

# PHYSICS: 7-12 PHYSICAL SCIENCE TEACHER PREPARATION CONCENTRATION, BACHELOR OF SCIENCE

## Expected Student Outcomes

Upon successful completion of the physics major, students will be able to:

- Think critically and logically and use the scientific method in their future investigations.
- Understand and apply knowledge of various subfields of physics at the undergraduate level and make a successful transition to technical fields, including engineering, teaching, business, and graduate studies.
- Effectively communicate their results orally and in writing.
- Learn independently, locate and use appropriate sources of technical material and make use of modern scientific and computational tools.

## Outcomes Assessment Activities

The Physics Program faculty will assess the skills, capacities, and knowledge of its majors as follows:

- The student must complete a senior research project including a formal presentation of results both in writing and orally to at least two members of the physics faculty (except for those in the teaching concentration areas).
- The student must take the Physics Major Field Achievement Test offered by The Educational Testing Services (ETS) or another departmentally approved exam covering the sub-fields in physics at some point during his/her senior year (except for those in the teaching concentration areas).
- By maintaining a portfolio for each student which contains college grades, records of special skills acquired, senior research project results, Field Achievement Test results and a record of co-curricular activities. The portfolio will remain on file in the department and will be added to as additional information is obtained from student or employer.

The program faculty believes that improvement in the skills, capacities, and knowledge of its minors can be assessed through required course work. The course grade will be a measure of the student's grasp of the basics in each discipline.

## Specific Program Requirements

- Students graduating with a BS in physics must have at least a 2.000 grade-point average in physics courses and no more than four credits in physics with grades of D.
- Students graduating with a minor in physics must have at least a 2.000 grade-point average in physics.
- A 2.500 grade-point average in the major area is required for admission to the teacher education program.

- At least 12 physics credits applied to the major (seven for minor) must be earned at CSU Pueblo with a C or better average.
- Students must have earned a C or better grade in lower-division prerequisite courses before being admitted to upper-division courses in physics.
- In all but the teaching concentration areas, students must demonstrate knowledge of computer programming.
- In all but the teaching concentration areas, majors are required to take the senior research course, in which students become involved in a theoretical or experimental research problem relating to physics under the supervision of a department faculty member.
- A fundamental understanding of chemistry and its lab techniques is required of all majors.

| Course                        | Title   | Credits        |
|-------------------------------|---|----------------|
| <b>PHYS Courses</b>           |   |                |
| PHYS 221 & 221L               | General Physics I and General Physics I Lab (GT-SC1)                | 5              |
| PHYS 222 & 222L               | General Physics II and General Physics II Lab (GT-SC1)              | 5              |
| PHYS 301                      | Analytical & Orbital Mechanics                                      | 4              |
| PHYS 321                      | Thermodynamics  | 3              |
| PHYS 322                      | Advanced Laboratory - Thermo  | 1              |
| PHYS 323 & 323L               | General Physics III and General Physics III Lab                     | 5              |
| PHYS 341                      | Optics  | 3              |
| PHYS 342                      | Advanced Laboratory-Optics  | 1              |
| PHYS 431                      | Electricity & Magnetism   | 4              |
| PHYS 432                      | Advanced Laboratory-Electricity and Magnetism                       | 1              |
| PHYS 441                      | Quantum Mechanics   | 4              |
| PHYS 480                      | Practicum in Laboratory Instruction                                 | 1              |
| PHYS 492                      | Research  | 1              |
| PHYS 493                      | Seminar   | 1              |
| PHYS 499                      | Thesis Research   | 1              |
| <b>Other Required Courses</b> |   |                |
| CHEM 121 & 121L               | General Chemistry I (GT-SC2) and General Chemistry Lab I (GT-SC1)   | 5              |
| CHEM 122 & 122L               | General Chemistry II (GT-SC2) and General Chemistry Lab II (GT-SC1) | 5              |
| MATH 242 or EN 103            | Introduction to Computation Problem Solving for Engineers           | 3-4            |
| MATH 126                      | Calculus & Analytic Geometry I (GT-MA1)                             | 5              |
| MATH 207                      | Matrix and Vector Algebra with Applications                         | 3              |
| MATH 224                      | Calculus and Analytic Geometry II                                   | 5              |
| MATH 325                      | Intermediate Calculus   | 4              |
| MATH 337                      | Differential Equations I  | 3              |
| MATH 338                      | Differential Equations II   | 3              |
| <b>Approved Math Elective</b> |   |                |
| Select 3-4 credits            |   | 3-4            |
| <b>General Education</b>      |   |                |
| Select 24 credits             |   | 24             |
| <b>Electives</b>              |   |                |
| Select 15-17 credits          |   | 15-17          |
| <b>Total Credits</b>          |   | <b>118-122</b> |

## Specific Concentration Requirements

| Course                         | Title  | Credits        |
|--------------------------------|--|----------------|
| <b>PHYS Courses</b>            |  |                |
| PHYS 110<br>& 110L             | Astronomy (GT-SC2)<br>and Astronomy Lab (GT-SC1)                                   | 4              |
| PHYS 140<br>& 140L             | Light, Energy, & the Atom (GT-SC2)<br>and Light, Energy and the Atom Lab (GT-SC1)  | 4              |
| PHYS 221<br>& 221L             | General Physics I<br>and General Physics I Lab (GT-SC1)                            | 5              |
| PHYS 222<br>& 222L             | General Physics II<br>and General Physics II Lab (GT-SC1)                          | 5              |
| PHYS 323<br>& 323L             | General Physics III<br>and General Physics III Lab                                 | 5              |
| <b>CHEM Courses</b>            |  |                |
| CHEM 121<br>& 121L             | General Chemistry I (GT-SC2)<br>and General Chemistry Lab I (GT-SC1)               | 5              |
| CHEM 122<br>& 122L             | General Chemistry II (GT-SC2)<br>and General Chemistry Lab II (GT-SC1)             | 5              |
| Select one of the following:   |  | 4-5            |
| CHEM 211<br>& 211L             | Introduction to Organic Chemistry<br>and Intro to Organic Chemistry Lab            | 4              |
| CHEM 301<br>& 301L             | Organic Chemistry I<br>and Organic Chemistry Lab I                                 | 5              |
| CHEM 317<br>& 317L             | Quantitative Analysis<br>and Quantitative Analysis Lab                             | 5              |
| CHEM 321                       | Physical Chemistry I   | 3              |
| CHEM 378                       | Practicum in Laboratory Instruction  | 1              |
| <b>Other Required Courses</b>  |  |                |
| BIOL 100<br>& 100L             | Principles of Biology (GT-SC2)<br>and Principles of Biology Lab (GT-SC1)           | 4              |
| BIOL 121<br>& 121L             | Environmental Conservation (GT-SC2)<br>and Environmental Conservation Lab (GT-SC1) | 4              |
| GEOL 101<br>& 101L             | Earth Science (GT-SC2)<br>and Earth Science Lab (GT-SC1)                           | 4              |
| MATH 126                       | Calculus & Analytic Geometry I (GT-MA1)  | 5              |
| MATH 224                       | Calculus and Analytic Geometry II  | 5              |
| ED 444                         | Teaching Secondary Science   | 4              |
| <b>General Education</b>       |  |                |
| Select 21 credits              |  | 21             |
| <b>Education Minor Courses</b> |  | <b>33</b>      |
| <b>Total Credits</b>           |  | <b>126-127</b> |