסות

[HTTPS://VLAB.AMRITA.EDU/INDEX.PHP](https://vlab.amrita.edu/index.php)

Welcome mip mip, you are logged in as Guest

Visit Dashboard

Log out

Featured Simulation
Neuronal Model

The Hodgkin-Huxley model is a scientific model that describes how action potentials in neurons are initiated and propagated. It is a set of nonlinear ordinary differential equations that approximates the electrical characteristics of excitable cells such as neurons and cardiac myocytes.

M.TECH AND INTEGRATED M.TECH + PHD

RANKED 4TH IN INDIA

Scholarship

- Scholarships for GATE qualified and Non-GATE students
- Top 40% students eligible
- Scholarship amounts range upto Rs 1 Lakh
- International semester abroad and collaboration

Virtual Labs at Amrita Vishwa Vidyapeetham

- Biotechnology and Biomedical Engineering**
Neurophysiology, Cell biology, Immunology Lab, Microbiology, Molecular Biology, Population Ecology, Biochemistry Virtual Labs...
- Chemical Sciences**
Physical Chemistry, Organic Chemistry, Inorganic Chemistry Virtual Labs...
- Physical Sciences**
Mechanics, Thermodynamics, Optics, Electricity and Magnetism, Basic Electric Circuits, Modern Physics Virtual Labs...
- Computer Science**
Wireless Sensor Network Remote Triggered Lab
- Mechanical Engineering**
Wind energy Labs, Solar energy Labs, Mechanics of Solids Labs, Energy Storage Labs

Developed @ Amrita Vishwa Vidyapeetham

Inspiration and Guiding Light, Amma
Sri Mata Amritanandamayi Devi
Chancellor, Amrita Vishwa Vidyapeetham

- דורש הרשמה לאתר
- עבודה ב FIREFOX (לא כרום).

• גרסה "פרוצה"

[TTP://WWW.VLAB.CO.IN/](http://www.vlab.co.in/)

- לא דורשת הרשמה
- לא כל הסימולציות עובדות טוב...
- דוגמא:

[HTTPS://DS1-IIITH.VLABS.AC.IN/DATA-STRUCTURES-1/](https://ds1-iiith.vlabs.ac.in/data-structures-1/)

סימולציות בפיזיקה

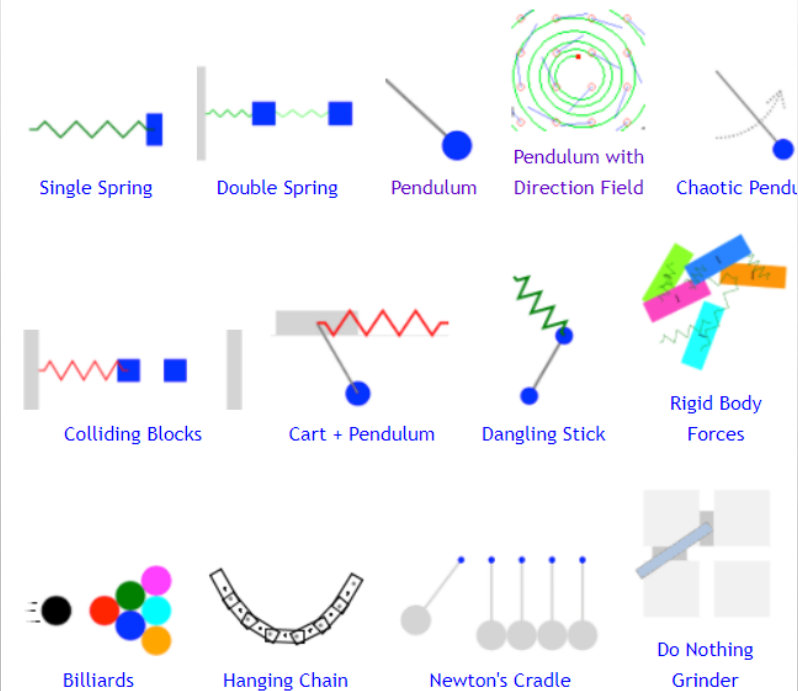
<https://www.myphysicslab.com/>,

physics.bu.edu/~duffy/HTML5/index.html

<https://ophysics.com/index.html>

Physics Simulations

Click on one of the physics simulations below... you'll see them animating with them by dragging objects or changing parameters like gravity.



