

Chemistry **AND YOUR CAREER**

QUESTIONS AND ANSWERS



AMERICAN CHEMICAL SOCIETY

Chemistry and Your Career

FACT:

Chemical research has led to the discovery and development of new and improved synthetic fibers, paints, adhesives, drugs, cosmetics, electronic components, lubricants, and thousands of other products.

FACT:

Students planning careers as chemists should take courses in science and mathematics, and should like working with their hands, building scientific apparatus, performing laboratory experiments and computer modeling.

What is Chemistry?

Chemistry is the science that helps us learn about the material world around us, from the tiniest particles within our bodies to the largest objects in the universe. Chemistry is studied and applied by many women and men, conducted in a variety of different situations, and used in numerous ways.

Chemistry involves the study of materials. It is the study of the basic structure of matter: what substances are made of, their properties, how they act, and how they interact.

Chemicals are found everywhere: in our bodies, the air we breathe, the water we drink, our clothes, CDs, books, sports equipment, and cars. The list goes on and on!

Why Study Chemistry?

A chemistry course is your ticket to understanding the world around you! It can also lead to an exciting career. From agriculture to zoology, from production to sales, in a forest, on a highway, or in a hospital, chemistry is everywhere and touches our lives in countless ways!

Chemistry can be interesting and fun, too. Understanding chemicals—whether those in your own home or at a chemical plant—will be important to you throughout your life. You will need to make decisions about what cars to buy, medications to take, and legislation that affects your environment. Having a good understanding of the chemistry involved will help you make the best choice for your lifestyle.

What is a Chemist?

● A SCIENTIST

The work of a chemist can be challenging and exciting. Most chemists work in laboratories equipped with state-of-the-art instruments. Chemists make new materials and discover ways to use known materials for new purposes. Chemists help make everyday products such as deodorants, plastic materials, and food products; they help look for cures to arrest diseases such as AIDS; and improve our food, air, and water. They work to answer such questions as “How old is the earth?” and “What is happening to our environment?”



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Most chemists are involved in either research and development or production. Research is the process of discovery—of exploring new or modified materials in the laboratory. Development is the stage at which it is determined if the compound can be produced successfully in commercial quantities, in a usable form, and at a realistic cost. In production, chemists prepare compounds in the proper form and amount for commercial use.



Cambridge Institute of Technology Photo

Some chemists—for example, managers, information specialists, and salespeople—work in office environments, instead of laboratories.

● A PROBLEM SOLVER

Chemists make contributions to the world around them by solving problems. Finding the solution to a problem often requires that a chemist work with other chemists, scientists or with other types of workers: medical doctors, environmentalists, law enforcement officials, or farmers.

● AN IMPORTANT PART OF THE WORKFORCE AND THE ECONOMY

Chemists produce many consumer products—from plastics to gasoline—and make special materials such as rocket fuel. Chemical and related industries produce a large amount of our exports.

Chemists are considered to be one of the most versatile of all employees and, therefore, can almost always find a job, even in tough economic times. There are some 198,000 chemists in the U.S. workforce.

● A COLLEGE DEGREE HOLDER

Approximately 22% of all working chemists have bachelor's degrees in chemistry or a related field. Some 17% of chemists have master's degrees, and 60% have doctorates. Chemical technicians may hold an associate's degree in applied science or chemical technology.

● A TEACHER

Chemists study or convey information that everyone in our society needs to understand. Chemists often find themselves in the classroom working as (or with) teachers and students.

● A CONSULTANT

Chemists serve as advisors to the people responsible for such varied tasks as hazardous waste disposal, lead paint exposure limits for children, and pharmaceutical

QUESTIONS AND ANSWERS



development.

What Do Chemists Do?

A career in chemistry will provide you the opportunity to contribute in many specialized areas: the environment, manufacturing, medicine, transportation, polymers, teaching, safety, and law enforcement, for example. Work activities for the chemist can vary from collecting field samples to writing for a technical journal.

