



## 2020/21 course catalog for online high school classes

To see what programs look like, visit [CaveSim.com/distance-learning](https://cavesim.com/distance-learning). For more info, contact us at [info@cavesim.com](mailto:info@cavesim.com), or 914-330-7824.

How our online courses work: you tell us what topics you're covering. We choose a lesson that fits your syllabus, or we custom-design a lesson that meets your needs. You choose one or more dates and times for online classes. We email you a short list of materials that we suggest that students get (not required, but students get more from class if they have materials). We join your class virtually on the chosen days/times.

### Quick facts:

- Video conferencing platforms: We'll use whatever platform you'd like, or we can send you a Zoom link.
- Available subjects: Physics (mechanics, waves, electromagnetics), Chemistry (conservation of matter, exothermic reactions, acid/base reactions, ideal gas law), Biology (macro, micro, and extremophile), Geology, Hydrology, Engineering. See "Course offerings" below for more information.
- Learning types: Students can be in-class, at home, or hybrid.
- Duration: Typical classes last about 60 minutes. We will adjust to fit your needs.
- Classes per day: We can work with as many classes per day as you would like. You can use [this template schedule](#) (make a copy of it and customize it to meet your actual schedule)
- Activities: We teach the lessons described below, and engage students with activities throughout the class period.

In 2020, we did 36 days of online classes. Here's what other teachers and administrators are saying:

*"Each time they have presented an informative, interactive, hands-on experience that my students talk about for weeks! Thank you Dave, and we look forward to next time!"* Janny Jarvis, CTE teacher, Tesla Education Opportunity High School, Colorado Springs

*"The class was an excellent mix of technical caving demonstrations and the scientific principles that are involved in exploring caves. Dave did a great job of engaging the students and keeping them connected with hands on labs to explore how rock type, weathering and erosion play a part in cave formation."* Corey Combs, science teacher, Holmes Middle School, Colorado Springs, CO

*"That was great. I liked the way you tried to get different students involved, had them providing words, making connections, etc. Great job."* Yann Ulrich, assistant principal, Holmes Middle School, Colorado Springs, CO

### Course offerings (with links to video examples):

- Physics ([CaveSim Distance Learning Lesson 1: Vertical Caving](#))
  - Description: students gain an intuitive understanding of physics concepts via vertical caving demonstrations on a 12' tower, pulley experiments, knots, friction demos (including a rope-slicing demo in which we cut through a piece of webbing with parachute cord and talk about molecular interactions).
  - Student involvement: Students actively participate from home or the classroom using simple materials like a metal fork, rope, and a shoelace to learn about friction (static and dynamic) and the physics of knots.
  - Science topics covered: mechanical advantage, friction, conservation of work, scientific method, physics terminology, logic and reasoning.
- Chemistry with carbide lamps: ([CaveSim Distance Learning Lesson 4: Chemistry](#))

