OpenEd
OPEN LEARNING AND EDUCATIONAL SUPPORT

Virtual Labs

Please Note:

This is a working document that will be updated periodically as new resources are identified. Instructors will need to explore the available resources and use their professional judgement to validate them for their personal use. While resources listed below are not supported by OpenEd, we can provide support in identifying which resources might be right for your course.

Resources

Site Name and URL	Description
The Chronicle of Higher Education - How to quickly (and safely) move a lab course online https://www.chronicle.com/article/How-to-Quickly-and-Safely/248261	Advice for moving to virtual labs, as well as the pros and cons of some of the available options.
The Derek Bok Center for Teaching and Learning - Science Labs https://bokcenter.harvard.edu/remote-labs	Science labs are often either integrated as components of larger lecture courses (lab sections) or comprise the entirety of smaller lab courses. In both scenarios, it is worth defining what the labs are meant to achieve before selecting an online alternative. This resource outlines three possible scenarios based on the focus of the labs. Since your labs are likely a combination of these scenarios then you could likewise combine these recommendations keeping in mind the appropriate level of time commitment for the combined activities.
Arizona State University -Lab Experiences https://teachonline.asu.edu/2020/03/lab-experiences/	Using a digital learning platform, you can bring traditional labs that are often done in campus immersion courses to the online learning environment, allowing students to fully immerse in the lab experience. Here we'll explore ways to do that. **Includes teaching toolkit for Remote Labs.
Labster -University of Ottawa: Scaling Chemistry Courses with Virtual Labs https://blog.labster.com/university-of-ottawa-scaling-chemistry-courses-with-virtual-labs/	Labster blog post with Dr. Alain St-Amant, a chemistry professor at the University of Ottawa. "He has been using Labster as a part of his course for the past two years. His goal in bringing Labster to the University of Ottawa was to bring context to chemistry and enhance his student's learning experiences. He spoke to us recently about how virtual simulations have added value to his course and helped engage more students in chemistry."

Free Labs & Simulations

Multiple Subjects

Site Name and URL	Description	Supports
PhET https://phet.colorado.edu/	Founded in 2002 by Nobel Laureate Carl Wieman, the PhET Interactive Simulations project at the University of Colorado Boulder creates free interactive math and science simulations. PhET sims are based on extensive education research and engage students through an intuitive, game-like environment where students learn through exploration and discovery.	Sciences Mathematics
The Concord Consortium -Resources for Online Learning https://concord.org/online-learning-resources/	Engage your students with scientifically accurate virtual labs—free today and always! These open educational resources have been funded by the National Science Foundation and other private and federal granting agencies and developed by curriculum experts—so you know you can trust them in your classroom!	STEM
The Concord Consortium -Molecular Workbench http://mw.concord.org/modeler/	The Molecular Workbench (MW) software is a modeling tool for designing and conducting computational experiments across science. It provides an authoring system for instructional designers to create and publish model and simulation-based curriculum materials and delivers an interactive learning environment that supports science inquiry. Is free and open source	Physics, Chemistry Biology Biotechnology Nanotechnology
Wolfram Demonstrations Project https://demonstrations.wolfram.com/	The Wolfram Demonstrations Project is part of the family of free online resources from Wolfram. Its daily growing collection of interactive illustrations is created by participating Wolfram users from around the world.	STEM Business Creative Arts

India -Ministry of Human Resource Development Virtual Labs http://vlab.co.in/	1. To provide remote access to Labs in various disciplines of Science and Engineering. These Virtual Labs would cater to students at the undergraduate level, post graduate level, as well as to research scholars. 2. To enthuse students to conduct experiments by arousing their curiosity. This would help them in learning basic and advanced concepts through remote experimentation. 3. To provide a complete Learning Management System around the Virtual Labs where the students can avail the various tools for learning, including additional web resources, video lectures, animated demonstrations and self-evaluation. 4. To share costly equipment and resources, which are otherwise available to limited number of users due to constraints on time and geographical distances.	Engineering Physical and chemical sciences
PraxiLabs https://praxilabs.com/en/virtual-labs	Tens of 3D simulations for the major experiments of Biology, Chemistry & Physics. Allows your students to access a realistic virtual lab from their devices at any time. Additional multimedia files to help students while performing the scientific experiments.	Biology Chemistry Physics
Lab Xchange https://www.labxchange.org/library	Labs are places of exploration and discovery for every field imaginable. In this spirit, you can discover, engage, and share what you learn on LabXchange. They curate and create world-class digital content, delivered on a free, online platform that lets you integrate your learning and research experiences. Here, you take control of your learning and solve real-world problems as a community. Participation will always be free.	Sciences
MERLOT Collection -Virtual Labs https://www.merlot.org/merlot/materials.htm?keywords=virtual+labs&sort.property=relevance	The MERLOT collection consists of tens of thousands of discipline-specific learning materials, learning exercises, and Content Builder webpages, together with associated comments, and bookmark collections, all intended to enhance the teaching experience of using a learning material. All of these items have been contributed by the MERLOT member community, who have either authored the materials themselves, or who have discovered the materials, found them useful, and wished to share their enthusiasm for the materials with others in the teaching and learning community.	Sciences & Technology Mathematics & Statistics Business
NOVA Interactives https://www.pbs.org/wgbh/nova/	In addition to its weekly television broadcast, NOVA extends its award-winning science reporting both online and in classrooms, producing an extensive list of resources and original content—including short-form videos, science and education blogs—available on our website, pbs.org/nova.	STEM

