

# Department of Chemistry and Physics

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## College of Arts and Sciences

### Faculty

**Randy F. Johnston** (1994). Professor of Chemistry and Department Chair. B.S., University of Missouri, St. Louis; Ph.D., Texas Tech University.

**Charles M. Baldwin** (1970-81, 1988). O.P. and Evalyn Hammons University Professor of Pre-Medical Studies. B.A., University of Corpus Christi; Ph.D., Texas Tech University; CChem FRSC. Additional study, University of Texas, Stanford University, Imperial College (London).

**Jimmy H. Davis** (1978). Professor of Chemistry and Associate Provost. B.S., Union University; Ph.D., University of Illinois; Additional study, University of Florida, Oak Ridge Associated Universities, Argonne National Laboratory, Harvard University and Oxford University (England).

**Kyle L. Hathcox** (1974-88, 1994). Professor of Physics and Coordinator of Physics. B.S. and Ph.D., University of North Texas; Additional study, Oak Ridge Associated Universities.

**Sally A. Henrie** (1998). Assistant Professor of Chemistry. B.S., University of Arizona; Ph.D., South Dakota State University.

**Carol Leslie** (1985). Associate Professor of Chemistry. B.S., University of Tennessee at Martin; M.S., University of Tennessee at Knoxville.

**Glenn A. Marsch** (1996). Associate Professor of Physics. B.S., Clemson University; Ph.D., Florida State University. Additional study, Iowa State University, Lawrence Livermore National Laboratory, University of California at San Francisco, Calvin College, and Vanderbilt University.

**Marlyn Newhouse** (1992). Associate Professor of Chemistry. M.A. and B.S.Ed., Northern Arizona University; D.A., Middle Tennessee State University.

**David A. Ward** (1992, 1999). Associate Professor of Physics, B.S. and M.A., University

## Chemistry

Students pursuing a major in Chemistry must complete Math 211-212, Physics 231-232, and meet the following requirements in Chemistry:

### I. Major in Chemistry—46 hours

- A. Core Requirements: CHE 111, 112, 211, 221, 314, 315, 317, 318, 319, 324, 325, 327, 335, 498
- B. Research, 3 hours from: 424 or 425
- C. One of: 405, 430, 435

### II. Major in Medical Technology

Leading to the Bachelor of Science in Medical Technology

- A. Chemistry 111, 112, 211-21, 314-15, 319, 324-25
- B. Biology 112, 211, 221, 222, 315, 316, 320
- C. Physics 213-214 or 231-232
- D. Computer Science (3 hours) and MAT 111 or preferably MAT 211
- E. A minimum of 33 hours of Medical Technology at an affiliated hospital as the fourth year of study.

### III. Major in Chemical Physics\*—105 semester hours

- A. Chemistry 111-112, 211, 221, 314-315, 324-325, 317-318, 327, 319, 335 ..... 34
- B. Physics 231-232, 311, 313, 314; 325 or 420; 430 ..... 26
- C. PHY 424 or CHE 424; PHY 498 or CHE 498; Upper level PHY or CHE ..... 6
- D. Math 211-212, 213, 314 ..... 15
- E. English 111-112; 201 or 202 ..... 9
- F. Art 210; CHR 111, 112; and 9 hours of social science ..... 18

\*This is a three year program for talented students. Qualifications are listed below. Students who are not qualified for the 3-year program may extend the program to four years and must meet all graduation requirements in doing so.

### IV. Teacher Licensure with Endorsement in Chemistry 7-12

- A. Complete the requirements for the Chemistry major as shown above including CHE 405.
- B. Professional Education: EDU 150, 250, 326, 418, 433; PSY 213, 318; SE 225
- C. Completion of applicable portions of the Praxis II.
- D. For additional information, see the Director of Teacher Education.

### V. Teacher Licensure With Dual Endorsements in Chemistry 7-12 and Physics 7-12

- A. Complete the requirements for the Chemical Physics major including both PHY 498 and CHE 498 plus PHY 317.
- B. Professional Education: EDU 150, 250, 326, 418, 433; PSY 213, PSY 318, SE 225.
- C. Completion of applicable portions of the Praxis II.
- D. For additional information, see the Director of Teacher Education.

### VI. Minor in Chemistry—26 or 27 hours

- A. CHE 111, 112, 211, 221, 314, 315, 324 325
- B. Elective, one of: 317, 319, 335, 405, 430

Entrance into the program as a freshman will be permitted under the following conditions:

**The C.R.C. Freshman Chemistry Award**, given to encourage and sustain interest in the sciences, is awarded in recognition of outstanding scholastic achievement in Freshman Chemistry.

chemical hazards, and proper ways to label, handle, store, and dispose of hazardous chemicals.