Chemistry is central to the development of new technologies and advances in other sciences.

● NANO CHEMISTRY

Chemists that work in this field are advancing the techniques and theory of building devices on an exceptionally small scale—on the order of nanometers.

● BIOTECHNOLOGY

Biotechnology chemists solve complex problems, such as conquering world hunger and developing new medicines, by applying biological processes in innovative ways.

● MATERIALS SCIENCE

Materials chemists are developing new ceramics, polymer alloys, and other materials to satisfy unique performance requirements, such as those needed for artificial body parts or automobile engines.

Where Do Chemists Work?

Approximately 54% of chemists work in research; yet many research chemists spend a good deal of time in nonlaboratory work environments. About 10% of all chemists are in production. The remainder of chemists are employed in education, marketing, sales, computer programming, law, or libraries.

● NONTRADITIONAL CAREERS

A small number of chemists work in nontraditional fields. Some are patent lawyers, science writers, editors, information specialists, investment bankers, business owners, technical librarians, consultants, personnel recruiters, and art conservators.

● THE CHEMICAL INDUSTRY

The chemical industry produces both bulk chemicals that are used by many industries and fine (or specialty) chemicals that have a smaller market. Many chemists also work in the plastics and polymers industry or in biotechnology, electronics, paints, pharmaceuticals, foods, flavors, fragrances, detergents, and cosmetics. Industry also hires chemists to work in various nontraditional scientific areas of the company.

● ACADEMIC INSTITUTIONS

Teaching in schools and colleges is one important function of chemists. Research also plays a major role in teaching at four-year colleges and universities.

College chemistry teachers have more flexible work schedules than industrial chemists, and they usually

engage in individual research projects. The doctorate is required by four-year colleges or universities and is preferred in most two-year colleges.

Chemists who teach in high schools usually have bachelor's or master's degrees. High school teachers are interested in guiding the personal development of students, as well as providing a solid background in science content.

Requirements for teaching credentials vary from state to state. There is a shortage of well-trained high school chemistry teachers that will likely persist for many years.

● GOVERNMENT

Federal, state, and local government agencies hire chemists for many types of jobs. A few examples are:

- Medicinal, analytical, and biochemical chemists—Food and Drug Administration
- Forensic and analytical chemists—Department of Justice and other law enforcement agencies
- Agricultural, biochemical, environmental, and analytical chemists—Department of Agriculture
- Physical, environmental, inorganic, and organic chemists—Environmental Protection Agency
- Patent researchers and lawyers—Patent Office
- Administrators, writers, and editors—National Science Foundation and other government agencies
- Industrial and engineering, materials, and environmental chemists—Department of Energy
- Geochemists and environmental chemists—National Oceanic and Atmospheric Administration



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What is a Chemical Engineer?

Chemical engineers usually are concerned with chemical reactions or refining materials at a scale larger than practical in a laboratory. Their work may involve large production plants directly or, on a smaller scale, pilot plants. Computer modeling of processes and equipment is also a task assumed by chemical engineers. Their challenges are to develop or improve safe, environmentally sound processes; to make products in commercial or test quantities; to determine the least costly production method; and to formulate the material for easy use and safe, economic transportation.

FACT:

Over half of all chemists are employed in manufacturing firms – mostly in the chemical manufacturing industry, which includes firms that produce plastics and synthetic materials, drugs, soaps and cleaners, paints, industrial organic chemicals, and other miscellaneous chemical products.

Employment of chemists is expected to grow about as fast as the average for all occupations through 2010. Job growth will be concentrated in drug manufacturing and in research, development, and testing services firms.



A chemistry career in more traditional areas also offers **rewards** and **excitement**: You could be the first to **prepare a compound with a new property**, such as high heat stability; or **unravel the structure of a complex molecule**, or **synthesize a new medication** that is effective for curing a disease.

What is a Chemical Technician?

