

## Science Technicians

(0\*NET 19-4011.01, 19-4011.02, 19-4021.00, 19-4031.00, 19-4041.01, 19-4041.02, 19-4051.01, 19-4051.02, 19-4091.00, 19-4092.00, 19-4093.00)

### Significant Points

- Science technicians in production jobs can be employed on day, evening, or night shifts.
- Many employers prefer applicants who have at least 2 years of specialized training or an associate degree.
- Job opportunities are expected to be best for graduates of applied science technology programs.
- Job growth will be concentrated in pharmaceutical manufacturing, chemical manufacturing, and biotechnological research and development firms.

### Nature of the Work

Science technicians use the principles and theories of science and mathematics to solve problems in research and development and to help invent and improve products and processes. However, their jobs are more practically oriented than those of scientists. Technicians set up, operate, and maintain laboratory instruments, monitor experiments, make observations, calculate and record results, and often develop conclusions. They must keep detailed logs of all of their work-related activities. Those who work in production monitor manufacturing processes and may be involved in ensuring quality by testing products for proper proportions of ingredients, for purity, or for strength and durability.

As laboratory instrumentation and procedures have become more complex in recent years, the role of science technicians in research and development has expanded. In addition to performing routine tasks, many technicians also develop and adapt laboratory procedures to achieve the best results, interpret data, and devise solutions to problems, under the direction of scientists. Moreover, technicians must master the laboratory equipment so that they can adjust settings when necessary and recognize when equipment is malfunctioning.

The increasing use of robotics to perform many routine tasks has freed technicians to operate more sophisticated laboratory equipment. Science technicians make extensive use of computers, computer-interfaced equipment, robotics, and high-technology industrial applications, such as biological engineering.

Most science technicians specialize, learning skills and working in the same disciplines in which scientists work. Occupational titles, therefore, tend to follow the same structure as those for scientists. *Agricultural technicians* work with agricultural scientists in food, fiber, and animal research, production, and processing. Some conduct tests and experiments to improve the yield and quality of crops or to increase the resistance of plants and animals to disease, insects, or other hazards. Other agricultural technicians do animal breeding and nutrition work. *Food science technicians* assist food scientists and technologists in research and development, production technology, and quality control. For example, food science technicians may conduct tests on food additives and preservatives to ensure FDA compliance on factors such as color, texture, and nutrients. They analyze, record, and compile test results; order supplies to maintain

laboratory inventory; and clean and sterilize laboratory equipment.

*Biological technicians* work with biologists studying living organisms. Many assist scientists who conduct medical research—helping to find a cure for cancer or AIDS, for example. Those who work in pharmaceutical companies help develop and manufacture medicinal and pharmaceutical preparations. Those working in the field of microbiology generally work as lab assistants, studying living organisms and infectious agents. Biological technicians also analyze organic substances, such as blood, food, and drugs, and some examine evidence in a forensic science laboratory. Biological technicians working in biotechnology labs use the knowledge and techniques gained from basic research by scientists, including gene splicing and recombinant DNA, and apply them in product development.

*Chemical technicians* work with chemists and chemical engineers, developing and using chemicals and related products and equipment. Generally, there are two types of chemical technicians—research and development technicians who work in experimental laboratories, and process control technicians who work in manufacturing or other industrial plants. Many research and development chemical technicians conduct a variety of laboratory procedures, from routine process control to complex research projects. For example, they may collect and analyze samples of air and water to monitor pollution levels or produce compounds through complex organic synthesis. Most process technicians work in manufacturing, where they test packaging for design, integrity of materials, and environmental acceptability. Often, process technicians who work in plants also focus on quality assurance: there, they monitor product quality or production processes and develop new production techniques. A few work in shipping to provide technical support and expertise for these functions.

*Environmental science and protection technicians* perform laboratory and field tests to monitor environmental resources and determine the contaminants and sources of pollution. They may collect samples for testing or be involved in abating, controlling, or remediating sources of environmental pollutants. Some are responsible for waste management operations, control and management of hazardous materials inventory, or general activities involving regulatory compliance.



Many science technicians make extensive use of computers, computer-interfaced equipment, robotics, and high-technology industrial applications.