**301. Perspectives in Science (4) F, W**

See PHY 301 for course description.

**314. Organic Chemistry I (3) F**

Prerequisite: CHE 112; Corequisite: CHE 324.

An introduction to the compounds of carbon, with emphasis on the relationship between structure and properties. Applications of bonding theory, reaction mechanism, and stereochemistry are included. Some functional groups containing halogen and oxygen will be examined in detail. Three lectures per week.

**315. Organic Chemistry II (3) S**

Prerequisite: CHE 314; Corequisite: CHE 325.

An in-depth examination of the common oxygen and nitrogen functional groups with respect to structure and chemistry. Continued application of basic theory is included. Heterocyclic and biomolecules will also be examined. Three lectures per week.

**317. Physical Chemistry I (3) F**

Prerequisites: CHE 211, MAT 212, and PHY 232.

An introduction to the application of physical techniques to chemical systems with emphasis on thermodynamics. The laws of thermodynamics will be derived and applied to phase and chemical equilibria, electrochemical cells, and surface phenomena. Three lectures.

**318. Physical Chemistry II (3) S**

Prerequisite: CHE 317.

A continuation of CHE 317 with emphasis on dynamics and quantum chemistry. Dynamics include kinetics, mechanisms, and photochemistry. Quantum chemistry includes atomic and molecular electronic structure and their application to spectroscopy. Three lectures.

**319. Biochemistry (4) F**

Prerequisite: CHE 315, CHE 325, and BIO 112.

An introduction to the organic chemistry of living systems. Topics include structure and function of proteins, enzymic control of chemical reactions, catabolism, anabolism, bioenergetics, biosynthesis, and molecular biology. Three lectures and one 3-hour lab per week.

**324. Organic Chemistry I Laboratory (2) F**

Corequisite: CHE 314.

An introduction to the basic techniques for the physical characterization and isolation of organic compounds. Use of spectrometric methods as applied to the determination of structure is included, as are some synthetic methods. Two three-hour laboratory periods per week.

**325. Organic/Inorganic Synthesis Laboratory (2) S**

Prerequisite: CHE 314 and CHE 324; Corequisite: CHE 315.

Application of laboratory techniques in synthesis and characterization of organic and inorganic compounds. Two three-hour laboratory periods per week.

**327. Physical Chemistry Laboratory (2) S**

Corequisite: CHE 318.

The application of physical methods in the study of chemical compounds. Two three-hour laboratory periods per week.



Basic principles of the pathogenesis of infection are covered with particular emphasis on theory and techniques for lab diagnosis.

**423. Serology (2)**

A lecture and lab course in immunology, which presents the basic principles of immunity as related to pathogenic organisms and the more complex reactions of the host. Laboratory methods of demonstrating reactions between antigens and antibodies are considered. Use of these reactions as a serodiagnostic tool is presented.

**424. Immunohematology (5)**

Includes selection, testing and bleeding of donors, identification of blood group antigens and antibodies, procedures employed in providing compatible blood for patients, and principles and procedures used in blood component therapy. Lecture and lab exercises are employed.

**425. Parasitology (2)**

A study of parasites of medical significance, both indigenous and foreign, with particular emphasis on life cycles and identification, is presented through lectures and laboratory practice.

**431. Urinalysis (2)**

A lecture and lab course which includes the gross, physical, microscopic, and chemical analysis of urine.

**432. Clinical Correlations (1)**

Basic understanding of altered physiology in disease; correlation between laboratory test results and anatomical/physiological changes.

**440. Principles of Management and Ethics (0)**

Preparation for the the medical graduate for positions of leadership as supervisors and instructors. General principles of management and of education are discussed through lecture, student projects, and audio-visual aids.

Union University students may enroll for courses taught at the Gulf Coast Research Laboratory during the summer and courses taught at Oak Ridge Associated Universities. For information see the Chemistry/Physics Department Chair.

**Physics**

It is the purpose of the department to help the student understand the workings behind many of the physical phenomena that occur around him/her every day and to stimulate his/her interest in realizing and utilizing the powers of analysis in all aspects of life. The courses are designed to provide basic content for students classified as physics majors/minors, non-science majors, pre-professionals, and those preparing to teach physics in high school. Included also are courses of general interest open to all students.

