



# SH1014 Modern Physics 4.0

## credits

Modern fysik

This is a translation of the Swedish, legally binding, course syllabus.

### Establishment

The official course syllabus is valid from autumn semester 2026 as decided by the Director of First and Second Cycle Education. Decision date: 2026-06-17

### Grading scale

A, B, C, D, E, FX, F

### Education cycle

First cycle

### Main field of study

Technology

### Specific prerequisites

At least one examination (TENx component) in SK1104 Classical Physics, SK1115 Electromagnetism and Wave Theory, or SK1112 Physics I must be passed.

### Intended learning outcomes

After completing this course a student should be able to:

- Explain the scientific basis of modern physics, as defined by the course syllabus.

- Set up and perform relativistic calculations for simple cases and quantum mechanical calculations on simple systems
- Apply quantum mechanical principles to scientific and technical applications

## Course contents

The experimental foundations of modern physics: Elementary relativity theory. The Michelson-Morely experiment. Einstein's theory of special relativity. Length contraction. Time dilation. Elementary quantum physics. Planck's radiation law. X-ray radiation and spectra. Rutherford's atomic model. Atomic structure. Bohr's atomic model. Atomic energy levels. Nuclear structure. Radioactive decay. Matter waves. Wave packets and the Heisenberg Uncertainty Principle. Wave-particle duality. Quantum mechanics: the foundations of quantum mechanics. The Schrödinger equation applied to simple potentials. Interpretation of wave functions. Plane wave solutions. The harmonic oscillator. Angular momentum and spin. The hydrogen atom and the periodic table. The Pauli principle. Applications to physical phenomena: the photoelectric effect, the Compton effect, X-ray diffraction, particle diffraction. Applications within science and technology (including) tunneling, the tunneling electron microscope, the Stern-Gerlach experiment, the atomic nucleus, the helium atom, simple molecules, solid matter. The building blocks of matter: particles and their interactions.

## Examination

- TEN1 - Exam, 4.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

## Other requirements for final grade

Pass the Written exam, 4,0 hp

## Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.