Updated 6/15/2020 - 214 simulations of mine plus 4 others

Beyond physics

- [at the Statue of Liberty](#)

Climate Change

- [Vehicle emissions of carbon dioxide](#)
- [Historical energy use in USA](#)
- [USA electricity generation map, by Dan Schroeder](#)

Vector Addition

- [Vector Addition](#)
- [Vector-Addition Patterns](#)

Motion in 1 dimension

- [Motion Diagrams](#)
- [Constant Velocity vs. Constant Acceleration](#)
- [Graph matching \(position + velocity graphs\)](#)
- [1-D motion: graphs](#)
- [Constant Acceleration, Same Physics](#)
- [Landing a rocket](#)
- [Ranking task - rank by acceleration](#)
- [Galileo's ramp \(with sound\)](#)
- [Relative velocity: race on a moving sidewalk](#)

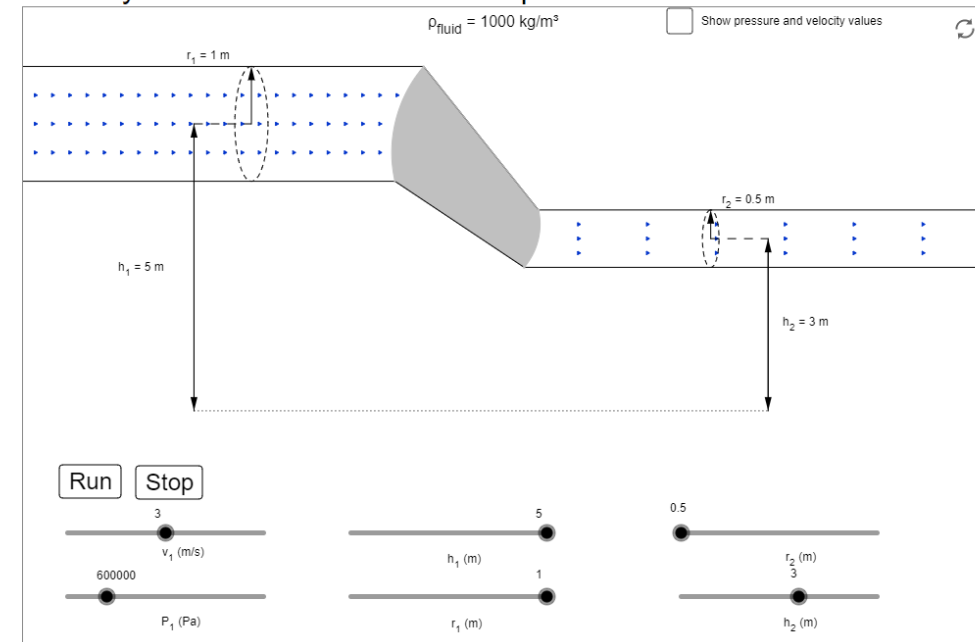
Motion in 2 dimensions

- [Race between a dropped ball and one launched horizontally](#)
- [A ballistics cart](#)
- [Projectile Motion \(set speed and angle\)](#)
- [Projectile Motion \(set initial velocity components\)](#)

oPhysics: Interactive Physics Simulations

Home Kinematics Forces Conservation Waves Light E & M Rotation **Fluids** Drawing Tools Fun Stuff

