

- **HANDS-ON WITH SIMULATION TOOLS:**

**FALSTAD CIRCUIT SIMULATOR
AND
ALGODOO**

**Dr. Uma Sharma
Consultant Academic
CIET-NCERT**

Falstad's Circuit Simulator

A circuit simulator is a great way to learn about circuits, test new designs, or troubleshoot a design prototype that has failed on the breadboard.

It offer a range of features, from simple interactive models to complex system dynamics simulations.

A collection of free online simulations for physics, math, and engineering.

<https://www.falstad.com/circuit>

This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 2 of the License, or (at your option) any later version.



See the GNU General Public License for more details.
For details of licensing see <http://www.gnu.org/licenses/>.
Source code (Paul): <https://github.com/pfalstad/circuitjs1>
Source code (Iain): <https://github.com/sharpie7/circuitjs1>

Important features

Free software

Standalone (offline) versions can be saved to your system.

More applets

Circuit - level Simulation

Full screen version is available.

It yields results in seconds!

This tool can be used to demonstrate many concepts of grade 10th and 12th like...

- Resistor in series and parallel
- Ohm's law
- AC circuits
- Logic Gates and many more.

Key Tools

1. File menu: It allows you to load or save circuit description files. You can also export a circuit description as a link so you can share a circuit with others.
2. Reset: This button resets the circuit to a reasonable state.
3. Run/Stop: This button allows you to stop the simulation.
4. Simulation Speed: This slider allows you to adjust the speed of the simulation.
5. Current Speed: This slider lets you adjust the speed of the dots, in case the currents are so weak (or strong) that the dots are moving too slowly (or too quickly).
6. Circuits menu: It can be used to view some interesting pre-defined circuits. Once a circuit is selected, you may modify it all you want.



falstad



All

Images

Videos

Shopping

News

Maps

Books

More

Tools



Paul Falstad

<https://www.falstad.com> > circuit

Circuit Simulator Applet

You can still use the original Java version. More acknowledgements in the about box.

java@falstad.com. free counters.

Falstad's CircuitJS

File, Edit, Draw, Scopes, Options, Circuits. Reset. RUN / Stop ...



Directions

... line! – the bottom two wires of a transmission line must always ...



Electronics Demonstrations

Ohm's Law - Resistors - Capacitor - NPN Transistor (Bipolar) - ...

Resistors

If there are multiple current paths, you may have resistors in ...

Ohm's Law

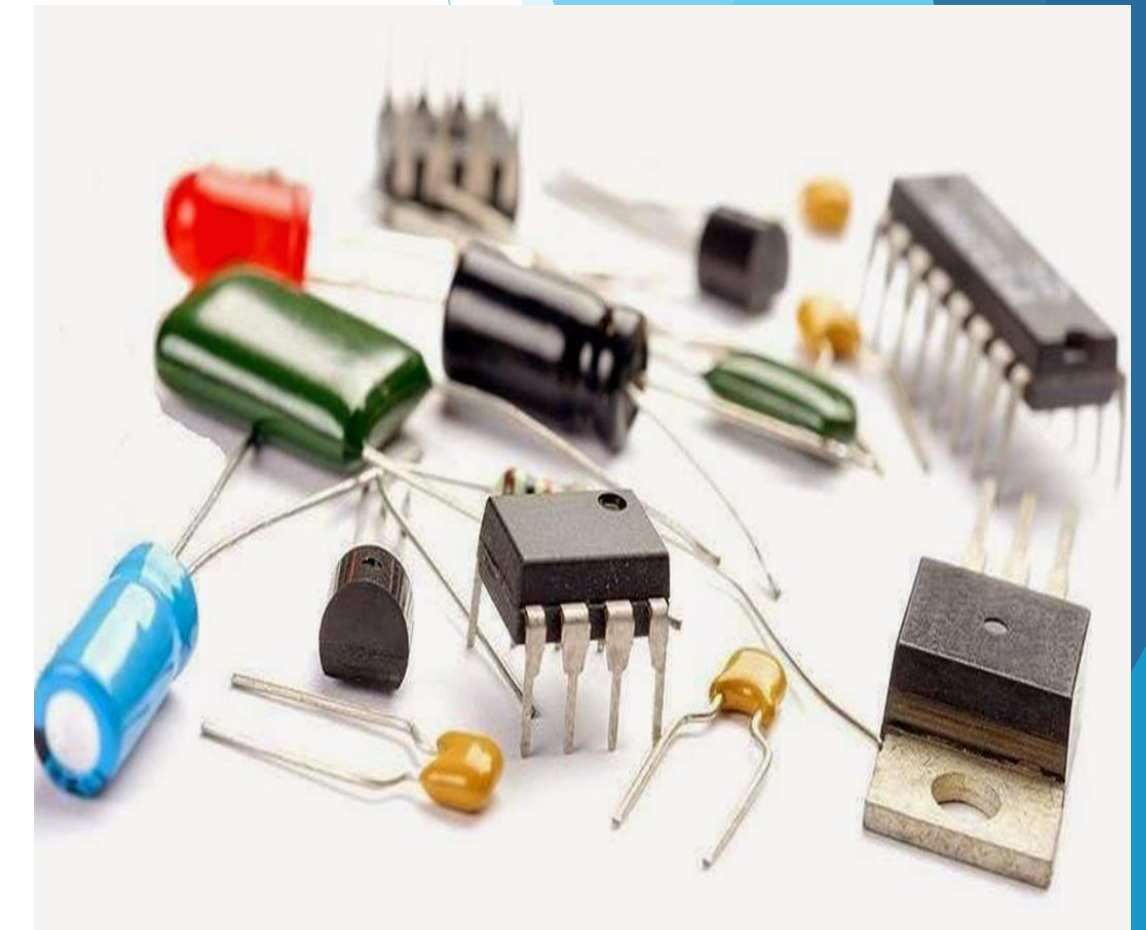
The resistor at right has 10 times as much resistance as it will

<https://falstad.com/circuit/circuitjs.html>

Tools for developing Circuit simulator

The screenshot shows a software interface for a circuit simulator. The menu is open, displaying various options for adding components and sources. The 'Draw' menu is active, and the 'Inputs and Sources' sub-menu is expanded. The waveform plot at the bottom left shows a sinusoidal wave with a peak value of 2.783 V and a capacitor value of 33 μF . The A/C source parameters are listed as follows:

A/C source
I = 23.054 mA
Vd = 4.278 V
f = 40 Hz
Vmax = 5 V
V(rms) = 3.536 V



<https://falstad.com/circuit/circuitjs.html>

File Scope Options Circuits

Resistors "Edit" box

Resistor

150

21mA

LED in the scope

21.07 mA

resistor

I = 21 mA

Vd = 3.15 V

R = 150 Ω

P = 66.13 mW

Resistors

Current

Voltage

Resistance

Power

Reset

Stopped

Simulation Speed

Edit Component

Resistance (ohms) 150

Apply OK

Current Circuit:

Blank Circuit

How to edit values of electrical circuit???

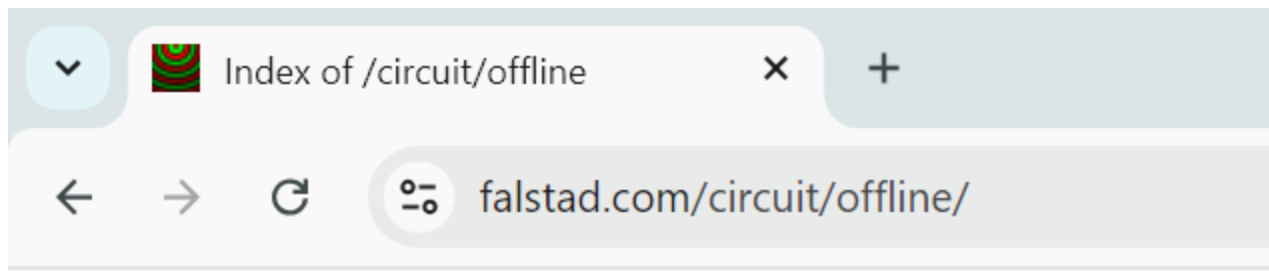
How to download standalone(offline) version?



