NGSS Aligned Experiments Using Technology

Lisa Ward and Jeanine Sheppard
ISBE Content Specialists
ICE 2017

NEXT GENERATION SCIENCE STANDARDS For States, By States

Life Science

All photos are hyperlinked to the websites as well as the Bit.ly links provided.

Solve the Outbreak

Click Icon Below

https://www.cdc.gov/mobile/applications/sto/web-app.html

Web App as well includes lesson plans for MS and HS

- Users in the mission get clues and analyze data to solve the outbreak and save lives!
- In this fun app, you get to be the Disease Detective.
- Do students quarantine the village? Interview people who are sick? Run more lab tests?
- The better students answers, the higher they score - and the quicker they will climb the ranks to become a decorated Disease Detective.
- In level 1, students start out as a Trainee and can earn badges by solving scenarios, with the goal of earning the top rank: Disease Detective.

Fish Pond Population Genetics

This model is an agent-based population genetics simulation.

The program contains the tools to conduct virtual experiments violating all the assumptions of Hardy-Weinberg theory (small population, selection, mutation, migration, and non-random mating).

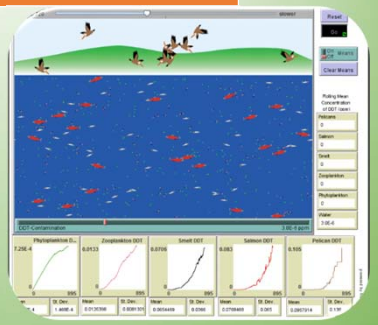
Grades: 6th – 12th

http://bit.ly/2lA7b2j

Biomagnification

In 1962, Rachel Carson published 'Silent Spring', which drew attention to how the use of pesticides was indirectly decimating bird populations by causing thinning of egg-shells.

This model illustrates how DDT in near-shore waters accumulates in a 'food chain' of phytoplankton, zooplankton, smelt, salmon, and pelicans.



Grades: 6th – 12th

http://bit.ly/2lzW0Xx

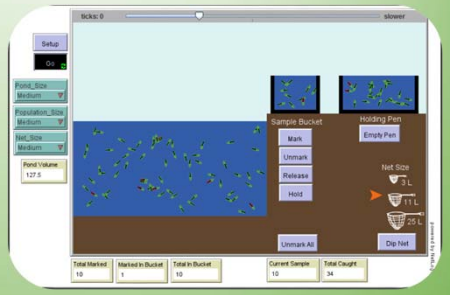
Estimating Population Size

Knowing how many individuals are in a population can be critical.

How can you tell how many there are when there are too many to count?

This model simulates a pond of tadpoles.

The population size can be estimated in three ways: direct sampling, sampling with removal, and mark/recapture.



Grades: 5th – 12th

http://bit.ly/2lHWRp1

Semipermeable Membrane

This simulation visualizes the process of diffusion across a semipermeable membrane and helps to explore the role of this phenomenon in body functioning.

Grades: 6th – 12th

http://bit.ly/2lMwq3g

Experiment with Ecosystems

The goal of this activity is to give students the opportunity to "think like a scientist," making hypotheses, doing experiments, making observations, and analyzing data. Students are encouraged to construct and conduct their own experiments with ecosystems comprising grass, rabbits, and up to two predator species: hawks and foxes. (Evolution Readiness Activity 10 of 10.)

Grades: 2nd – 5th

http://bit.ly/2lNf9Hb

Earth & Space Science

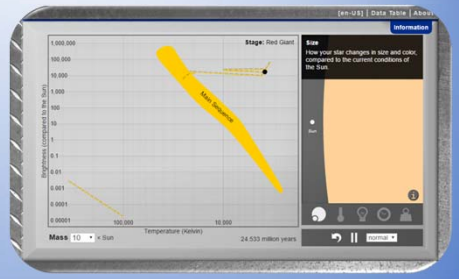
Star in a Box

Star in a Box is an interactive webapp which animates stars with different starting masses as they change during their lives.

Some stars live fast-paced, dramatic lives, others change very little for billions of years.

The webapp visualizes the changes in mass, size, brightness and temperature for all these different stages.

It allows a user to examine snapshots of a star's position on the color-magnitude diagram (CMD) - the primary diagram used by astronomers to study evolution within stellar populations and to see how stellar parameters relate to one another.