Fluid Dynamics and the Bernoulli Equation



סימולציות בביולוגיה

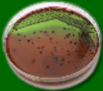
<http://virtualbiologylab.org/>



**VIRTUAL
BIOLOGY
LAB**
An Inquiry-based learning environment

Home Our People Ecology Models ▾ Evolution Models ▾ Cell Biology Models ▾

<http://learn.chm.msu.edu/vibl/content/gramstain.html>



Virtual Interactive Bacteriology Laboratory
Michigan State University

Home

Gram Stain

Streak Plate

Differential Media

Biochemical Tests

Antimicrobial Susceptibility

The Gram Stain


The gram stain is the most frequently used stain in a clinical microbiology laboratory and is usually the first step in identifying bacteria. Based on differences in cell wall components, bacteria are categorized as either gram-positive (stains dark purple) or gram-negative (stains pink). In addition to the gram reaction, the morphology and configuration of the bacteria can be observed, i.e., gram-positive coccus in chains or gram-negative rod.

- Click to open the [module](#)

- Module instructions Gram Stain



<https://learn.genetics.utah.edu/content/labs/>



Learn.Genetics
GENETIC SCIENCE LEARNING CENTER

Home / Virtual Labs

[View Teach.Genetics for Classroom Materials](#)

Virtual Labs

- 1.0 DNA EXTRACTION** [Interactive explore](#)
DNA is extracted from human cells for a variety of reasons. Try this virtual laboratory to extract DNA from human cells.
- 0.5 GEL ELECTROPHORESIS** [Interactive explore](#)
Sort and measure DNA strands by running your own gel electrophoresis experiment.
- FLOW CYTOMETRY** [Interactive explore](#)
Flow cytometry can sort and count mixtures of tiny particles. Here, you'll use this tool to get information about the cells in blood and bone marrow samples.
- PCR** [Interactive explore](#)
PCR is a relatively simple and inexpensive tool that you can use to focus in on a segment of DNA and copy it billions of times over. See how it works!
- DNA MICROARRAY** [Interactive explore](#)
Scientists are using DNA microarrays to investigate everything from cancer to pest control. Use a DNA microarray to investigate the differences between a healthy cell and a cancer cell.

סימולציות מעניינות נוספות

משחקי פלאש בביולוגיה

<https://biomanbio.com/HTML5GamesandLabs/LifeChemgames/lifechem.html>

Home Teachers Students Contact Quizzes

Life Chemistry (DNA etc.)

Living organisms perform chemical reactions all day, every day! These chemical reactions are what keep you alive! Learn about DNA, RNA, protein synthesis, and other major biological molecules like lipids, nucleic acids, and carbohydrates.

Life Chemistry Video Games, Virtual Labs & Activities

BioAgent vs. Green Zombie Toxin (Genetic Engineering 101)

As a BioAgent, your job is to defend the world from biological threats, such as Dr. Vial's latest scheme. In this game, you will discover this scheme and learn how to use genetic engineering to make recombinant plasmids and transform bacteria. If successful, you will save humanity from Green Zombie Toxin! If not, it will be the end of the world as we know it!

Enzymatic

ENZYMES are extremely important in Biology! Essentially EVERY life process relies for EVERY living thing relies on ENZYMES! So... it might be important to understand them (at least a little bit...) In this amazing interactive experience, you will learn about enzymes by playing games, performing virtual experiments, and solving puzzles! Welcome to

Biology Games & Virtual Labs!

- Body Systems (Physiology)
- Cells
- Ecology
- Evolution & Classification
- Genetics & Meiosis
- Life Chemistry (DNA, Proteins, etc.)
- Respiration & Photosynthesis
- Scientific Methods

המדריך השלם למיקרוסקופיה

<https://micro.magnet.fsu.edu/primer/index.html>

MOLECULAR EXPRESSIONS™
Optical Microscopy Primer
Introduction

Search our site: GO

BASIC CONCEPTS • DIGITAL IMAGING • VIRTUAL MICROSCOPY • PHOTO GALLERY • HOME

Italian Wooden Microscope (circa 1600s)

Introduction to Optical Microscopy, Digital Imaging, and Photomicrography

This treatise on optical microscopy is divided into several sections that are available through the links displayed immediately to the left (in the darker navigational boxes) and below. In order to print the entire microscopy primer as a paper document, you must download each link independently, send the file to your printer, and put the results together.