Biology

Site Name and URL	Description
Modular Digital Course in Undergraduate Neuroscience Education at UCLA https://mdcune.psych.ucla.edu/	The Modular Digital Course in Undergraduate Neuroscience Education (MDCUNE) provides modules of instruction based in neurobiology for faculty to use in their own courses or for independent learning. These modules are inquiry-based but are completely digital so that only computers are required for their execution. These modules have been successfully taught in Psychology and Neuroscience laboratory courses at UCLA and all tutorials and programs are now available for free.
Whiteman College Virtual Fetal Pig Dissection https://www.whitman.edu/academics/departments-and-programs/biology/virtual-pig	Supplement to laboratory dissections exploring introductory mammalian anatomy and physiology
Whole Frog https://froggy.lbl/gov/	Interactive frog dissection, images, 3D rotatable images, stories, and games
Virtual Microscope http://virtual.itg.uiuc.edu/	Virtual microscopes, 90 samples of multi-dimensional, high-resolution image datasets. The Virtual Microscope, available for free download, supports functionality from electron, light, and scanning probe microscopes, datasets for these instruments, training materials to learn more about microscopy, and other related tools
StarGenetics http://star.mit.edu/genetics/	Mendelian genetics cross simulator developed at MIT by biology faculty, researched-trained scientists and technologists at MIT's OEIT. StarGenetics allows students to simulate mating experiments between organisms that are genetically different across a range of traits to analyze the nature of the traits in question. Its goal is to teach students about genetic experimental design and genetic concepts.
UC San Diego -Open Neuroscience Education https://sites.google.com/ucsd.edu/neuroedu	The Allen Institute for Brain Science has an amazing set of open data and resources for both researchers and educators alike. Here are some tools to help you integrate these datasets into your classroom.
Center for Biodiversity and Conservation https://ncep.amnh.org/	Our open access teaching modules improve access to high quality, up-to-date educational resources for conservation teachers and professional trainers around the world, particularly in regions with high biodiversity, significant threats, and limited opportunities. A great addition to any class that has topics of biodiversity, conservation, and ecology. All materials go through peer-review and are designed with evidence-based teaching techniques in mind
Learn Genetics https://learn.genetics.utah.edu/	Interactive techniques labs, online lessons in genetics, cell biology, evolution, human health, plants, neuroscience, ecology

Evo-Ed -Cases for Evolution Education http://www.evo-ed.org/index.htm	We have developed case studies that track the evolution of traits from their origination in DNA mutation, to the production of different proteins, to the fixation of alternate macroscopic phenotypes in reproductively isolated populations.
Biotechnology & Biomedical Engineering Labs https://vlab.amrita.edu/index.php?sub=3	A wide variety of virtual labs spanning topics such as bioinformatics, microbiology, immunology, and others.

Chemistry

Site Name and URL	Description
OrgChem101 Learning Lab https://orgchem101.com/	OrgChem101 is a set of organic chemistry learning modules that provide structured guidance as you (the student) explore organic chemistry concepts. The modules provide metacognitive support, interactive instructional videos, animations, and interactive activities that promote the mastery of concepts, provide feedback, and link to real-world contexts.
Chem Collective CMU http://chemcollective.org/home	There is an exciting FREE online resource for high school chemistry teachers available developed by a collaborative effort between Carnegie Mellon University and WestEd, funded by the US Department of Education's Institute of Education Sciences. This beta-version of online materials aims to teach and reinforce chemistry concepts in the context of real-world scenarios, while incorporating virtual lab activities and strengthening student application of NGSS practices
Royal Society of Chemistry -Titration Experiment http://www.rsc.org/learn-chemistry/resources/screen-experiment/titration/experiment/2	This resource has been developed in partnership with Learning Science and the University of Bristol
American Chemical Society -Virtual Chemistry and Simulations (list of resources) https://www.acs.org/content/acs/en/education/students/highschool/chemistryclubs/activities/simulations.html	List of available virtual simulations for chemistry (including options like PhET and ChemCollective), along with reviews and blog posts about some of the available options.
Chem1 Virtual Textbook: A reference text for General Chemistry http://www.chem1.com/acad/webtext/VT-about.html	"This "reference text" is intended to serve either as a supplement to a regular textbook or as a substitute for one." Terms of use: Creative Commons Attribution 3.0 License