*Forensic science technicians* investigate crimes by collecting and analyzing physical evidence. Often, they specialize in areas such as DNA analysis or firearm examination, performing tests on weapons or substances such as fiber, hair, tissue, or body fluids to determine significance to the investigation. They also prepare reports to document their findings and the laboratory techniques used, and may provide information and expert opinion to investigators. When criminal cases come to trial, forensic science technicians often provide testimony, as expert witnesses, on specific laboratory findings by identifying and classifying substances, materials, and other evidence collected at the crime scene.

*Forest and conservation technicians* compile data on the size, content, and condition of forest land tracts. These workers usually work in a forest under the supervision of a forester, conducting specific tasks such as measuring timber, supervising harvesting operations, assisting in roadbuilding operations, and locating property lines and features. They also may gather basic information, such as species and population of trees, disease and insect damage, tree seedling mortality, and conditions that may cause fire danger. Forest and conservation technicians also train and lead forest and conservation workers in seasonal activities, such as planting tree seedlings, putting out forest fires, and maintaining recreational facilities.

*Geological and petroleum technicians* measure and record physical and geologic conditions in oil or gas wells, using advanced instruments lowered into wells or by analysis of the mud from wells. In oil and gas exploration, these technicians collect and examine geological data or test geological samples to determine petroleum and mineral and element composition using scanning electron microscopes. Some petroleum technicians, called *scouts*, collect information about oil and gas well drilling operations, geological and geophysical prospecting, and land or lease contracts.

*Nuclear technicians* operate nuclear test and research equipment, monitor radiation, and assist nuclear engineers and physicists in research. Some also operate remote control equipment to manipulate radioactive materials or materials to be exposed to radioactivity.

Other science technicians collect weather information or assist oceanographers.

### Working Conditions

Science technicians work under a wide variety of conditions. Most work indoors, usually in laboratories, and have regular hours. Some occasionally work irregular hours to monitor experiments that cannot be completed during regular working hours. Production technicians often work in 8-hour shifts around the clock. Others, such as agricultural, forest and conservation, geological and petroleum, and environmental science and protection technicians, perform much of their work outdoors, sometimes in remote locations.

Some science technicians may be exposed to hazards from equipment, chemicals, or toxic materials. Chemical technicians sometimes work with toxic chemicals or radioactive isotopes, nuclear technicians may be exposed to radiation, and biological technicians sometimes work with disease-causing organisms or radioactive agents. Forensic science technicians often are exposed to human body fluids and firearms. However, these working conditions pose little risk, if proper safety procedures are followed. For forensic science technicians, collecting evidence from crime scenes can be distressing and unpleasant.

### Employment

Science technicians held about 208,000 jobs in 2002. As indicated by the following tabulation, chemical and biological technicians accounted for over half of all jobs:

Chemical technicians .....	69,000
Biological technicians .....	48,000
Environmental science and protection technicians, including health .....	28,000
Agricultural and food science technicians .....	20,000
Forest and conservation technicians .....	19,000
Geological and petroleum technicians .....	11,000
Forensic science technicians .....	8,400
Nuclear technicians .....	5,700

Chemical technicians held jobs in a wide range of manufacturing and service industries, but were concentrated in chemical manufacturing, where they held 26,000 jobs. About 17,000 worked in professional, scientific, or technical services firms; about 17,000 biological technicians also worked in professional, scientific, or technical services firms. Most other biological technicians worked in pharmaceutical and medicine manufacturing or for Federal, State, or local governments. Significant numbers of environmental science and protection technicians also worked for State and local governments and professional, scientific, and technical services firms. Almost two-thirds of forest and conservation technicians held jobs in the Federal Government; another 20 percent worked for State governments. Around 22 percent of agricultural and food science technicians worked for food processing companies; most of the rest worked for scientific research and development services firms and State governments. Over one-fifth of all geological and petroleum technicians worked for oil and gas extraction companies, and forensic science technicians worked primarily for State and local governments.

### Training, Other Qualifications, and Advancement

There are several ways to qualify for a job as a science technician. Many employers prefer applicants who have at least 2 years of specialized training or an associate degree in applied science or science-related technology. Because employers' preferences vary, however, some science technicians have a bachelor's degree in chemistry, biology, or forensic science, or have taken several science and math courses at 4-year colleges.