Grades: 6th -12th

http://bit.ly/2lYj3gP

Journey North Class Study

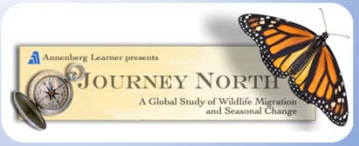
Seasonal change is all around us. Children see it in the length of a day, in the appearance of a flower, in the flight of a butterfly. Journey North is a free, Internet-based program that explores the interrelated aspects of seasonal change. Through interrelated investigations, students discover that sunlight drives all living systems and they learn about the dynamic ecosystem that surrounds and connects them.

•Sunlight and the Seasons: Children study seasonal change in sunlight in a global game of hide and seek called Mystery Class.

•Plants and the Seasons: Children explore tulip growth in their own gardens, running an experiment that tracks the arrival of spring.

•Seasonal Migrations: Children follow animal migrations. They observe, research, and report findings and watch journeys progress on live maps.

Journey North for Kids: A simple, student-directed entry point to Journey North studies. Engaging stories, photos, videos, and slide shows from the natural world build observation skills, inspire scientific thinking, and create fertile ground for discussions and new questions!



Grades: K-12th

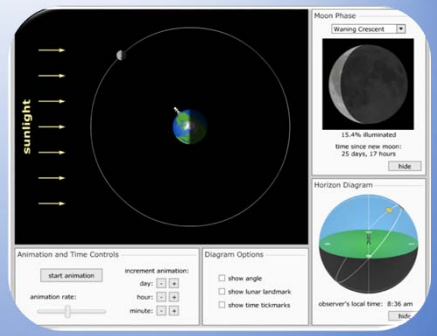
https://www.learner.org/jnorth/

Lunar Phase Simulator

Astronomy Education at the University of Nebraska-Lincoln

The NAAP Lunar Phases Lab demonstrates how the earth-sun-moon geometry gives rise to the phases of the moon as seen from earth.

A distant view of an observer looking down on earth as well as a perspective of an observer looking into the sky are used in the simulator.



Grades: 3rd – 9th

http://bit.ly/2m36iSo

Find My Shadow

This data set allows the user to calculate the position and height of the sun anywhere in the world on any date and plot the shadow cast by the sun at different times of the day.

User can get started by finding their location and setting the date they are interested in and see the sun position plot change.

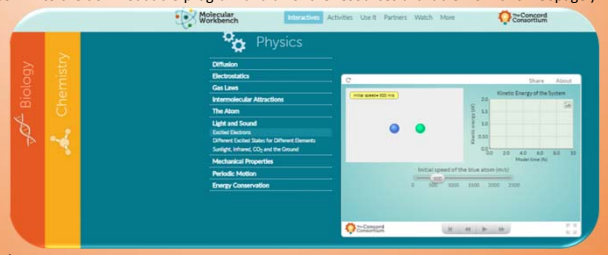
Then they can try out the scene drawing tool to find where your shadows fall.

Grades: 3rd – 12th http://bit.ly/2lra5pk

Physical Science

Molecular Workbench

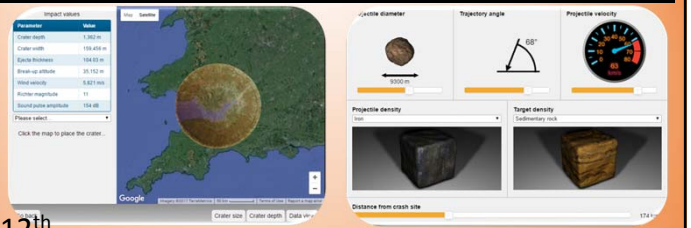
The complete workbench is a downloadable program that can be modified by the educator and then the students can control he experiments more. However, there is now a selection of "online" HTML 5 experiments and simulations that can be utilized completely online and are Chromebook compatible. This is the link to those resources. (You can also link to the downloadable program and all of the resources available from this webpage.)



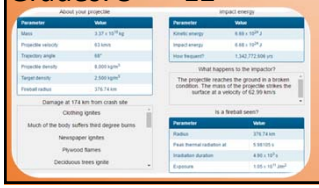
Grades: K- 12th http://bit.ly/2lrxTcM

Craters on Earth and Other planets

Additional Info: GO-LAB



Grades: 5th – 12th



In this lab, pupils can simulate the impact of an object (e.g., an asteroid) on the Earth, Moon or Mars. They can vary parameters such as the diameter, density and velocity of the projectile and see the characteristics of the resulting crater. They can also analyze satellite imagery of real craters on a number of planets and moons. Various related classroom exercises are included. The lab uses satellite data from European Space Agency missions. It was developed in partnership with Faulkes Telescope.

http://bit.ly/2mD31WI

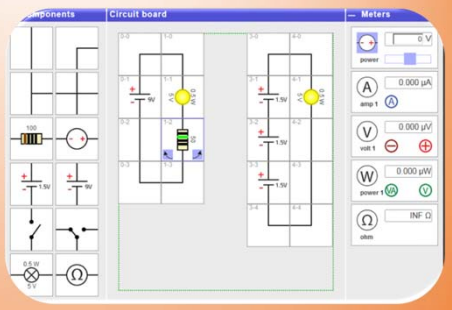
GO-LAB

Electrical Circuit Lab

In the Electrical Circuit Lab students can create their own electrical circuits and do measurements on it.