In the Bibliography, we have included links to other works on optical microscopy and our section on Web Resources contains links to other microscopy sites on the Internet. This material is targeted for educational purposes only, and is not available to be posted on remote websites (either commercial or educational) or distributed in any electronic format.

Frequently Asked Questions - Mortimer Abramowitz, senior microscopist at Olympus America Inc., answers the 50 most commonly asked questions about microscopy and photomicrography.

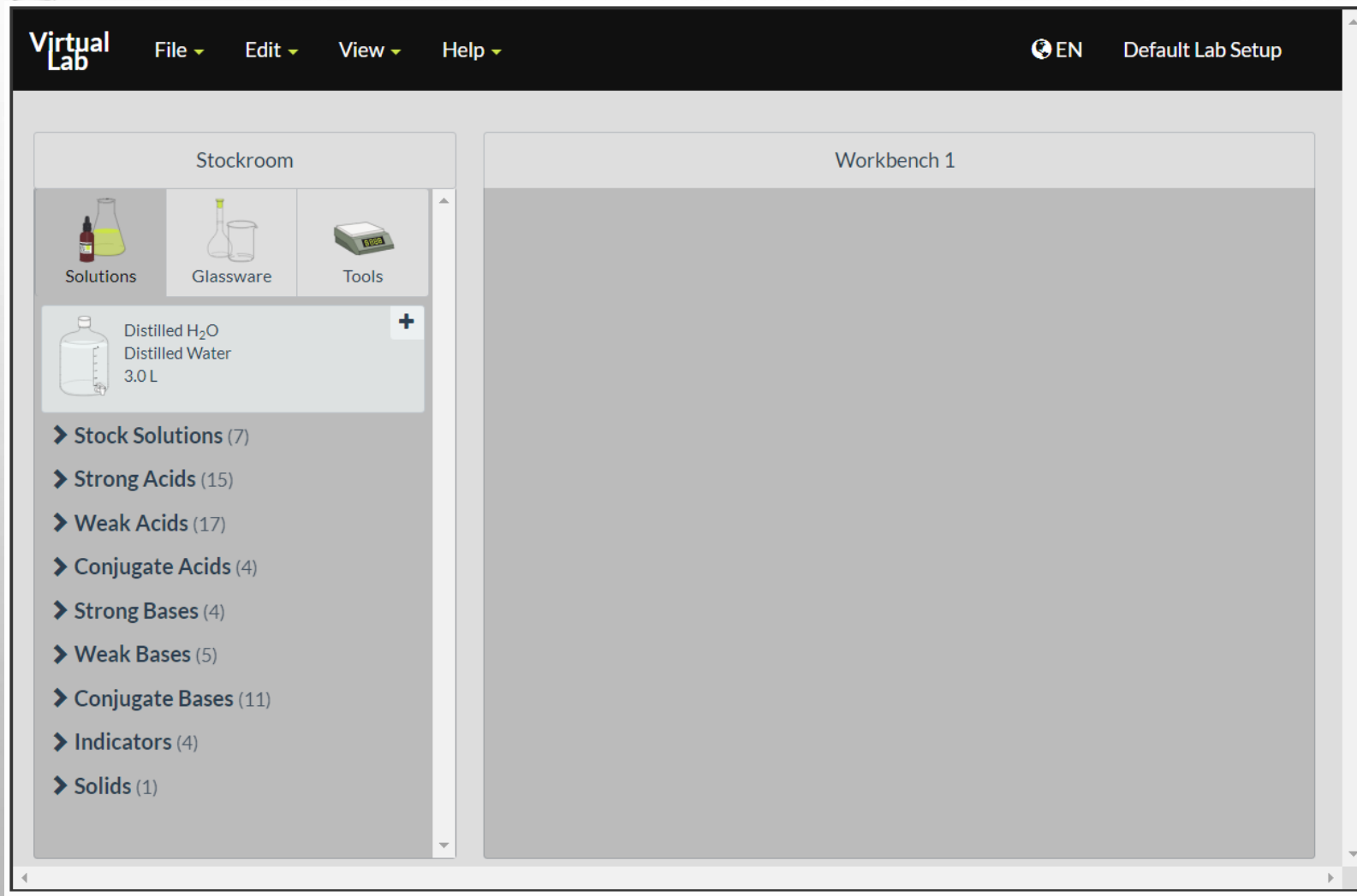
Physics of Light and Color - Visible light represents only a small portion of the entire electromagnetic spectrum of radiation that extends from high-frequency gamma rays through X-rays, ultraviolet light, infrared radiation and microwaves to very low frequency long-wavelength radio waves. The complex phenomenon of visible light is classically discussed in terms of rays and wavefronts. Starting with the nature of electromagnetic radiation, a wide variety of topics are covered in this section, including refraction, reflection, diffraction, interference, birefringence, polarization, primary colors, human vision, mirrors, prisms, beamsplitters, laser systems, geometrical optics, filtration, color temperature, and the speed of light.