<https://www.falstad.com/circuit>

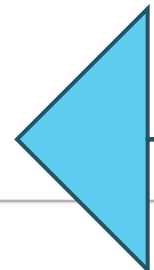


Click on circuitjs-win.zip file and download it.



Index of /circuit/offline

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
Parent Directory		-	
CircuitJS1-mac.dmg	2024-08-07 02:24	88M	
CircuitJS1-macarm.dmg	2024-08-07 02:26	109M	
circuitjs1-linux64.tgz	2024-08-07 02:27	81M	
circuitjs1-win.zip	2024-08-07 02:28	75M	



To save a circuit that you have made go:

File > Export > (Copy the code in the export box) > (Paste into a .txt document or similar) > Save the code.

When loading a circuit:

Find the .txt (Or similar file) > Copy the code > (File > Import) > If there is any code in the import box, clear it and paste your code into that box.

[New Text Document.txt](#)

The screenshot displays a circuit simulation software interface. A central dialog box titled "Export as Text" is open, showing a text file for the circuit. The text is as follows:

```
$ 1 0.000005 26.59566520631553 77 5 50 5e-11
w 96 96 176 96 0
r 176 96 336 96 0 1000
162 336 96 336 256 2 default-led 1 0 0 0.01
w 96 256 336 256 0
v 96 96 96 256 0 0 40 5 0 0 0.5
o 2 64 0 4099 5 0.00009765625 0 2 2 3
o 1 64 0 4099 0.0000762939453125 0.00009765625 1 2 1 3
```

Below the text are three buttons: "OK", "Copy to Clipboard", and "Re-Import".

To the right of the dialog box is a control panel with the following elements:

- Reset button
- RUN / Stop button
- Simulation Speed slider (set to approximately 10%)
- Current Speed slider (set to approximately 10%)
- Power Brightness slider (set to approximately 10%)
- Current Circuit: (text label)

The background shows a circuit diagram with a resistor and an LED. The resistor is labeled "resistor, 1 kΩ" and the LED is labeled "LED (default-led)". The simulation time is shown as "t = 2.811 s" and the time step is "time step = 5 μs".


BASIC CIRCUITS



	RESISTOR		VOLTAGE DIVIDER
	CAPACITOR		POTENTIOMETER
	INDUCTOR		OHM'S LAW
	LRC CIRCUIT		THEVENIN'S THEOREM

All many circuits!!!

File Edit Draw Scopes Options **Circuits**



40Hz

180

- Basics ▶ Ohm's Law
- A/C Circuits ▶ Resistors
- Passive Filters ▶ Capacitor
- Other Passive Circuits ▶ Inductor
- Diodes ▶ LRC Circuit
- Op-Amps ▶ Voltage Divider
- Transistors ▶ Potentiometer
- MOSFETs ▶ Potentiometer Divider
- 555 Timer Chip ▶ Thevenin's Theorem
- Active Filters ▶ Norton's Theorem
- Logic Families ▶
- Combinational Logic ▶
- Sequential Logic ▶
- Analog/Digital ▶
- Power Converters ▶
- Phase-Locked Loops ▶
- Transmission Lines ▶
- Misc Devices ▶
- Blank Circuit ▶

Current Circuit:
Capacitor

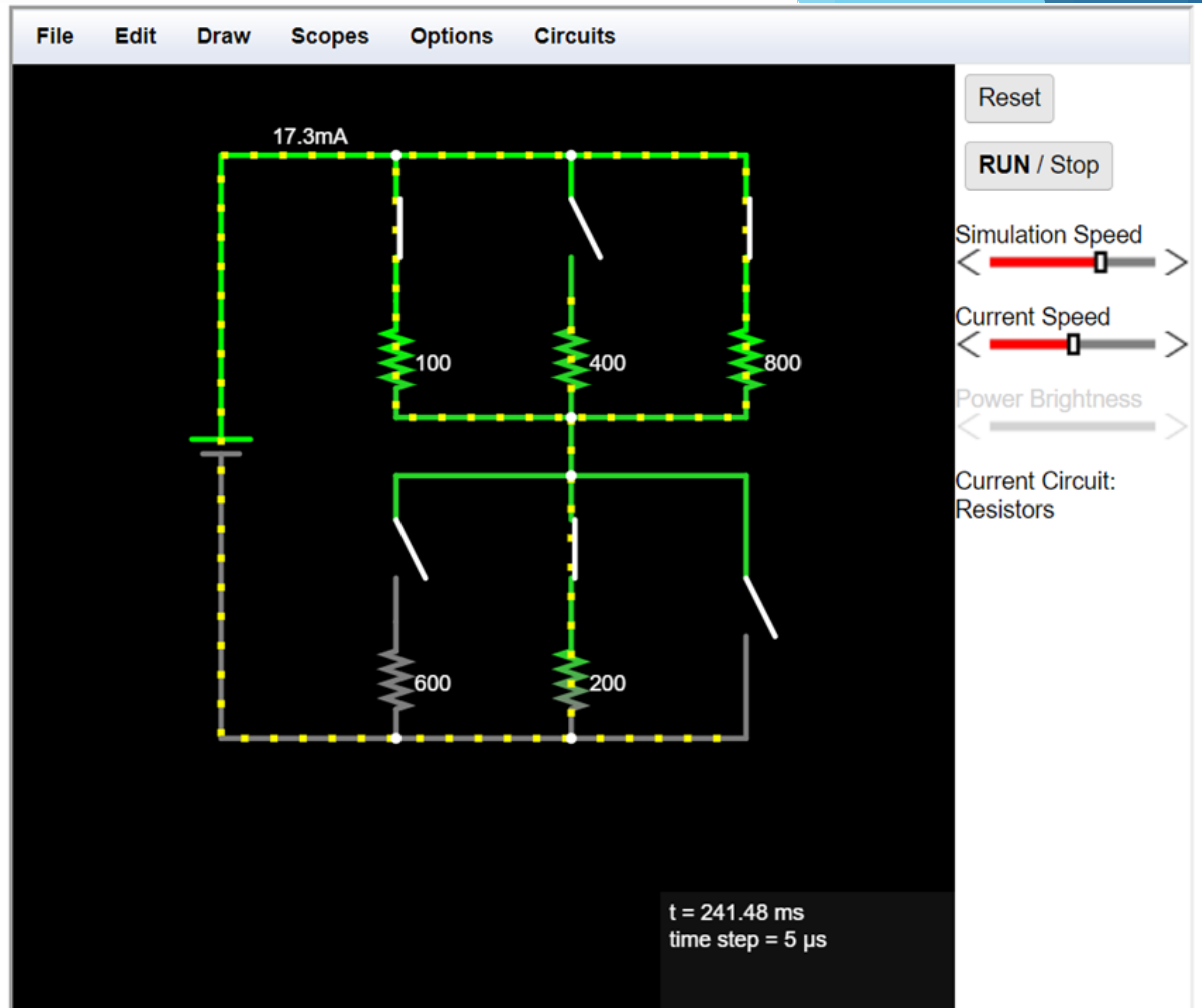
Capacitance

Max=2.783 V
capacitor, 33 μ F

t = 4.896 s
time step = 5 μ s

Resistor-This is a java applet showing a simple resistive circuit.

<https://www.falstad.com/circuit/>



Ohm's law states the relationship between electric current and potential difference. The current that flows through most conductors is directly proportional to the voltage applied to it.

Ohm's Law-This is a java applet showing a simple demonstration of [Ohm's Law](https://www.falstad.com/circuit/).