In the circuits the students can use resistors, light bulbs, switches, capacitors and coils. The circuits can be powered by a AC/DC power supply or batteries.
There is an ammeter, voltmeter, wattmeter and an ohmmeter. There is also a version of the Electrical Circuit Lab in which data can be collected.

Students can analyze the collected data by creating graphs of the data and use the graphs in the conclusion tool.



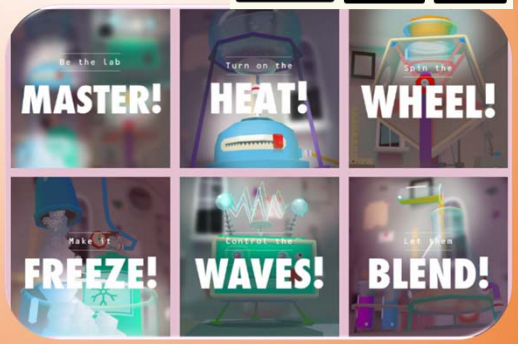
Grades: 6th – 12th

http://bit.ly/23iiw4x

Toca Lab App

Mobile app for iOS, Android and Kindle Fire for elementary students that includes activities with the periodic table, mixtures, and other experiments

Student have access to a centrifuge, Bunsen burner, cooling agent, test tubes and oscilloscope.



Grades: K- 5th

http://bit.ly/2m3qXWJ

GO-LAB

Splash Virtual Buoyancy Lab

In Splash students can create objects from object properties like mass, volume, and density, and drop these objects in a tube filled with a fluid.

In some phases students can choose the density of the fluid themselves, allowing them to discover the interaction between object properties and fluid density.

In other phases students can measure the amount of fluid displaced by the object and discover about Archimedes' Principle.

Grades: 3rd – 9th

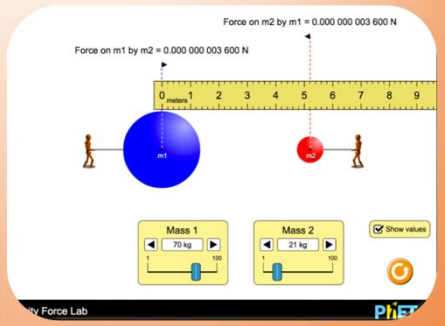
http://bit.ly/2aXB5tx

PhET INTERACTIVE SIMULATIONS

Gravity Force Lab

This lab allows the user to visualize the gravitational force that two objects exert on each other.

It is possible to change properties of the objects in order to see how that changes the gravitational force between them.



Grades: 5th – 12th

http://bit.ly/2020R26

Elements 4D by DAQRI

http://apple.co/2lYr5WX

https://goo.gl/dFl9S3

Part educational story and part game, the Elements 4D app offers a new, fun way to experience augmented reality and learn about real-life chemistry.

Paired with either paper or wood blocks that are inscribed with the symbols of 36 elements from the periodic table, this app will instantly transform a simple, inanimate object into dynamic, dimensional, 4D representations of each element.

Grades: ALL

Physics Toolbox Suite

Click the Icons for link

http://apple.co/2ha55qJ

https://goo.gl/6iZklB

This is an app that has a multitude of scientific tools that any mobile device can emulate.

Whichever tool a student may need a gyroscope, GPS, light meter, UV meter, barometer, pitch detector, color detector or tone generator, plus many more, this app can do it.