Anatomy of the Microscope - A thorough discussion of the elements that comprise modern microscopes and theories behind important concepts such as magnification, image formation, objective specifications, Köhler illumination, optical aberrations, immersion media, light sources, eyepieces, condensers, and ergonomics, among others.

Microscopy Primer

- Light and Color
- Microscope Basics
- Special Techniques
- Digital Imaging
- Confocal Microscopy
- Live-Cell Imaging
- Photomicrography
- Microscopy Museum
- Virtual Microscopy
- Fluorescence
- Web Resources
- Science, Optics & You
- License Info
- Image Use
- Custom Photos
- Partners
- Site Info
- Contact Us
- Publications

[HTTP://CHEMCOLLECTIVE.ORG/VLAB/VLAB.PHP](http://chemcollective.org/vlab/vlab.php)



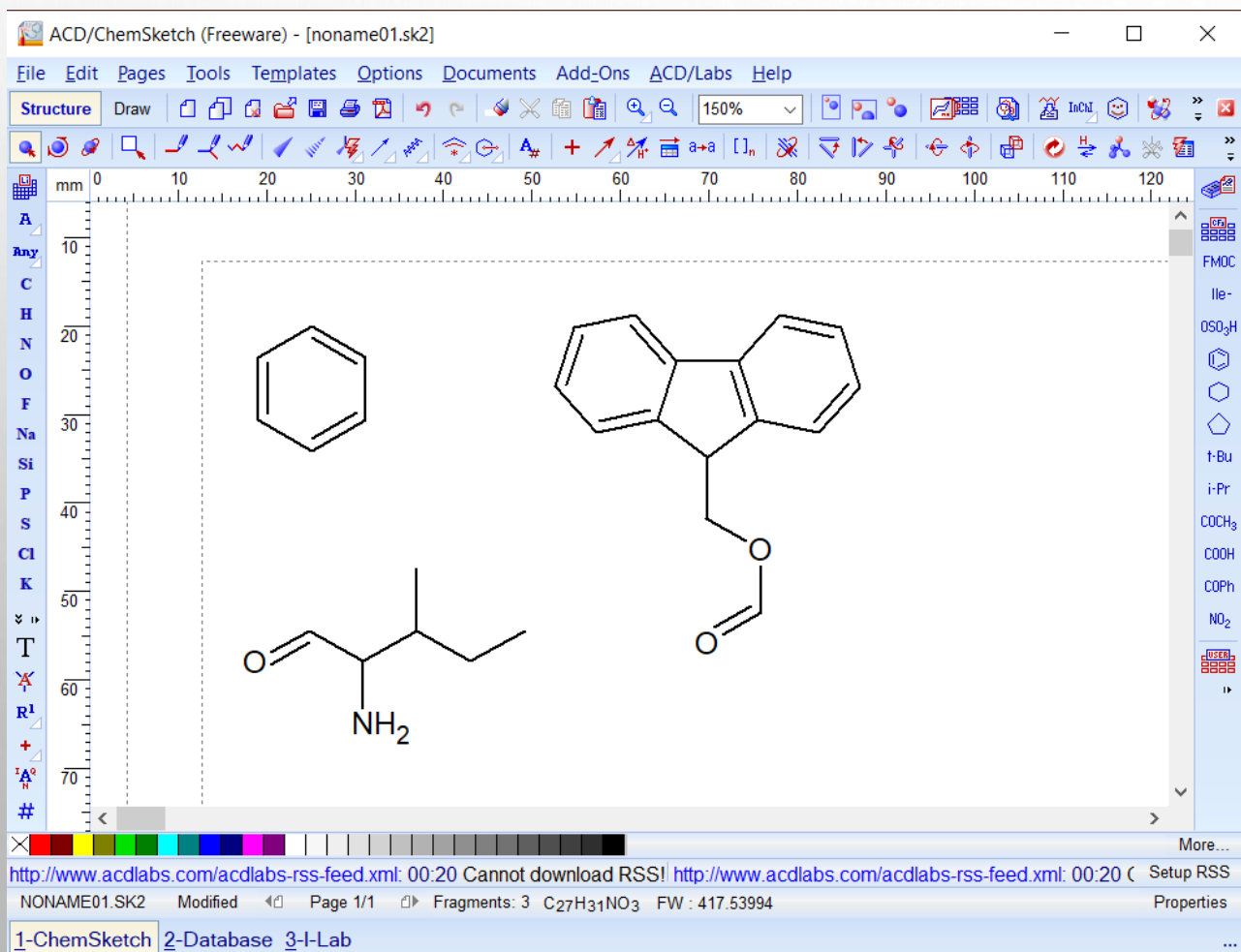
מעבדות וירטואליות בכימיה •

כלים נוספים בכימיה

Chemsketch

<https://www.acdlabs.com/resources/freeware/chemsketch/index.php>

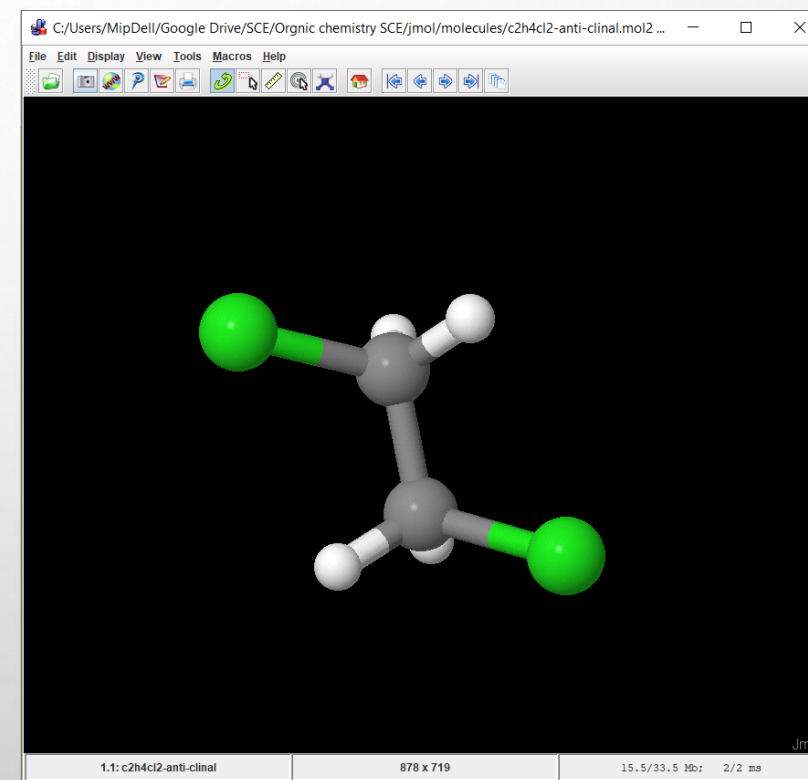
כלי חינמי לציור מולקולות ותגובות



jmol

<http://jmol.sourceforge.net/>

תכנה להצגה תלת מימדית של מולקולות



אתר המכיל מולקולות בנויות

<http://vchem3d.univ-tlse3.fr/index.html#.Xwo5iygzZPY>

ועוד שני כלים אחרונים....

[HTTPS://WWW.WOLFRAMALPHA.COM/](https://www.wolframalpha.com/)

• כלי היודע לבצע חישובים חכמים בתחומים שונים באופן אוטומטי, עוזר בבניית שאלות ותרגילים

The image shows the main interface of the WolframAlpha website. At the top, the logo features a red starburst icon followed by the text "WolframAlpha" in orange and "computational intelligence." in a smaller font. Below the logo is a large search bar with the placeholder text "Enter what you want to calculate or know about" and a search button on the right. Underneath the search bar are four navigation links: "Extended Keyboard" (with a keyboard icon), "Upload" (with an upload icon), "Examples" (with a grid icon), and "Random" (with a random icon). A central text block reads: "Compute expert-level answers using Wolfram's breakthrough algorithms, knowledgebase and AI technology". Below this, there are four main category headers: "Mathematics", "Science & Technology", "Society & Culture", and "Everyday Life". Each header is followed by a grid of sub-category buttons with icons and text: Mathematics includes "Step-by-Step Solutions", "Elementary Math", and "Algebra"; Science & Technology includes "Units & Measures", "Physics", and "Chemistry"; Society & Culture includes "People", "Arts & Media", and "Dates & Times"; and Everyday Life includes "Personal Health", "Personal Finance", and "Surprises".

WolframAlpha computational intelligence.

Enter what you want to calculate or know about

Extended Keyboard Upload Examples Random

Compute expert-level answers using Wolfram's breakthrough algorithms, knowledgebase and AI technology

