Find out how to prove — and improve — the effectiveness of your Chemistry program with the *ETS*® Major Field Tests.

Content Validity

The *ETS*® Major Field Test (MFT) in Chemistry, first administered in 1989, assesses mastery of concepts, principles and knowledge by graduating Chemistry students. To ensure fairness and content relevance, the test is revised approximately every four to five years.

Developed by Leading Educators in the Field

Experienced faculty members representing all the relevant areas of the discipline determine test specifications, questions and types of scores reported. ETS assessment experts subject each question to rigorous tests of sensitivity and reliability. Every effort is made to include questions that assess the most common and important topics and skills.

In addition to factual knowledge, the test evaluates students' abilities to analyze and solve problems, understand relationships and interpret material. Questions that require interpretation of graphs, diagrams and charts are included. Academic departments may add up to two subgroups and as many as 50 additional locally written questions to test areas of the discipline that may be unique to the department or institution.

National Comparative Data

A *Comparative Data Guide*, published each year, contains tables of scaled scores and percentiles for individual student scores, departmental mean scores and any subscores or group assessment indicators that the test may support. The tables of data are drawn from senior-level test takers at a large number of diverse institutions. Nearly 1,500 colleges and universities employ one or more of the Major Field Tests for student achievement and curriculum evaluation each year.

Who Develops the MFT in Chemistry?

Individuals who serve or recently have served on the Committee for the MFT in Chemistry are faculty members from the following institutions:

Augusta State University
Georgetown University
University of Kentucky
University of New Hampshire
University of New Orleans
University of Wisconsin-LaCrosse
Virginia Tech University
Williams College

For more information about the MFT in Chemistry:

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Visit: **www.ets.org/mft**

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ETS Major Field Tests

Measuring the Power of Learning.®

Test Content — Chemistry

The Major Field Test in Chemistry consists of 100 multiple-choice questions, some of which are grouped in sets and based on such materials as a descriptive paragraph or experimental results. It is designed to take two hours and may be split into two sessions. This test must be given by a proctor. Test questions are constructed to simplify mathematical manipulations. As a result, calculators are not needed. A Periodic Table and Table of Information are available for reference (under "Exhibits" for online users and inside the test book for paper-and-pencil users).

The content of the test emphasizes the four fields into which chemistry traditionally has been divided and some interrelationships among the fields. Approximately 30 percent of the questions in subgroups I-IV will test a student's ability to reason and think clearly, and come to a rational conclusion. These will include the ability to use and interpret data or results to solve a problem, make a prediction, or derive a reasonable conclusion. Such a question in organic or inorganic chemistry might be a multistep synthesis, a mechanism, or analysis and interpretation of spectroscopic data. In analytical or physical chemistry such a question might be the interpretation of data and the assessment of the quality of the data.

The content categories and approximate distribution of questions among them are outlined below.

The Test Outline

I. Physical Chemistry (28%)

A. Thermodynamics: first, second and third laws; equilibrium constants; spontaneity; LeChatelier's principle; thermochemistry; mixing; phase equilibria; colligative properties; electrochemistry and statistical thermodynamics

B. Kinetics: kinetic theory of gases, ideal and real gas equations and properties, rate laws, rate constants, half-life, reaction mechanisms, enzyme kinetics, activated complex theory, collision theory, photochemistry and solution dynamics

C. Quantum chemistry and applications: classical experiments, principles of quantum mechanics, atomic and molecular structure, molecular spectroscopy

II. Organic Chemistry (30%)

A. Molecular structure: bonding, Lewis structures, orbital hybridization, resonance, aromaticity, stereochemistry, conformational analysis, acid-base properties, IUPAC nomenclature, IR, NMR, UV/visible spectroscopy and mass spectrometry

B. Functional groups: preparation and reactions of alkanes, alkenes, alkynes, dienes, alkyl halides, alcohols, thiols, ethers, sulfides, epoxides, aromatic compounds, aldehydes, ketones, amines, carboxylic acids and their derivatives

C. Reaction mechanisms: electrophilic substitutions and eliminations, nucleophilic substitutions and additions, nucleophilic addition-eliminations, cycloadditions, and radical reactions, catalysis, reaction coordinate diagrams, thermodynamic and kinetic control, stereochemistry of reactions, relative reactivities, relative stabilities and reactive intermediates (carbocations, carbanions, radicals, carbenes, enols, enolates, etc.)

D. Biochemistry: carbohydrates, amino acids, peptides, proteins, lipids, alkaloids, pharmaceuticals, nucleotides and nucleic acids, glycoproteins, polysaccharides, terpenes and steroids

E. Special topics: catalysis, organometallic chemistry, polymers and rearrangements

III. Inorganic Chemistry (26%)

A. General Chemistry: periodic trends, electronic structure, acid-base theory and reactions, balancing equations, stoichiometry, oxidation states and nuclear chemistry

B. Structure and bonding: Lewis diagrams, molecular geometries and VSEPR concept, valence bond description and hybridization, bond energies, van der Waals radii of the elements, molecular orbitals and intermolecular forces

C. Metallic and ionic substances: lattice structure, lattice energies, theory of metallic bonding, conductors, semiconductors, superconductors and liquid crystals

D. Chemistry of the main group elements: physical and chemical properties of the elements and their compounds, and occurrences and recovery

E. Chemistry of the transition elements: electronic structures, physical and chemical properties of the elements and their compounds, occurrences and recovery, coordination chemistry, including ligands, stereochemistry, nomenclature, bonding, spectroscopy, thermodynamic and kinetic aspects

F. Special topics: bioinorganic chemistry, catalysis, environmental chemistry, organometallic chemistry, including effective atomic number rule, bonding and reactions

IV. Analytical Chemistry (30%)*

A. Experimental design and data acquisition: accuracy and precision, random and systematic error, standard deviation, confidence limits, calibration, detection limits, sensitivity and significant figures

B. Homogeneous equilibria: acid-base equilibria and titrations, redox reactions and titrations, electrochemical cells and complexometric titrations

C. Heterogeneous equilibria: gravimetric analysis, solubility and chemical separations

D. Solutions: concentration terms, ionic strength and activity, standardizations and primary standards

E. Instrumental methods: Beer's law, spectroscopic methods, chromatographic methods, radiochemical methods, electrolysis, potentiometry and lasers

V. Critical Thinking and Reasoning Ability (30% overlapping other areas)

How scores for the Major Field Test in Chemistry are reported:

Total Score — Reported for each student and summarized for the group

Subscores — Reported for each student and summarized for the group

- Physical Chemistry (28)
- Organic Chemistry (30)
- Inorganic Chemistry (26)
- Analytical Chemistry (30)*

Assessment Indicators – Reported for the group** only

- Critical Thinking and Reasoning Ability (30)
- Biochemistry (15)***

Numbers in parentheses are the approximate number of questions in each category.

* Approximately 16 percent of the analytical chemistry questions will be drawn from the traditional topics in content category IV and about 14 percent from analytical chemistry-related questions in content categories I-III.

** A minimum of five (5) students is required for assessment indicators to be reported.

*** Approximately 7 percent from content category II and 8 percent from content categories I, III and IV.