- Description: students learn about chemical reactions with exciting carbide lamp demonstrations, as well as acid/base reaction demos. We use a digital scale and a custom-designed carbide lamp to demonstrate conservation of mass.
- Student involvement: students participate by producing safe exothermic reactions with vinegar and powdered laundry detergent. See also the geology lessons below which include acid-base reaction activities.
- Science topics covered: experiment safety, conservation of mass, exothermic reactions, the ideal gas law, science terminology (e.g., flammable, exothermic), limiting reactants, acid/base reactions.
- Biology ([CaveSim Distance Learning Lesson 2](#))
  - Description: students learn about the unique macro- and microbiological food web that exists in caves, and about the exciting ways in which cave-dwelling creatures like bats help humans.
  - Student involvement:
    - Minimal-materials activities: echolocation exercise with a blindfold in which students see if they can detect a wall before they bump into it; echolocation exercise with a friend to demonstrate the power of stereo hearing.
    - Materials-intensive lab: Slime mold experiments in which participants use living *Physarum Polycephalum* to demonstrate the amazing material transport efficiency of single-celled organisms
  - Science topics covered: microbiology (the role of rock-metabolizing bacteria in cave formation), food webs, adaptation and inheritance, habitats, species classification, the role that single-celled organisms play in helping humans develop efficient computer code, emerging work by NASA in exoplanetary microbiology.
  - Other topics covered: the role of bat guano in Civil War history
- Geology ([CaveSim Distance Learning Lesson 3: Geology part 1](#))
  - Description: students learn about the different types of rocks and how we can test rocks to figure out what they are. We do demonstrations with HCl acid, and talk about how different cave formations grow.
  - Student involvement: Students will participate by finding rocks at home and doing some of the simple tests, including Mohs hardness test, sink/float test, magnetism test, and rock solubility test (which students can do using vinegar).
  - Science topics covered: experiment safety, acid/base reactions, precipitation reactions, geology (metamorphosis, rock types, fossils), oil/water interaction, science terminology.
- Hydrogeology and landforms ([CaveSim Distance Learning Lesson 3: Geology part 2](#))
  - Description: in this follow-up lesson about geology and earth science, students will go hands-on using simple household materials like cups, sugar, and baking soda. Students will get to do one or more of the following: (1) grow their own cave formations and/or (2) make their own cave sinkhole in a cup.
  - Student involvement: Students gather household materials like cups, sugar, sand, string, paper, tape, etc. to do one or both of the labs described above
  - Science topics covered: experiment design, chemical reactions, geology, hydrology
  - Other topics covered: conservation, environmental engineering
- STEM lab ([CaveSim Distance Learning Lesson 5: Energy and Waves](#))
  - Description: students will go hands-on using simple household materials like cups and string to learn about different types of energy, and conversion from one type of energy to another. Students will see demos with home-made waterproof speakers and high-tech engineering equipment to learn that sound is a mechanical wave, and to learn that electrical energy can be converted into mechanical energy. Students will also see a demo of some equipment repair to learn about how engineering really works.

- Student involvement: Students will use cups and string to make cup phones, and will conduct a series of experiments to learn about wave propagation.
- Science topics covered: forms of energy, graphing, frequency/pitch/period/amplitude, experiment design, engineering
- Art ([CaveSim Distance Learning Lesson 6: Art](#))
  - Description: students will go hands-on with art using simple materials that they have at home. Students will learn about how ancient people made rock art in caves using pigment blown through a bone or reed.
  - Student involvement: students will make their own paint using ground-up charcoal and water, and will then spray their paint (using an arrangement of straws in a cup) to make hand-stencil paintings.
  - Science topics covered: the Bernoulli principle
  - Other topics covered: early hominid art, art preservation, painting techniques
- Maker lab ([CaveSim Distance Learning Lesson 7: Ropes, carabiners, and taking stuff apart](#))
  - Description: We dissect and repair several pieces of vertical caving equipment, including carabiners and dynamic kern mantle rope. This allows us to showcase a variety of different tools, from the hot knife to the Dremel tool.
  - Student involvement: using found materials, students design an impact-absorbing device intended to protect a brittle piece of wood. Students test their device by suspending a heavy object from a string and then cutting the string, causing the object to fall on their device (this simulates an experiment that we do on the vertical caving tower with a cut rope)
  - Science topics covered: potential and kinetic energy, elastic and inelastic collisions, prototyping, material science.
- Maker lab part 2 ([CaveSim Distance Learning Lesson 8: Sparks, heat, and high-tech tools](#))
  - Description: We dissect and repair a piece of high-tech electronic test equipment, and show how this equipment can be used to test cave rescue phones and waterproof speakers.
  - Student involvement (requires adult supervision and safety glasses): Students use capacitors, wire, and resistors to learn about basic electronic components and their uses. We will send you a materials list with links where you can purchase low-cost materials. Exciting experiments include: making sparks with a capacitor; making heat with a capacitor and resistor; making light with a capacitor, resistor, and LED.
  - Science topics covered: forms of energy (and conversion among electrical, thermal, and mechanical energy), electromagnetics.

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