<https://www.falstad.com/circuit/>

Ohm's Law

falstad.com/circuit/e-ohms.html

File Edit Draw Scopes Options Circuits

Reset

RUN / Stop

Simulation Speed

Current Speed

Power Brightness

Current Circuit:
Ohm's Law

Voltage

+5V

100

1k

50mA

5mA

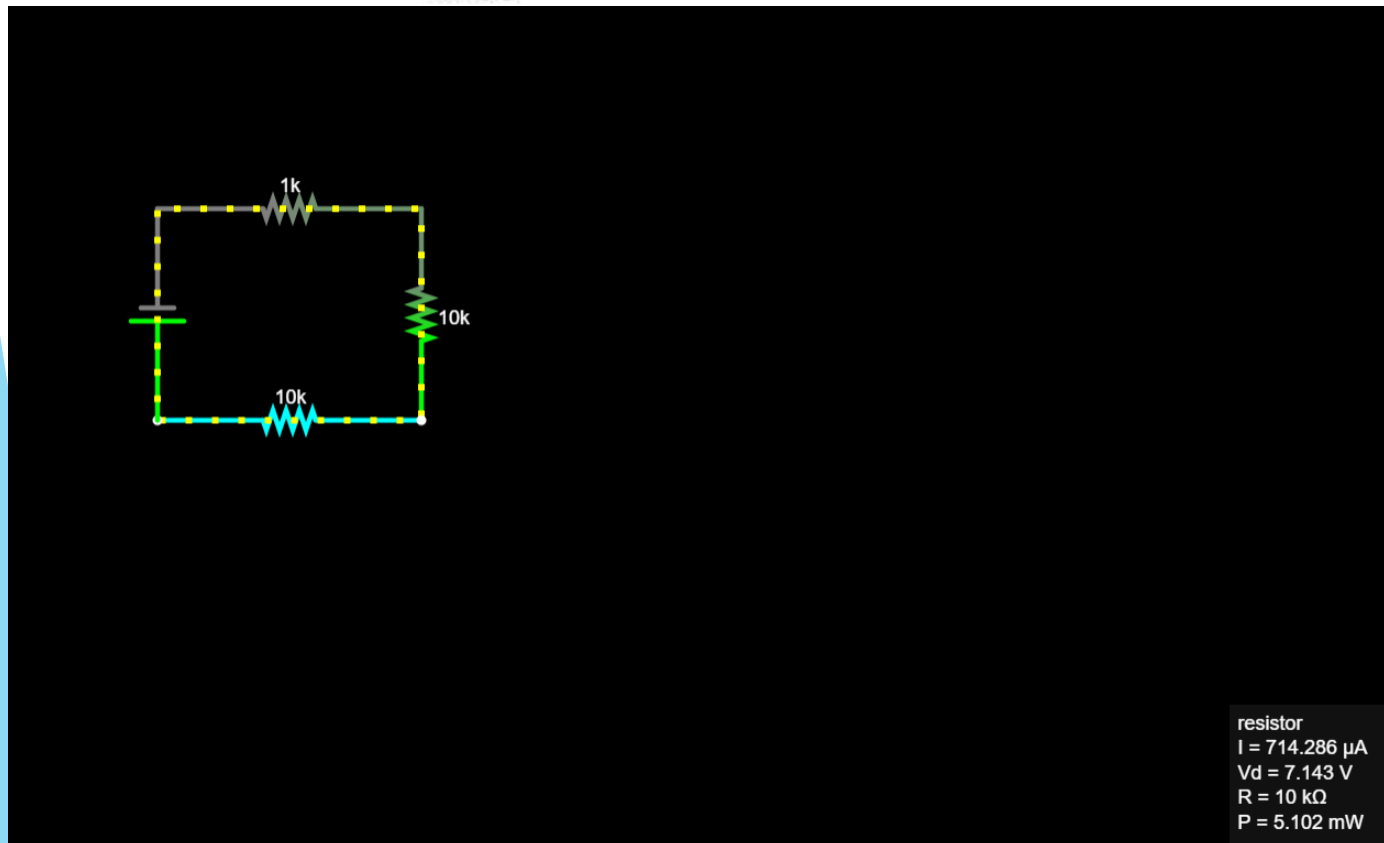
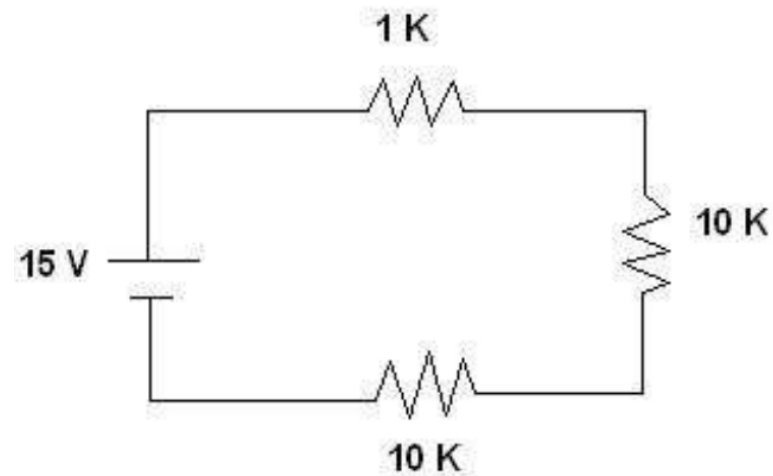
t = 92.66 ms
time step = 5 μ s

HANDS-ON EXERCISE

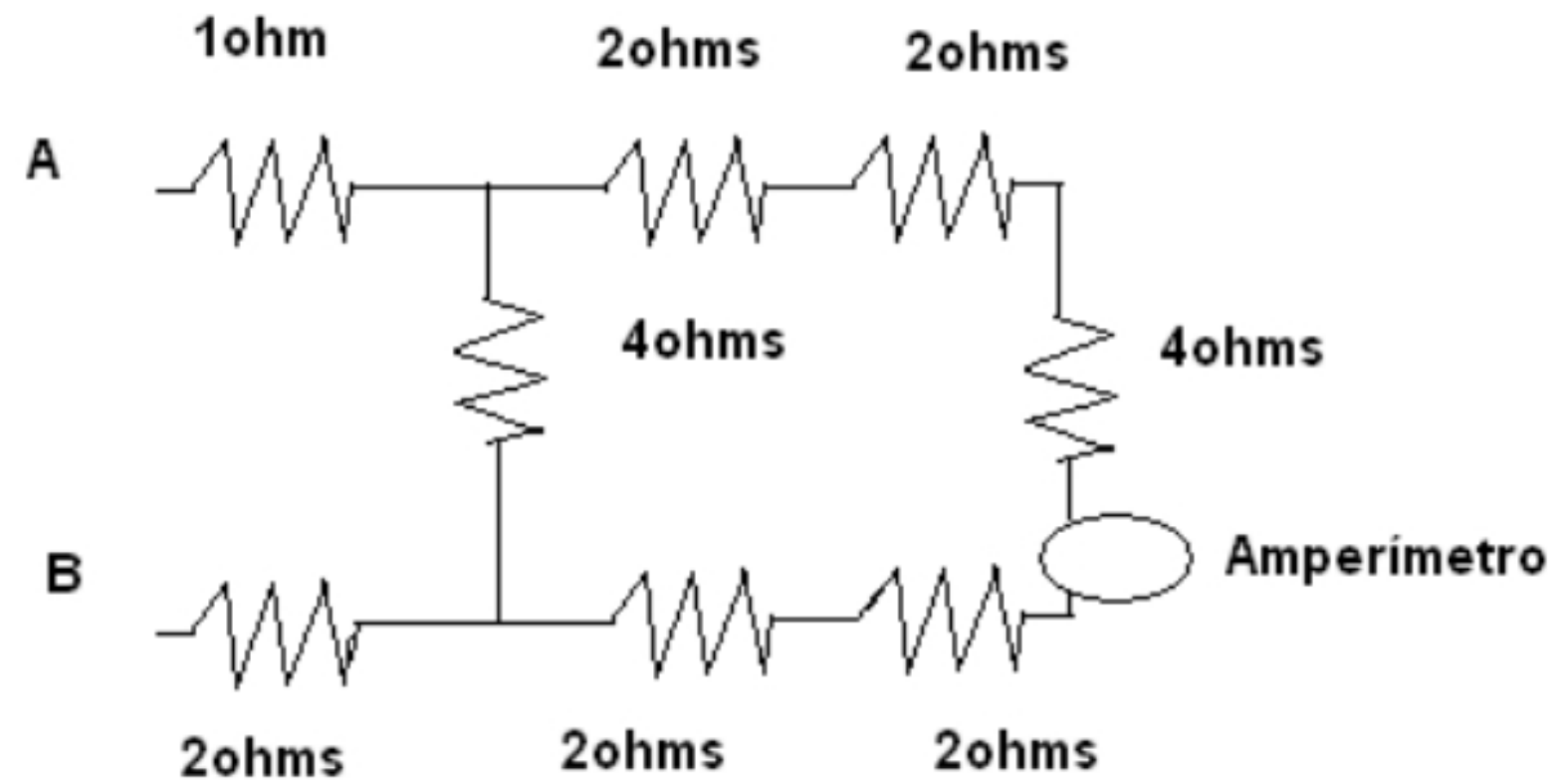
Exercise 1: Given the circuit shown in the figure:

Measure the total resistor of the circuit

- Do a screen capture for the circuit
- Calculate the voltage drop of 1 K Ω resistor
- Calculate the voltage drop of 10 K Ω resistor



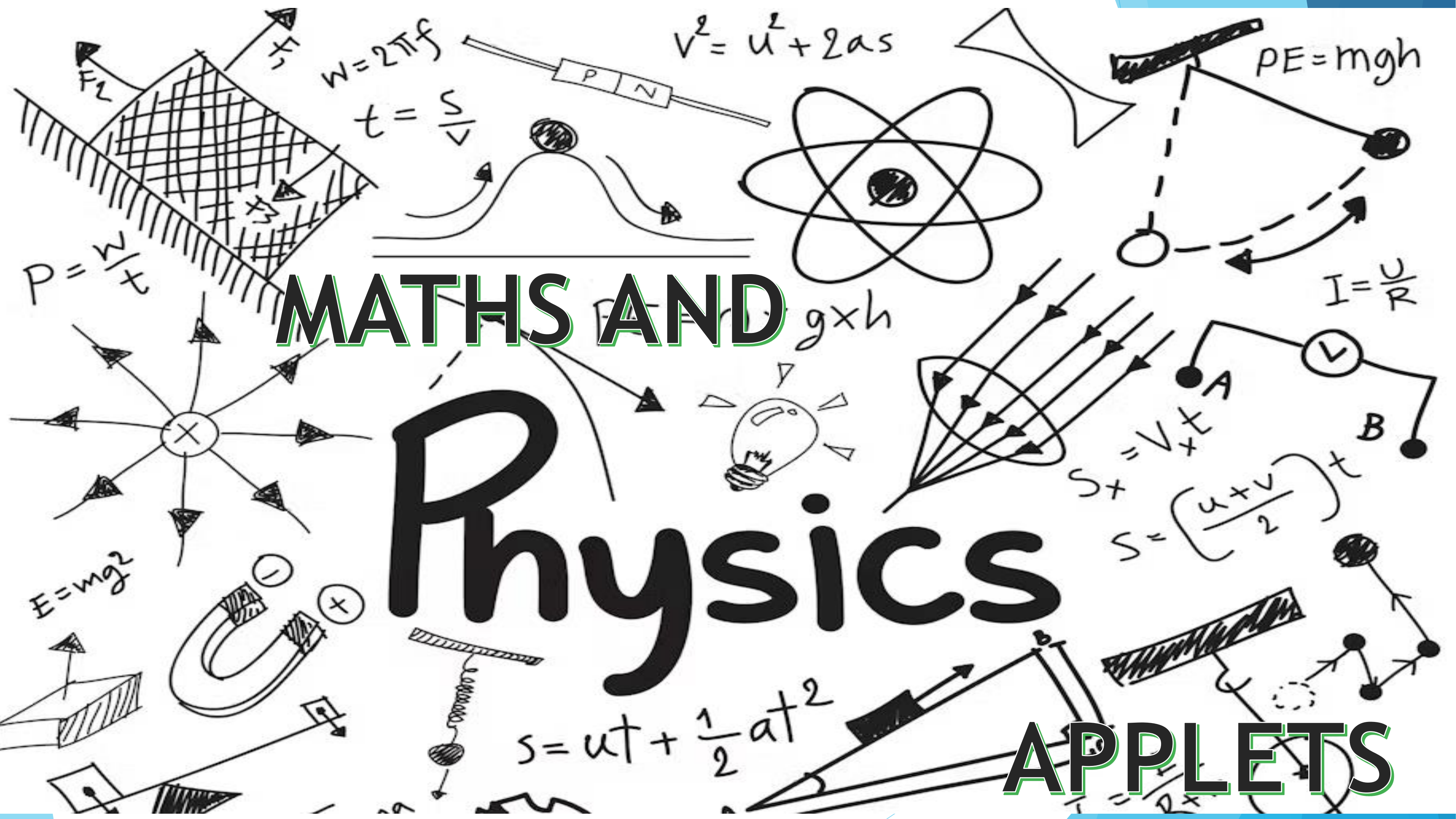
Exercise 2: Determine the equivalent resistor of the network in the following figure. What is the voltage drop between A and B if the ammeter shows 1 A? Also, do a screen capture for the circuit.



MATHS AND

Physics

APPLETS



CONCEPTS learner can understand !!!

**Oscillations and
Waves**

**Electricity and
Magnetism:
Statics**

Electrodynamics

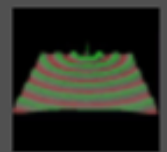
Thermodynamics

**Quantum
Mechanics**

Mechanics

These are some educational applets I wrote to help visualize various concepts in math, physics, and engineering. They were originally written in Java, but they've mostly been converted to Javascript, so you should be able to view them without a Java-capable browser.

Oscillations and Waves



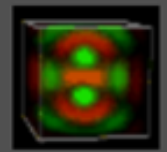
Ripple Tank (2-D Waves) Applet

Ripple tank simulation that demonstrates wave motion, interference, diffraction, refraction, Doppler effect, etc.



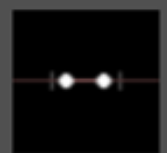
2-D Waves Applet

Demonstration of wave motion in 2-D.



3-D Waves Applet

Demonstration of wave motion in 3-D.



Coupled Oscillations Applet

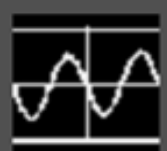
Demonstration of longitudinal wave motion in oscillators connected by springs.



Dispersion Applet

Dispersion and group velocity.