Online Resources for Organic Chemistry (a compilation) https://docs.google.com/document/d/1rvR8ph9fdVrYpAxRAbldXTutrWFMKeDRtTqgYuAQcC8/edit	In light of the need for some faculty to immediately alter the way they deliver content in light of COVID-19, the OrganicERs leadership board has put together this list of resources. **Not all resources listed in document are free**

Math and Physics

Site Name and URL	Description
Maplesoft https://www.maplesoft.com/ products/StudentApps/	Interactive Math apps Maple combines the world's most powerful math engine with an interface that makes it extremely easy to analyze, explore, visualize, and solve mathematical problems.
My Physics Lab https://www.myphysicslab.com/	Physics simulations, animating in real time. Interact with them by dragging objects or changing parameters like gravity.
Boston University -HTLM5 Simulations https://physics.bu.edu/~duffy/HTML5/index.html	Over 200, free physics simulations
Open Source Physics https://www.compadre.org/osp/index.cfm	The OSP Collection provides curriculum resources that engage students in physics, computation, and computer modeling. Computational physics and computer modeling provide students with new ways to understand, describe, explain, and predict physical phenomena. Browse the OSP simulations or learn more about our tools and curriculum pieces below.
The Physics Classroom https://www.physicsclassroom.com/forces-come-in-pairs	**Teachers can easily acquire a no-strings-attached, 100% FREE account until the end of July, 2020.**
Positive Physics https://www.positivephysics.org/	**Free through July 2020 due to Coronavirus closures.** See Positive Physics & The Physics Classroom collaboration https://docs.google.com/spreadsheets/d/17si90o2SAAtcVowVcNd2CG-WLl1hcOayQJgda2hf8qQ/edit#gid=0

Geology

Site Name and URL	Description
Carleton University -Finding Lab Activities Online https://serc.carleton.edu/NAGT Workshops/online/lab_activities.html	List of available resources for virtual labs and simulations in geology.
Geology Lab Study Materials http://profharwood.x10host.com/GEOL101/Study2.htm	A handful of virtual labs with fillable worksheets/lab reports
Virtual Microscope https://www.virtualmicroscope.org/collections	Virtual microscope collections include a full range of rock types native to Earth and beyond. To these we have added minerals and a Cabinet of Curiosities.

Paid Labs

Site	Description	Supports
Labster https://www.labster.com/covid-19/	Labster can help you move science courses online quickly in the event that your school has to close or students decide to stay home. We are here to help with guidance and examples of how other schools are doing it.	Science Engineering
Gizmos https://www.explorelearning.com/	Over 400 math and science Gizmos gives everyone something to graph, measure, and compare. Even predict and prove. That's hundreds of opportunities where students don't just act like scientists and mathematicians. They are. Designed with K-12 in mind. **Can sign up for 60-day free trial**	Sciences Math
PNX Labs http://pnxlabs.com/	PNX Labs is a German Technology company with main offices in Berlin specialized in the development of VR Labs for the STEM (Science, Technology, Engineering and Math) market. Its VR Labs come packed with academic content and real-world applications which allow students to experience a true learning experience in a hazard free environment. They have partnered with leading technology companies in the world to provide a complete package of learning tools which were impossible before without recurring to high cost solutions.	Sciences Engineering

JoVE Science Education https://www.jove.com/science-education-library	JoVE Science Education is a revolutionary video library dedicated to teaching scientific fundamentals through simple easy-to-understand video demonstrations. **JoVE Education videos free until June 15th**	Sciences
EduWebLabs http://eduweblabs.com/ Free trial**	This site was designed to give the student an opportunity to manipulate laboratory equipment, gather data and process that data following standard mathematical and observational techniques. The labs follow procedures found in most school experiments and include the opportunity to make mistakes and observe the results. These labs can be used as stand alone labs, as pre-labs for a classroom assignment or as a setting to learn more about laboratory equipment and data gathering. **Uses Flash**	Sciences
EduMedia https://www.edumedia-sciences.com/en/node/105-global	Developed as a K-12 resource **Free during the Covid-19 crisis**	Sciences