Mathematics ›

- Step-by-Step Solutions
- Elementary Math
- x^2-1 Algebra

Science & Technology ›

- Units & Measures
- Physics
- Chemistry

Society & Culture ›

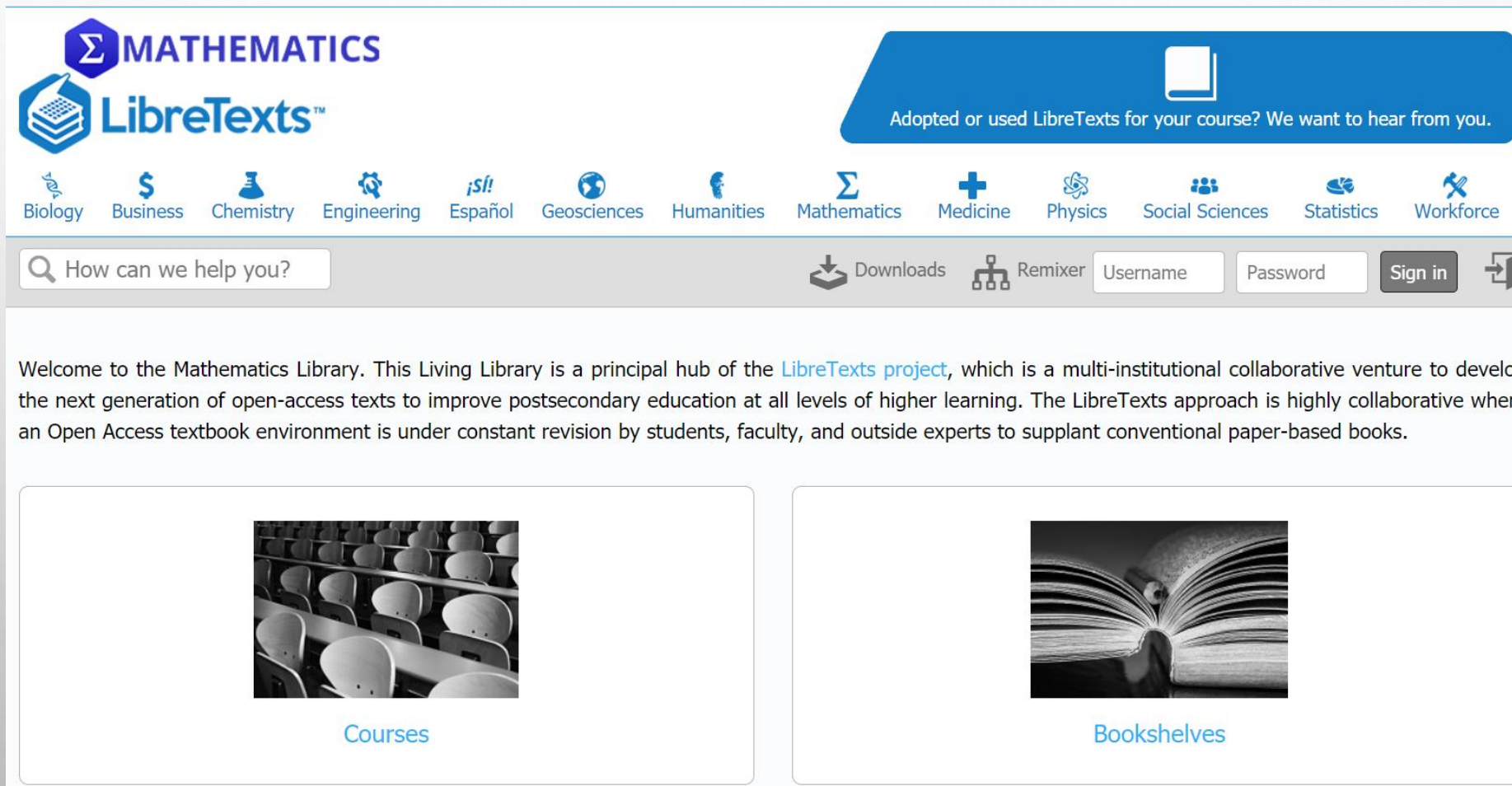
- People
- Arts & Media
- Dates & Times

Everyday Life ›

- Personal Health
- Personal Finance
- Surprises

[HTTPS://LIBRETEXTS.ORG/](https://libretexts.org/)

ספרי לימוד מלאים מקוונים, כוללים חומר תיאורטי, דפי שאלות ותשובונים



The screenshot shows the homepage of the LibreTexts Mathematics Library. At the top left is the logo for "MATHEMATICS LibreTexts™". To the right is a blue banner with a book icon and the text "Adopted or used LibreTexts for your course? We want to hear from you." Below the logo is a navigation bar with icons and labels for various subjects: Biology, Business, Chemistry, Engineering, Español, Geosciences, Humanities, Mathematics, Medicine, Physics, Social Sciences, Statistics, and Workforce. A search bar with the placeholder text "How can we help you?" is on the left, and a utility bar with "Downloads", "Remixer", "Username", "Password", "Sign in", and a home icon is on the right. The main content area features a welcome message: "Welcome to the Mathematics Library. This Living Library is a principal hub of the LibreTexts project, which is a multi-institutional collaborative venture to develop the next generation of open-access texts to improve postsecondary education at all levels of higher learning. The LibreTexts approach is highly collaborative where an Open Access textbook environment is under constant revision by students, faculty, and outside experts to supplant conventional paper-based books." Below this are two large buttons: "Courses" with an image of a lecture hall and "Bookshelves" with an image of an open book.

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[Courses](#)

[Bookshelves](#)

אשמח לענות על כל שאלה
ותודה רבה על ההקשבה!