**I. Major in Physics—38 semester hours**

- A. Physics 231-232, 311, 313, 314, 317, 325, 395\*, 420, 430, 424, 498
- B. Prerequisites in Math: 211, 212, 213, 314

\*Must be approved Special Studies

**II. Major in Physical Science—48 hours**

- A. Chemistry 111-112, 211, 221, + three hours CHE electives ..... 16
- B. Physics 112, 231-232, 311, 310 or 301, + 2 hours PHY elective ..... 24
- C. Biology 8 hours ..... 8

**III. Teacher Licensure in Physics (Grades 7-12)**

- A. Complete the requirements shown above for the Physics major.
- B. Professional Education minor: EDU 150, 250, 326, 418, 433, PSY 213, 318, SE 225.
- C. Complete the applicable portions of the Praxis II.

D. For additional information, see the Director of Teacher Education.

**IV. Minor in Physics—24 semester hours**

Physics 231-232, 311, + 10 hours of Physics electives except PHY 111, 112, 301, 310

**Course Offerings in Physics (PHY)**

( )-Hours Credit; F-Fall; W-Winter; S-Spring; Su-Summer

**111. Principles of the Physical Sciences (4) F, W, S, Su**

A concise introduction to physics and chemistry for any non-science major. The laboratory exercises are chosen to be indicative of various scientific methods, and a part of the classroom experience will be designed to acquaint the student with the historical, philosophical, and social significance of the physical sciences. Knowledge of basic algebra is assumed. Science credit will not be given after completion of a course in either Chemistry or Physics. Three lectures, one 2-hour laboratory per week.

**112. Earth and Space Science (4) F, W, Su**

Prerequisite: PHY 111. Reciprocal credit: GEO 112.

An overview of earth science and astronomy with their nature, history, divisions, and relation to other sciences being discussed. The physical laws of nature will be examined as they apply to physical geography, meteorology, and astronomy. Three lectures & one 2-hour laboratory per week.

**213-4. Introduction to Physics (4) 213—F, 214—S**



**313. Intermediate Mechanics (3) F—Odd Years**

Prerequisite: PHY 232 & MAT 212.

An introduction to the rectilinear and curvilinear dynamics of particles and rigid bodies. Both Lagrangian and Hamiltonian formulations of mechanics will be developed and applied.

**314. Intermediate Electricity and Magnetism (3) S—Even Years**

Prerequisite: MAT 212 & PHY 232.

A study of electric and magnetic fields both in media and in a vacuum. Maxwell's equations are used to determine the electromagnetic fields produced by a variety of charge and current distributions.

**317. Introductory Electronics (4) S—Odd Years**

Prerequisite: MAT 212.

An introduction to the field of electronics beginning with DC and AC circuit theory, and continuing through the semiconductor devices. Digital electronics are also introduced. Three lectures and one 3-hour lab per week.

**325. Thermodynamics & Statistical Mechanics (3) F—Odd Years**

Prerequisites: MAT 212 & PHY 232.

An intermediate survey of heat and thermodynamics including the concepts of temperature and heat, the laws of thermodynamics, thermodynamics potentials, the Maxwell relations and statistical methods applied to the thermodynamics of various states of matter, including gases, liquids, and quantum fluids.

**420. Quantum Mechanics (3) S—Odd Years**

Prerequisites: PHY 311 & MAT 314.

Fundamental principles of quantum mechanics, methods of calculation, and solutions to Schrodinger's equation. Applications to atomic, molecular, and nuclear physics with an introduction to operator notation. Three lecture hours per week.

**424. Physics Research (1-3) S**

Prerequisite: PHY 311.

The student's knowledge is integrated by application of a simple piece of original work to include a literature search and summary paper on a topic of current interest in physics. Under the supervision of a faculty member, this work may be done off site at a national laboratory or comparable research facility.

**430. Experimental Physics Laboratory (3) F—Even Years**

Prerequisite: PHY 311 & MAT 213.

Introduction to modern experimentation, research, data acquisition and analysis. The

**195-6-7. Special Studies (1-4) On Demand**

Lower-level group studies which do not appear in the regular departmental offerings.

**395-6-7. Special Studies (1-4) On Demand**

Upper-level group studies which do not appear in the regular departmental offerings.

**495-6-7. Independent Study (1-4) On Demand**

Individual study under the guidance of a faculty member(s).

**499. Seminar (1-3) As Needed**

To be used at the discretion of the department.