Acoustics



Loaded String Applet

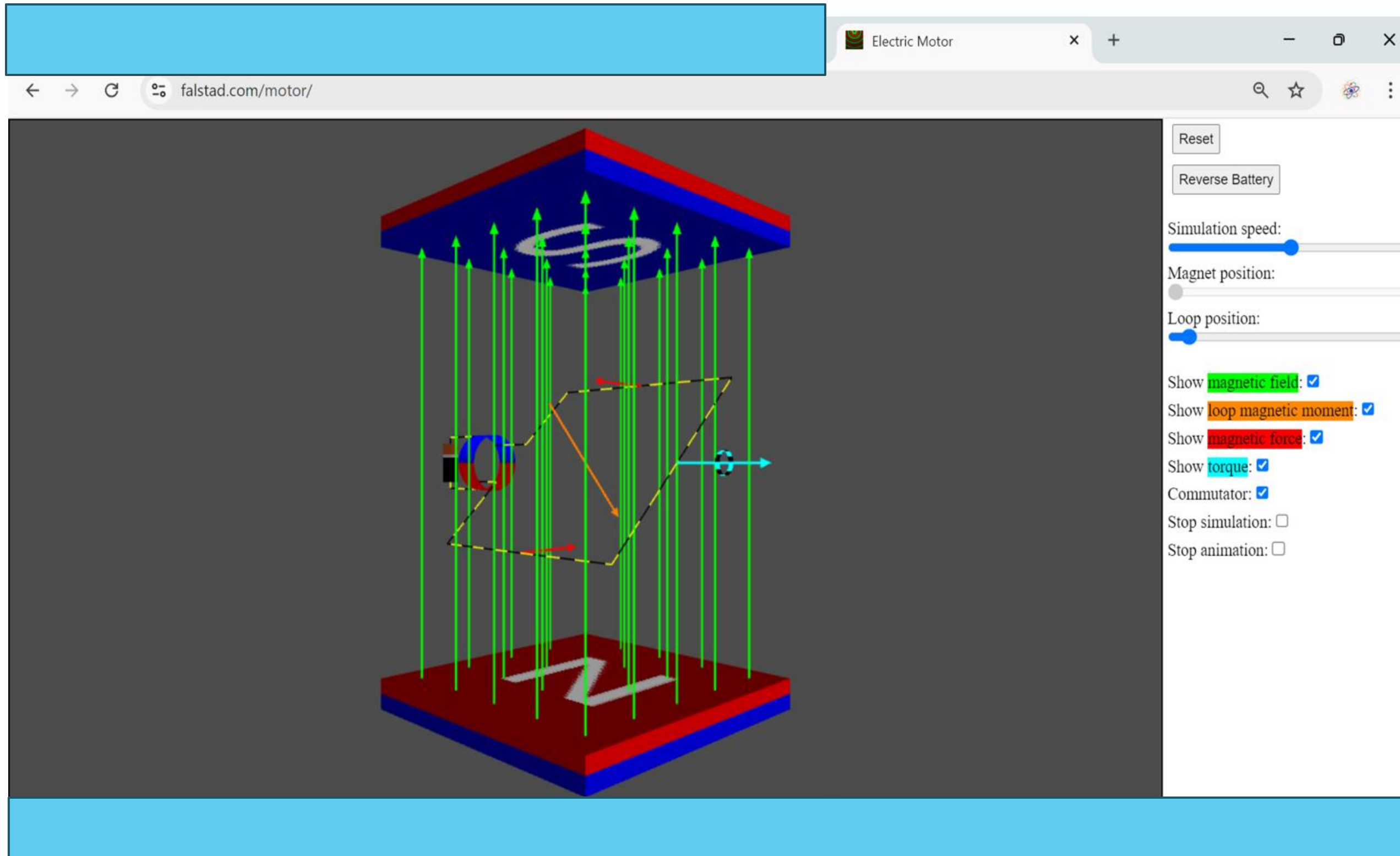
Simulation of wave motion of a string.



Rectangular Membrane Waves Applet

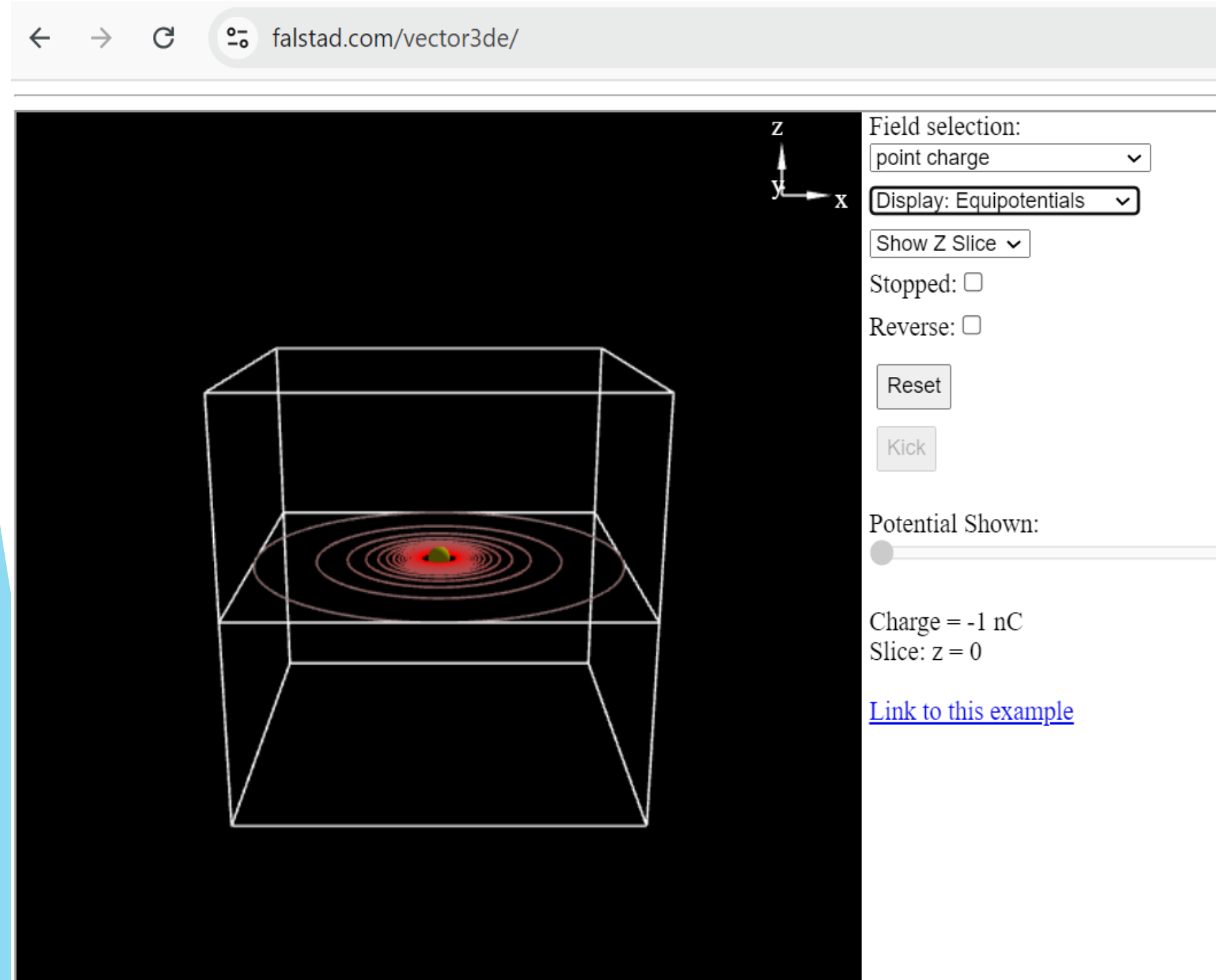
Vibrational modes in a 2-d membrane.

