

Dr. Rider's Laboratory at Voyagers

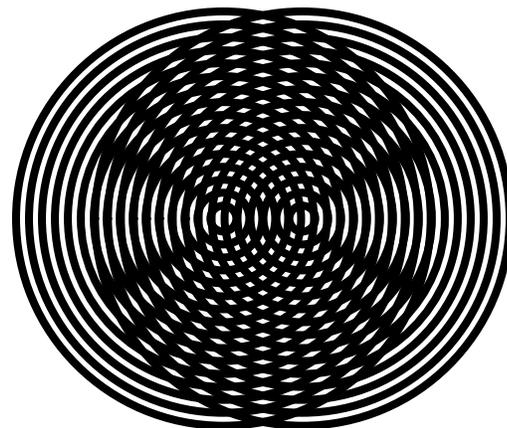
Physics

Mondays 1:00-2:30 Spring 2020

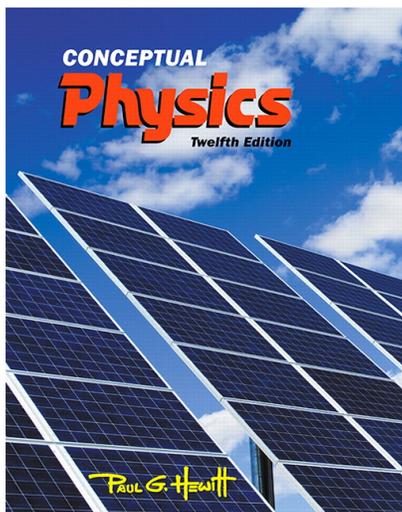
\$390 members/\$440 nonmembers

Chelmsford, MA voyagersinc.org

Dr. Todd H. Rider, thor@riderinstitute.org



This course will present an overview of physics, ranging from Newton's laws to relativity and quantum physics. **No prior knowledge is required—new students are very welcome to join.** Each class will have short lectures but will mainly focus on hands-on lab activities using high-quality pulleys, centrifuges, electronics, optical components, Geiger counters, and other professional laboratory equipment. It is recommended (though not required) that students buy a physics textbook for supplementary readings during each week. Students can use **either** Paul Hewitt's *Conceptual Physics* **or** Young & Freedman's *University Physics with Modern Physics* (make sure it says that last part—some versions do not):



For younger/less
experienced
students:

12th ed. (2014)

or

11th ed. (2009)

or

10th ed. (2005)

or

9th ed. (2001)

OR

For older/more
experienced
students:

15th ed. (2019)

or

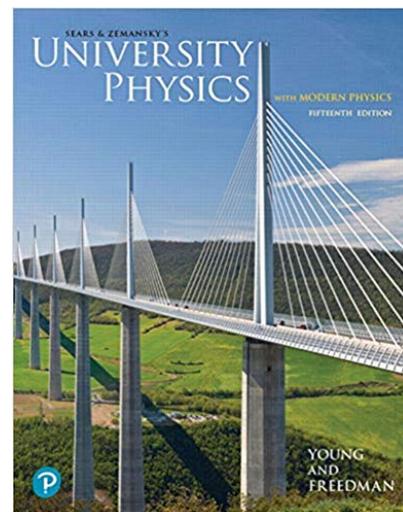
14th ed. (2015)

or

13th ed. (2011)

or

12th ed. (2007)



| Date | Topic | Hewitt | or | Young & Freedman |
|------|----------------------------------|------------|----|------------------|
| 1/27 | Electric and magnetic fields | Ch. 22, 24 | | Ch. 21, 27 |
| 2/3 | Electric circuits | Ch. 23 | | Ch. 25-26 |
| 2/10 | Electromagnetic fields and waves | Ch. 25, 26 | | Ch. 29, 32 |
| 2/17 | [No class—vacation week] | | | |
| 2/24 | Colors and polarized light | Ch. 27, 29 | | Ch. 33 |
| 3/2 | Refraction | Ch. 28 | | Ch. 34 |
| 3/9 | Diffraction | Ch. 28 | | Ch. 35-36 |
| 3/16 | Special relativity | Ch. 35 | | Ch. 37 |
| 3/23 | General relativity | Ch. 36 | | Ch. 44 |
| 3/30 | Nonrelativistic quantum physics | Ch. 31 | | Ch. 38-40 |
| 4/6 | Relativistic quantum physics | Ch. 32 | | Ch. 41, 44 |
| 4/13 | Nuclear structure and decay | Ch. 33 | | Ch. 43 |
| 4/20 | [No class—vacation week] | | | |
| 4/27 | Nuclear fission and fusion | Ch. 34 | | Ch. 43 |

Note: Chapter numbers may vary in some editions, so always verify that the chapter's topic matches the intended topic.

New textbooks are insanely expensive, but more affordable used copies are available from online dealers at amazon.com, abebooks.com, etc. Students can also save money (without losing much scientific content) by buying an edition that is recent but not the very latest edition. Dr. Rider will bring copies of the textbooks to the first class if you would like to examine them before deciding which one to order. He can suggest free information sources online for those who prefer not to buy a book.

Students are encouraged to pursue their own independent studies or science fair projects outside of the course. Dr. Rider is happy to offer suggestions or advice. Some useful books on setting up a home lab are:

Raymond E. Barrett & Windell H. Oskay, *The Annotated Build-It-Yourself Science Laboratory* (2015)

Janice VanCleave, *A+ Projects in Physics* (2003)

...for the *Evil Genius* book series [various authors]

David Prutchi & Shanni Prutchi, *Exploring Quantum Physics through Hands-on Projects* (2012)

A good source of supplies for setting up a home lab is:

www.homesciencetools.com (Great quality, selection, and price; ignore the creationist books)

www.sciplus.com (Random assortment of weird and wonderful supplies)

Information on upcoming science fairs and previous winning projects is available at:

www.societyforscience.org

About the instructor:

Dr. Todd H. Rider received his Ph.D. from MIT, and his research has been featured in magazines ranging from *Science* to *Time* and on TV programs from NBC's Nightly News to BBC's Horizon. In biology research, he invented and developed the CANARY sensor, which uses genetically engineered white blood cells to rapidly identify bacteria, viruses, and other pathogens. Dr. Rider also invented the DRACO broad-spectrum antiviral therapeutics and demonstrated that they are safe and effective against 18 different viruses in cells and 4 viruses in mice. In physics research, he discovered fundamental physical limitations on nuclear fusion reactors, analyzed antimatter rocket engines, and demonstrated methods to combine numerous laser beams to form more powerful laser beams. He created the K-12 Science on Saturday program at MIT and has over 25 years of experience teaching biology, chemistry, physics, earth science, engineering, and archaeology courses to students at all levels. He is currently working on his plan for world domination.