Chemical technicians are valuable members of research, development, or production teams. Chemical technicians are experts in equipment and laboratory procedures, operating many kinds of laboratory equipment, including sophisticated instruments. Technicians set up apparatus, run chemical reactions, and test for quality, performance, or composition. They conduct a variety of laboratory procedures, from routine process control to complex research projects. The high demand for technicians has meant that many current technicians were trained on the job, but college chemistry courses are being required for most new technicians.



Air Products & Chemicals Photo

More Questions?

Your school guidance counselor, science teacher, or the staff in a nearby college or university chemistry department can help you focus on your own situation and interests.

ACS Career and Education Resources

Other career and education resources are available from the American Chemical Society. Visit our Online store at www.chemistry.org or call 1-800-227-5558 to request a catalog.

● OTHER ORGANIZATIONS

Addresses for organizations who might have information about scientific careers are listed below:

American Association of Clinical Chemistry (AACC)

2101 L Street, NW, Suite 202, Washington, DC 20037-1558
800-892-1400, aacc.org

American Institute of Chemical Engineers (AIChE)

3 Park Avenue, New York, NY 10016-7338
212-591-7338, aiche.org

American Institute of Physics (AIP)

One Physics Ellipse, College Park, MD 20740-3843
301-209-3100, aip.org

American Society for Biochemistry and Molecular Biology (ASBMB)

9650 Rockville Pike, Bethesda, MD 20814-3996
301-530-7145, asbmb.org

Association of American Geographers (AAG)

1710 Sixteenth Street, NW, Washington, DC 20009-3198
202-234-1450, aag.org

Biotechnology Industry Organization (BIO)

1625 K Street, NW, Suite #1100, Washington, DC 20036
202-857-0244, bio.org

Chemical Specialties Manufacturers Association

1913 Eye Street, NW, Washington, DC 20036, 202-872-8110

Environmental Protection Agency

Ariel Rios Building, 1200 Pennsylvania Avenue, NW, Washington, DC 20460, 202-272-0167, epa.gov

Mathematical Association of America (MAA)

1529 Eighteenth Street, NW, Washington, DC 20036
1-800-741-9415, maa.org

U.S. Geological Survey

USGS National Center, 12201 Sunrise Valley Drive, Reston, VA 20192, 703-648-4000, usgs.gov

● The chemical industry employs 65% of all chemists.

● Academic institutions employ 27% of all chemists.

● Government employs 8% of all chemists.

What Can I Earn?

● CHEMISTS

Chemists' salaries vary depending on degree, employer, geographic area, and experience. Starting salaries for all chemistry professionals tend to provide a comfortable living. Starting salaries for B.S. chemists in 2005 were in the \$35,000 range. The 2005 ACS ChemCensus revealed that the median salary earned by B.S. chemists was \$63,000; by M.S. chemists, \$74,000; and by Ph.D. chemists, \$93,000. Salaries tend to be higher for those chemists working in industry rather than in academia or government.

● CHEMICAL ENGINEERS

Chemical engineers tend to have higher starting salaries than do B.S. chemists. In 2005 salaries started around \$52,000. The 2005 ACS ChemCensus revealed that the median salary earned by B.S. chemical engineers was \$77,000; by M.S. chemical engineers, \$96,000; and by Ph.D. chemical engineers, \$107,000. A large percentage of chemical engineers no longer do chemical engineering work as a regular part of their responsibility by the tenth year of their career. At that point, they are managing plants or large design groups.

● CHEMICAL TECHNICIANS

Chemical technicians with chemical technology degrees from two-year programs earn starting salaries ranging from \$32,000 to \$64,000, with the higher salaries coming from shift differentials and overtime. The median salary for chemical technicians was \$46,000. The biggest areas of employment for chemical lab technicians is in chemical manufacturing as well as polymers and coatings. There has recently been considerable growth in pharmaceutical manufacturing and biotechnology.