ELECTRIC MOTOR



<https://www.falstad.com/mathphysics.html>

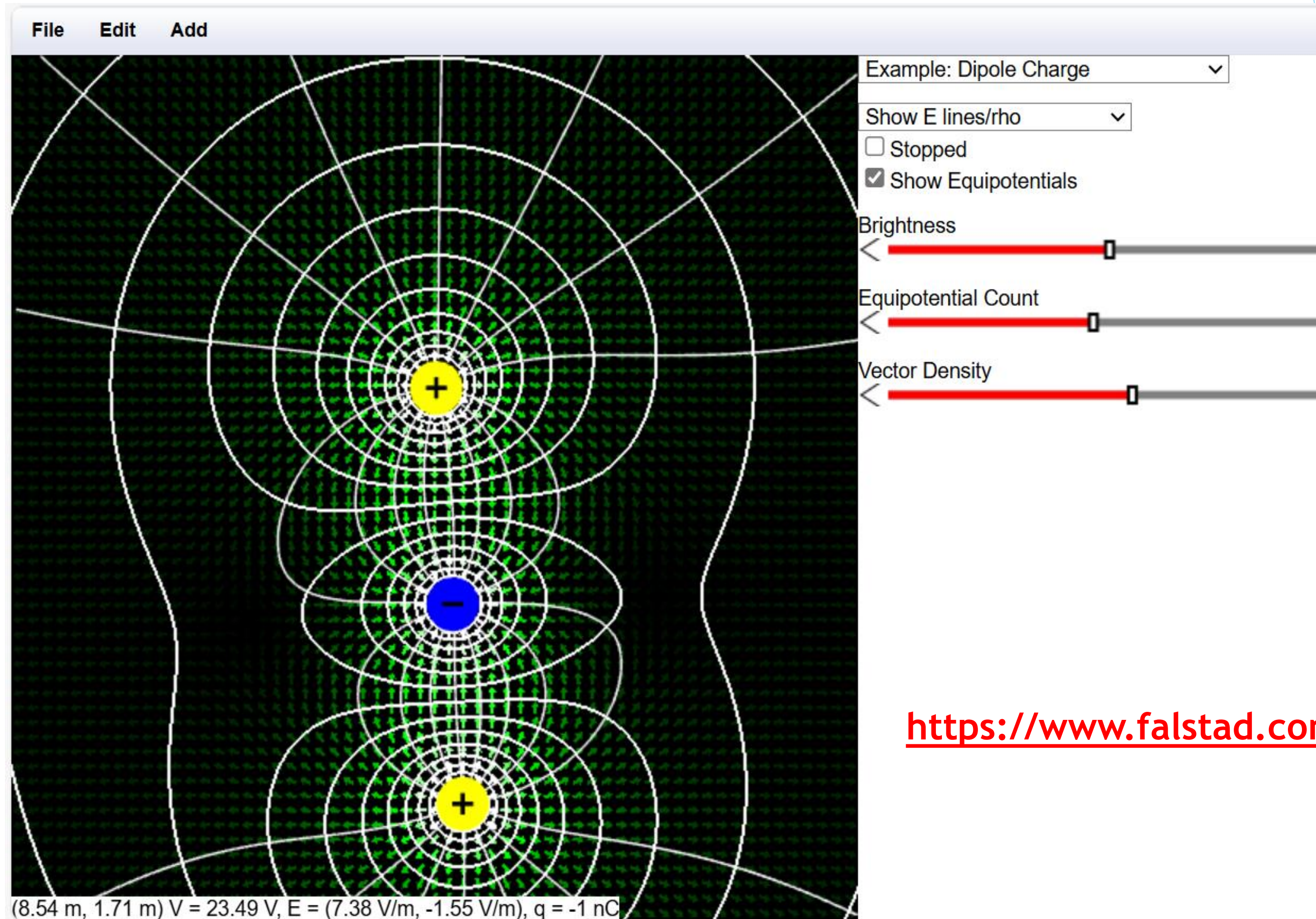
Electrostatics 3-D demonstration



- This java applet is an electrostatics demonstration which displays the electric field in a number of situations.
- You can select from a number of fields and see how particles move in the field if it is treated as either a velocity field (where the particles move along the field lines) or an actual force field (where the particles move as if they were charged particles).
- This helps you visualize the field.

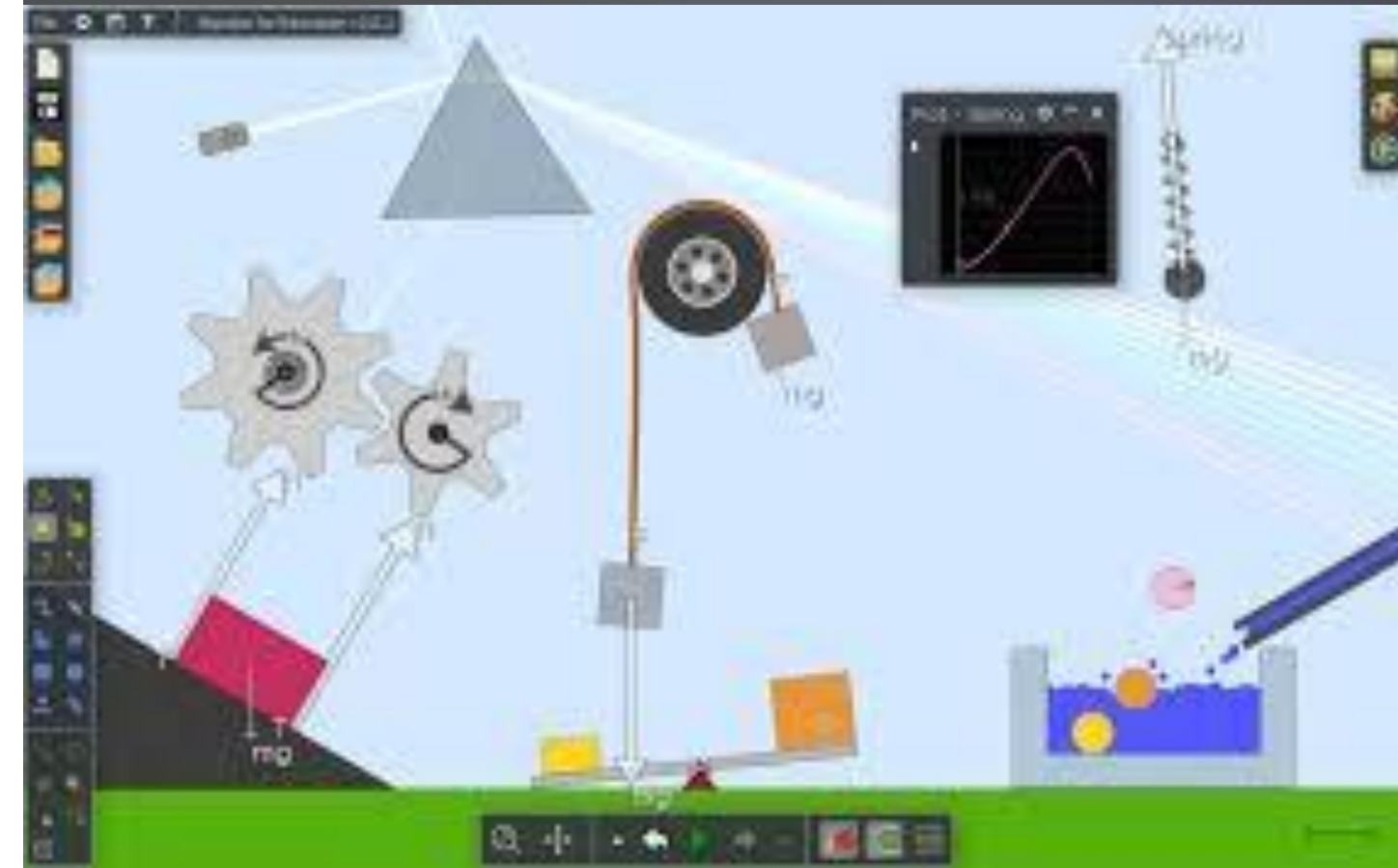
<https://www.falstad.com/mathphysics.html>

Exercise- Illustrate the effect of electric field and electrostatic potential on point charge due to a dipole and do a screen capture of it.



<https://www.falstad.com/mathphysics.html>

Anggodoo



What is Algodoo?

Algodoo is a user-friendly physics simulation software that allows users to design and build interactive 2D worlds. This intuitive software makes it easy to create objects, apply forces, and observe the resulting motion and interactions.



Physics Sandbox

Algodoo offers a playground for for experimenting with physical physical concepts like gravity, friction, and collisions.

Visual Programming

Its visual programming interface interface enables users to create create complex scenarios with with ease, promoting hands-on on learning.

Educational Tool

Algodoo is widely used in education to teach physics concepts and inspire and inspire creativity in students of all ages.



Key Features of Algodoo

Algodoo offers a range of features that make it a versatile and powerful tool for physics simulations and creative exploration.

1 Object Creation

Algodoo provides a diverse set of objects to create interactive simulations, including balls, blocks, ropes, springs, and motors.

3 Force Application

Algodoo allows users to apply forces like gravity, wind, and friction to objects, simulating real-world scenarios.

2 Material Properties

Users can customize material properties like density, elasticity, and friction to create realistic simulations of different materials.

4 Simulation Control

Users can control simulation speed, pause, and rewind to analyze the results and understand the physics behind the interactions.

