Physical Science and Physics
Courses for K-12 Teachers

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All 600-level physics courses at UVa are graduate credit, professional development courses primarily designed for teachers.

- The courses are not used for any physics graduate degrees except MAPE
- MAPE is our Master of Arts in Physics Education degree
- Courses are at the undergraduate level – mostly first year
- Level of courses are usually indicated
Background

• Many decades of experience at UVa in doing these courses
• Lindgren and Thornton – since early 1990s
• Lindgren and Thornton have taught almost 200 of these courses for thousands of teachers
Purpose

• More content in physics or physical science
• Certification to teach physical science in middle/high school
• Certification to teach high school physics
• Recertification points
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Courses have different purposes and presentation options.

- **Distance Learning**
  - PHYS 601, 602  Concepts of Physics for Elementary School Teachers I, II – Begins Fall 2005
  - PHYS 605, 606  How Things Work I, II
  - PHYS 609  Galileo and Einstein
  - PHYS 633  Classical and Modern Physics III (modern physics)
  - PHYS 641  Physics Pedagogy

- **Residence only**
  - PHYS 611, 612  Physical Science for Teachers
  - PHYS 631, 632  Classical and Modern Physics I, II
  - PHYS 635, 636  Curriculum Enhancement I, II

- **Other**
  - PHYS 613  Topics in Physical Science (also JLAB)
  - PHYS 620  Topical Physical Science (local school systems)
Courses have different purposes and presentation options.

• **Laboratory setting**
  PHYS 611, 612  Physical Science for Teachers
  PHYS 635, 636  Curriculum Enhancement I, II

• **Primarily for K-8 teachers**
  PHYS 601, 601  Concepts of Physics for Elementary School Teachers I, II
  PHYS 611, 612  Physical Science for Teachers
  PHYS 620  Topical Physical Science

• **Primarily for high school teachers**
  PHYS 631, 632, 633  Classical and Modern Physics I, II, III
  PHYS 635, 636  Curriculum Enhancement I, II
  PHYS 641  Physics Pedagog
Courses have different purposes and presentation options.

- For all K-12 teachers
  - PHYS 605, 606  How Things Work I, II
  - PHYS 609  Galileo and Einstein
  - PHYS 613  Topics in Physical Science
  - PHYS 640  Independent Study

- Calculus based
  - PHYS 631, 632, 633  Classical and Modern Physics I, II, III
PHYS 601, 602 – (3) (Y) Concepts of Physics for Elementary School Teachers I, II

Prerequisites: Undergraduate degree or instructor permission. Primarily for teachers with little or no background in physics. 601 is a course in classical physics including mechanics, heat, electricity, magnetism, and waves with many applications. 602 is a course in modern physics including waves, optics, relativity, atomic structure, nuclear physics with many applications. This may be a distance-learning course for in-service teachers. Not suitable for physics majors or any graduate degrees in physics (including the Masters of Art in Physics Education). The two courses may be taken in any order.
PHYS 605, 606 - (3) (SI)  
How Things Work I, II  
*Prerequisite:* Undergraduate degree or instructor permission.  
These courses consider objects from our daily environment and explain how they work with emphasis on physics concepts. PHYS 605 focuses on mechanics and heat; PHYS 606 treats objects involving electromagnetism, light, special materials, and nuclear energy. These may be distance learning courses intended for in-service science teachers with lectures, homework and exams conducted via the internet.
PHYS 609 - (3) (SI)
Galileo and Einstein

*Prerequisite:* Undergraduate degree or instructor permission.
This course examines how new understanding of the natural world developed from the time of Galileo to Einstein taking the two famous scientists as case studies. This may be a distance learning course intended for in-service science teachers with lectures, homework and exams conducted via the internet.
PHYS 611, 612 - (3) (IR)
Physical Science for Teachers

Prerequisite: Undergraduate degree and presently (or intending to be) a K-8 teacher. Laboratory-based course providing elementary and middle school teachers hands-on experience in the principles and applications of physical science. Not suitable for physics majors; no previous college physics courses are assumed.
PHYS 613 - (1-3) (SI)
Topics in Physical Science

*Prerequisite:* Undergraduate degree or instructor permission.
Small classes studying special topics in physical science using cooperative teaching in a laboratory setting. Hands-on experiments and lecture demonstrations allow special problems to be posed and solved. May be taken more than once.
PHYS 620 - (1) (SI)
Topical Physical Science
Prerequisite: Undergraduate degree or instructor permission.
A series of one-credit science courses of interest to K-12 teachers, as well as the general public. These courses are offered anywhere in the state as needed through School of Continuing and Professional Studies regional centers. The courses are designed to meet Virginia’s SOLs and consist of lectures, demonstrations, and many hands-on science activities. Current course topics include Sound, Light & Optics, Aeronautics and Space, Electricity, Meteorology, Magnetism, Heat & Energy, Matter, and Force & Motion. May be taken more than once.
PHYS 620 courses

620A  Sound
620B  Light and Optics
620C  Aeronautics and Space
620D  Electricity
620E  Meteorology
620F  Magnetism
620G  Heat and the Conservation of Energy
620H  Properties of Matter
620I  Force and Motion
CLASSICAL AND MODERN PHYSICS I, II, III

Prerequisite: Undergraduate degree and instructor permission.

A comprehensive study of physics using some calculus and emphasizing concepts, problem solving, and pedagogy. The courses are typically taught for 3-4 weeks in the summer with a daily two-hour lecture and two-hour problem session. Problem sets continue for two months into the next semester.

I. Motion, kinematics, Newton’s laws, energy and momentum conservation, gravitation, harmonic motion, waves, sound, heat, and fluids.

II. Coulomb’s law, Gauss’s law, electrostatics, electric fields, capacitance, inductance, circuits, magnetism, electromagnetic waves, and geometric and wave optics.

III. Relativity and modern physics.
PHYS 635, 636, 637 - (3) (SI)
Curriculum Enhancement I, II, III

Prerequisite: Undergraduate degree and instructor permission.

A laboratory sequence normally taken concurrently with PHYS 631, 632, 633, respectively. It includes experiments with sensors that are integrated with graphing calculators and computers and other experiments using low cost apparatus. The courses are typically held in the summer for four weeks and are extended into the next semester creating an activity plan. The laboratories utilize best teaching practices and hands-on experimentation in cooperative learning groups.
PHYS 640 - (3-6) (SI)

Independent Study

Prerequisite: Undergraduate degree and instructor permission.

A program of independent study for in-service science teachers carried out under the supervision of a faculty member culminating in a written report. A typical project may be the creation and development of several physics demonstrations for the classroom or a unit activity. The student may carry out some of this work at home, school, or a site other than the University.
PHYS 641 - (3) (Y)
Physics Teaching Pedagogy
*Prerequisite:* PHYS 631, 632, 633, 635, and 636 or permission of instructor.

A course in the pedagogy of teaching secondary school physics. This is a distance-learning course intended for in-service teachers desiring to teach secondary school physics. Not suitable for physics majors.
For More Information:

Website:  www.k12.phys.virginia.edu

Email:  PhysicsEducation@Virginia.edu