Grades: ALL

SENSORS

(1) G-Force Meter - ratio of Fn/Fg (x, y, z and/or total)
(2) Linear Accelerometer – acceleration (x, y, and/or z)
(3) Gyroscope - radial velocity (x, y, and/or z)
(4) Barometer - atmospheric pressure
(5) Roller Coaster - G-Force Meter, Linear Accelerometer, Gyroscope, and Barometer
(6) Hygrometer - relative humidity
(7) Thermometer - temperature
(8) Proximeter - periodic motion and timer (timer and pendulum modes)
(9) Ruler - distance between two points
(10) Magnetometer - magnetic field intensity (x, y, z and/or total)
(11) Compass - magnetic field direction and bubble level
(12) GPS - latitude, longitude, altitude, speed, direction, number of satellites
(13) Inclinometer - azimuth, roll, pitch
(14) Light Meter - light intensity
(15) Sound Meter - sound intensity
(16) Tone Detector - frequency and musical tone
(17) Oscilloscope - wave shape and relative amplitude

MULTI RECORD

(18) Multi Record

GENERATORS

(19) Tone Generator – sound frequency producer
(20) Color Generator – R/G/B/Y/C/M, white, and custom color screen
(21) Stroboscope (beta) - camera flash

Engineering

Wind Energy Simulation

GO-LAB

Take control of a wind farm to provide electrical energy to a small town.

Understand how random changes - in wind speed and power requirement of the town - affect the use of this natural energy resource.

Grades: 6th – 12th

http://windenergy.ea.gr/

PBS Zoom Goldburger

Rube Goldberg designed machines that made simple tasks much more complicated.

The ZOOMers were challenged to design a machine that serves lunch to the ZOOM cast and crew. They've called it the **Goldburger To Go**, and they need your help to finish it.

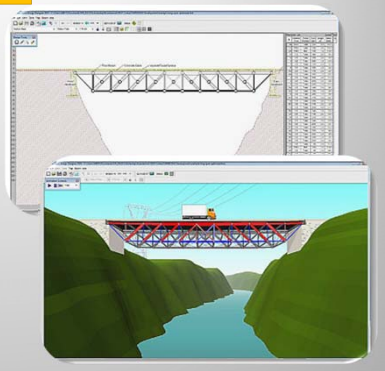
The website also have other resources on Rube Goldberg designs that students can investigate.

Grades: 3rd- 7th

http://to.pbs.org/2lMZIPh

West Point Bridge Designer

The Bridge Designer is a *free* educational software package designed to provide middle-school and high-school students with a realistic introduction to engineering through the design of a steel highway bridge.
The Bridge Designer has the look and feel of an industry-standard computer-aided design (CAD) package but is much easier to use. The software guides the user through the processes of:
•graphically creating a structural model;
•defining the material and mechanical properties of each member in the structure;
•running a simulated load test of the structure to determine if it is strong enough to carry a standard, code-specified highway loading;
•displaying a 3-D animation of the load test, with members color-coded to indicate tension (blue) and compression (red)



Grades: 5th – 12th

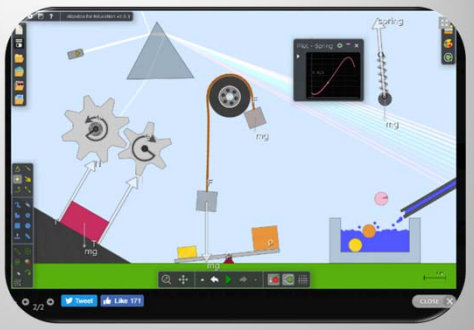
http://bit.ly/2mmVG1p

Algadoo

Algodoo is a unique 2D-simulation software from Algoryx Simulation AB.

Algodoo is designed in a playful, cartoony manner, making it a perfect tool for creating interactive scenes.

Explore physics, build amazing inventions, design cool games or experiment with Algodoo in your science classes.



Grades:

http://www.algodoo.com

Tools and Resources

TOOLS

http://dirtdirectory.org/

The DiRT Directory is a registry of digital research tools for scholarly use. DiRT makes it easy for digital humanists and others conducting digital research to find and compare resources ranging from content management systems to music OCR, statistical analysis packages to mind mapping software.

http://bit.ly/1OxeRx6

Kidzone online graphing tool. Extremely kid friendly for elementary students to graph data online. Includes a tutorial to get started if students are new to graphing.

Video choices where "kids" are doing the experiments

http://bit.ly/1adSpaA

http://bit.ly/1NZpeH2

http://bit.ly/2mwYshy

Our Main Website

www.ilclassroomsinaction.org

Our Tech Website

www.ilclassroomtech.weebly.com

Thank you!

Lisa Ward
ISBE Content Specialist
for Learning Supports
lward@illinoiscsi.org
618-960-5382
www.ilclassroomsinaction.org

Jeanine M. Sheppard
ISBE Math/Science Content Specialist
jmpsheppard@gmail.com
618-410-7197
www.ilclassroomsinaction.org