Applying Physics Principles in Algodoo

Algodoo offers an interactive platform to explore fundamental physics principles in action.

1

Newton's Laws of Motion

Simulate and observe the effects of inertia, acceleration, and force on objects.

2

Conservation of Energy

Create simulations that demonstrate the transfer of energy between different forms, such as potential and kinetic energy.

3

Gravity and Friction

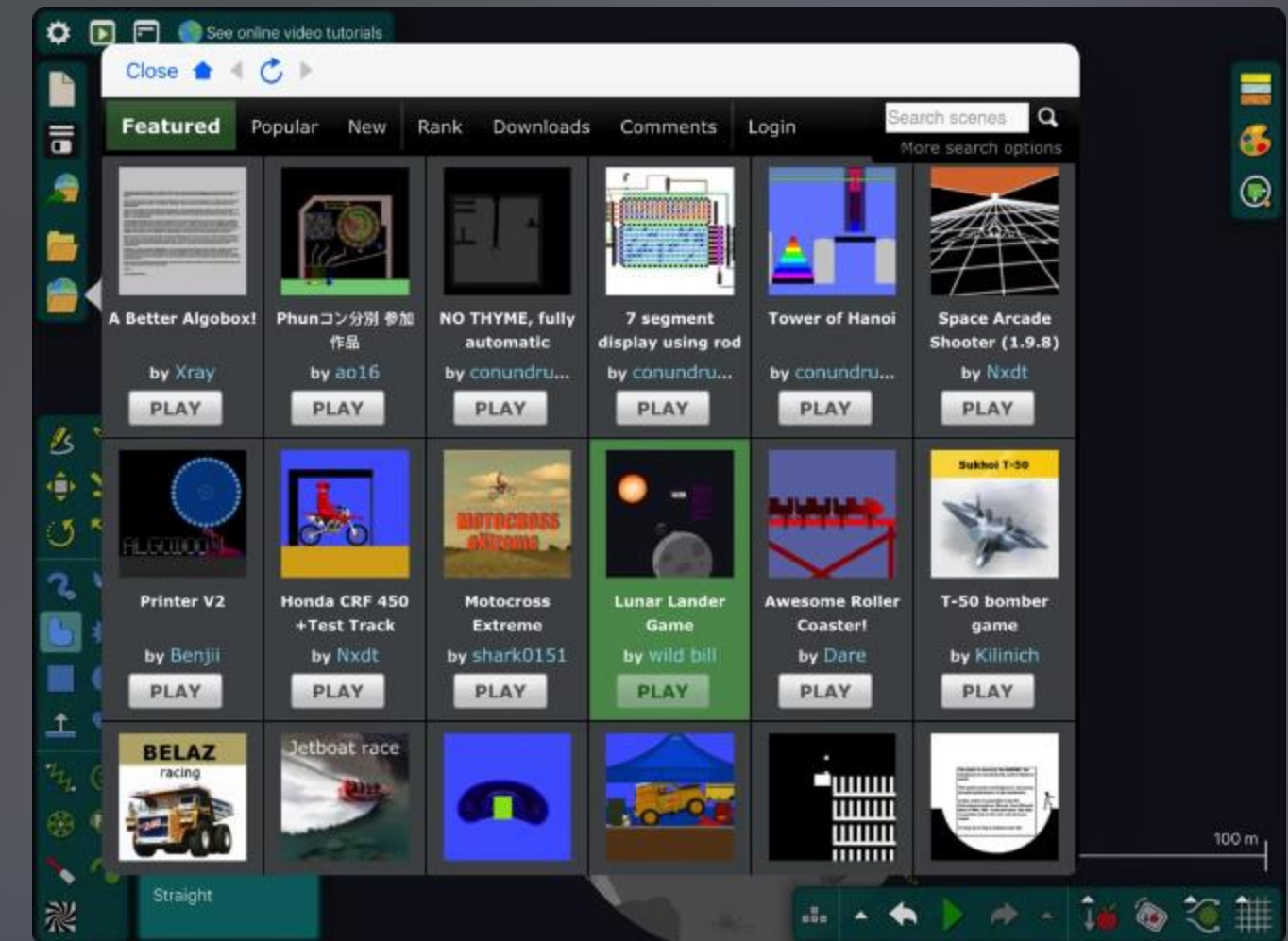
Explore the influence of gravity and friction on the motion and interactions of objects.

4

Collisions and Momentum

Investigate the impact of collisions on objects and the conservation of momentum.

<http://www.algodoo.com/download/>



Source: <http://www.algodoo.com/>

TOP MENU
Change language, Toggle fullscreen, Open options, Hide windows, Run tutorials and much more.

BROWSER
Browse & Save scenes.
Find & Share scenes online.
Drag & Drop components.

PROPERTIES
Set material and color.

RIGHT-CLICK (or DOUBLE-CLICK)
Make water, Clone, Show info, Add mechanics, etc.

Welcome!

Hello, and welcome to Algodoo!



Setup

Set language and the Algodoo look and feel



Tutorials

Learn the basics of Algodoo in a minute



Lessons

Use Algodoo as a teaching aid

Do not show this message again

TOOLBAR
Tools for Drawing, Editing and Interact with your scenes.

TOOL OPTIONS
Options for the selected tool.

SIMULATION CONTROL
Play, pause, undo and redo.

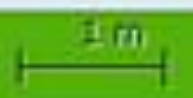
ENVIRONMENT
Turn on/off Gravity, Air friction and Background grid.



Select by encircling

? Sketch

Simulation control icons: zoom, pan, play, pause, undo, redo, environment settings (gravity, air friction, grid).





Home

Download

What is it?

Learn it

Algobox

Forum



LOG IN



Search



TRANSLATE/COPY

EDIT

MOTION

LANGUAGE:

English

DESCRIPTION:

Motion is a fundamental concept in science. This lesson explores different causes of motion, such as pull, push, drop (gravity), and also introduces the term force.

TARGET:

Key Stage 1, Key Stage 2

CATEGORY:

Demonstration, Exercise, Laboratory

DISCIPLINE:

Static forces, Dynamic forces, Gravity, Motion

LEARNING OBJECTIVES:

Knowing different ways of setting an object into motion. Knowing a cause of motion (push, pull, drop, slide) in terms of influence of a force. Knowing about the relation between speed, distance and time.

IN CLASS:

Discuss what causes an object to move. Let the students suggest different ways of setting an object into motion and list them on the whiteboard. For example pushing, pulling, throwing, dropping, sliding, adding a motor.

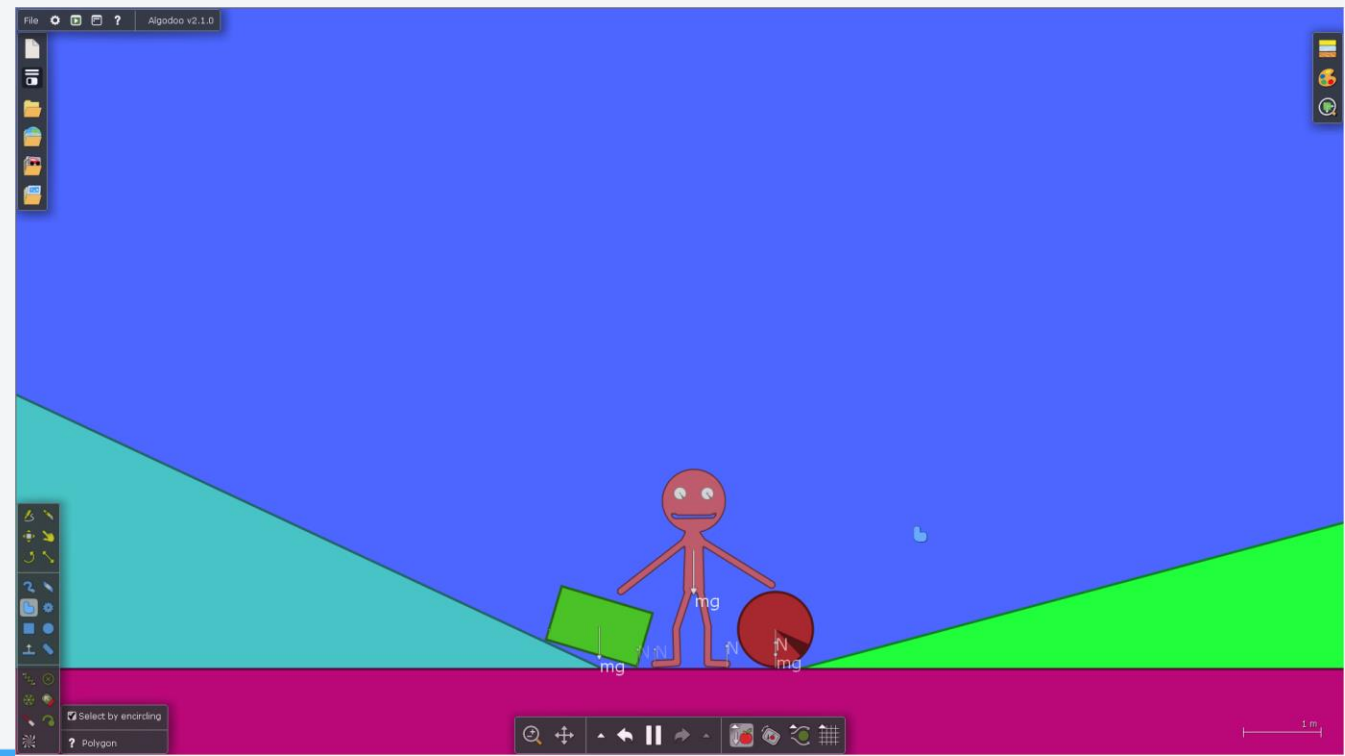
Discuss that the cause of motion is called force. Discuss how the size of the force influences the motion. Discuss relation between speed, distance and time.

Discuss how this can be visualized and explored in Algodoo. Let the students create scenes in Algodoo using the suggestions you came up with together or let them use their own ideas. Help the students make decisions and ask guiding questions.

HANDS-ON EXAMPLE
LESSON 1-MOTION

Create a scene

Create a horizontal plane and one plane as a slope. Make objects that can roll, slide, driven by a motor, fall.



Make a prediction

How can the object be set into motion? What makes the object stop?

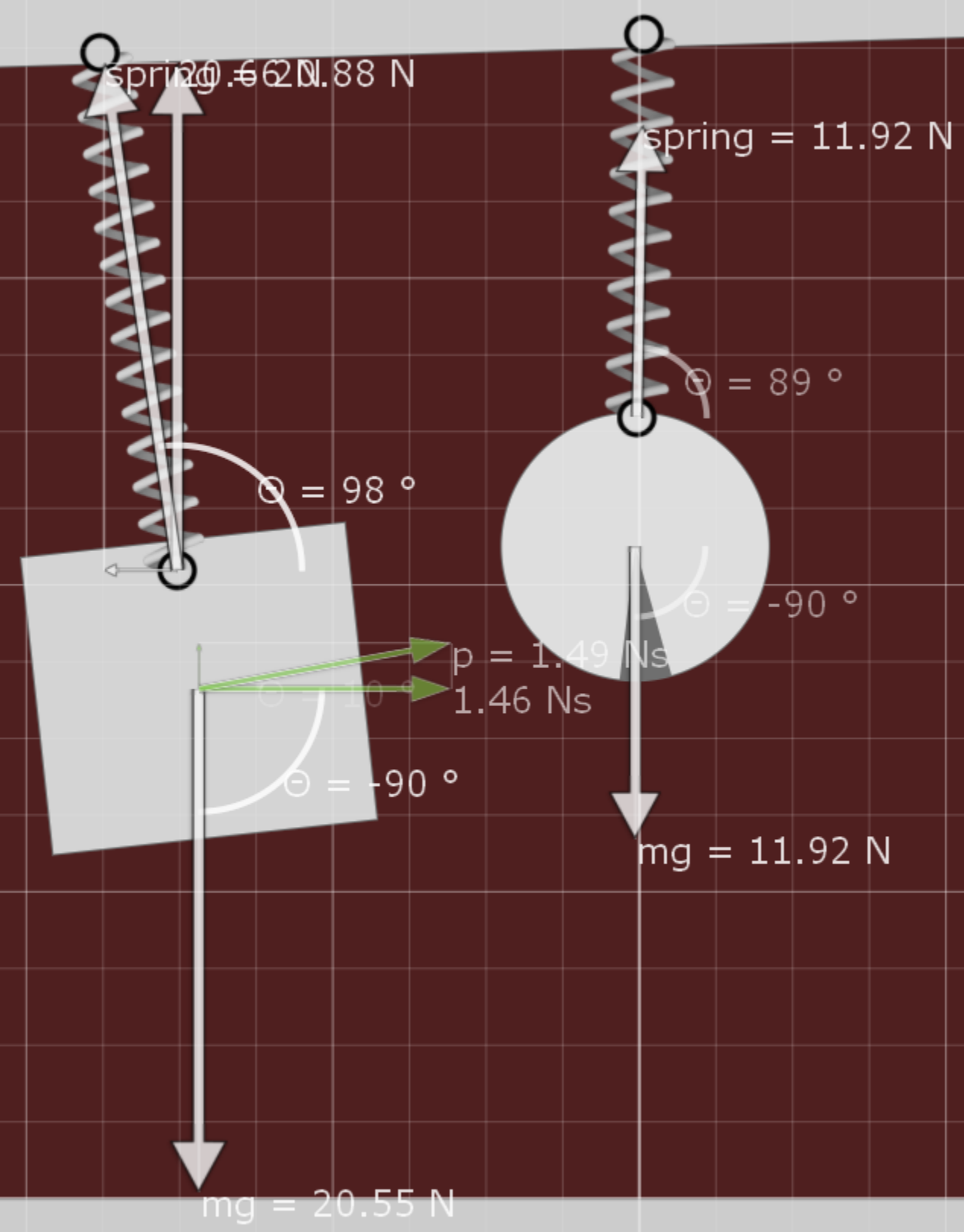
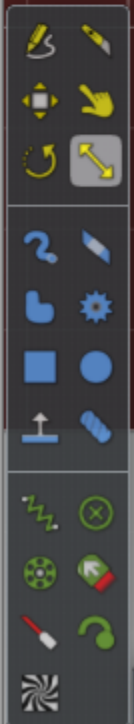
Run interact

Explore different ways of moving the object. Rotate the planes (if you have a computer with accelerometer, tilt the PC) and move objects, watch the object slide down the plane or fall through the air. Turn off and on gravity and explore its influence on the motion. Grab the object by using the hand tool. Push and pull and make the objects move in different ways.

Evaluate

What behaviour is observed with the different wheel shapes?
How long do they roll?

C:\Users\Dell\Downloads\58877_motion.phz



Visualization

Fit arrows to screen

Show names Show values
 Show components Show angles

Forces Velocities Momentums Other

Here you can choose to visualize the forces that act on objects.

View forces

Improve arrow stability. With this on, the physics solver will behave slightly differently when showing force arrows.

Force arrows scale: 0.080 m/N

Select forces to view:

<input type="checkbox"/> Total	Σ	<input checked="" type="checkbox"/> Attraction	G
<input checked="" type="checkbox"/> Gravity	mg	<input checked="" type="checkbox"/> Axle	A
<input checked="" type="checkbox"/> Spring	spring	<input checked="" type="checkbox"/> Normal	N
<input checked="" type="checkbox"/> Torque	τ	<input checked="" type="checkbox"/> Air friction	air friction
<input checked="" type="checkbox"/> Friction	T	<input checked="" type="checkbox"/> Chain	C
<input checked="" type="checkbox"/> Air buoyancy	air lift	<input checked="" type="checkbox"/> Thruster	ext
<input checked="" type="checkbox"/> Controller	ext		

Check all Uncheck all

? Scale



1 m

THANK YOU