Many technical and community colleges offer associate degrees in a specific technology or a more general education in science and mathematics. A number of 2-year associate degree programs are designed to provide easy transfer to a 4-year college or university, if desired. Technical institutes usually offer technician training, but provide less theory and general education than do technical or community colleges. The length of programs at technical institutes varies, although 1-year certificate programs and 2-year associate degree programs are common.

More than 20 colleges or universities offer a bachelor's degree program in forensic science; more than 10 additional schools offer a bachelor's of science in chemistry, biochemistry, or genetic engineering with an emphasis on forensic science; a few additional schools offer a bachelor's of science degree with an emphasis in a specialty area, such as criminalistics, pathology, jurisprudence, odontology, toxicology, or forensic accounting.

In contrast to some other science technician positions that require only a 2-year degree, a 4-year degree in forensics science is usually necessary to work in the field. Knowledge and understanding of legal procedures also can be helpful. Forestry and conservation technicians can choose from more than 20 associate degree programs in forest technology accredited by the Society of American Foresters.

Most chemical process technicians have a 2-year degree, usually an associate degree in process technology, although in some cases a high school diploma is sufficient. They usually receive additional on-the-job training. Entry-level workers whose college training encompasses extensive hands-on experience with a variety of diagnostic laboratory equipment usually require less on-the-job training. Those with a high school diploma typically begin work as trainees under the direct supervision of a more experienced process technician. Many with only a high school diploma eventually earn a 2-year degree in process technology, often paid for by their employer.

Some schools offer cooperative-education or internship programs, allowing students the opportunity to work at a local company or other workplace while attending classes in alternate terms. Participation in such programs can significantly enhance a student's employment prospects.

Persons interested in careers as science technicians should take as many high school science and math courses as possible. Science courses taken beyond high school, in an associate or bachelor's degree program, should be laboratory oriented, with an emphasis on bench skills. A solid background in applied basic chemistry, physics, and math is vital. Because computers often are used in research and development laboratories, technicians should have strong computer skills. Communication skills also are important; technicians often are required to report their findings both orally and in writing. Additionally, technicians should be able to work well with others, because teamwork is common. Organizational ability, an eye for detail, and skill in interpreting scientific results also are important. High mechanical aptitude, attention to detail, and analytical thinking are all important characteristics of science technicians.

Prospective science technicians can acquire good career preparation through 2-year formal training programs that combine the teaching of scientific principles and theory with practical hands-on application in a laboratory setting with up-to-date equipment. Graduates of 4-year bachelor's degree programs in science who have considerable experience in laboratory-based courses, have completed internships, or have held summer jobs in laboratories also are well qualified for science technician positions and are preferred by some employers. However, those with a bachelor's degree who accept technician jobs generally cannot find employment that uses their advanced academic education.

Technicians usually begin work as trainees in routine positions, under the direct supervision of a scientist or a more experienced technician. Job candidates whose training or educational background encompasses extensive hands-on experience with a variety of laboratory equipment, including computers and related equipment, usually require a short period of on-the-job training. As they gain experience, technicians take on more responsibility and carry out assignments under only general supervision, and some eventually become supervisors. However, technicians employed at universities often have their fortunes tied to those of particular professors; when professors retire or leave, these technicians face uncertain employment prospects.

## **Job Outlook**

Overall employment of science technicians is expected to increase about as fast as the average for all occupations through the year 2012. Continued growth of scientific and medical research, particularly research related to biotechnology, as well as the development and production of technical products, should stimulate demand for science technicians in many industries. The increase in the number of biological technicians will be about as fast as average, as the growing number of agricultural and medicinal products developed using biotechnology techniques will boost demand for these workers. Also, stronger competition among pharmaceutical companies and an aging population are expected to contribute to the need for innovative and improved drugs, further spurring demand for biological technicians. Fastest employment growth of biological technicians should occur in the pharmaceutical and medicine manufacturing industry and in scientific research and development services firms.

Job growth for chemical technicians is projected to grow more slowly than average. The chemical manufacturing industry, the major employer of chemical technicians, will experience a decline in overall employment as companies downsize and turn to outside contractors to provide specialized services. Job opportunities are expected to be more plentiful in pharmaceutical and medicine manufacturing as the public continues to demand newer and better pharmaceuticals. To meet this demand, pharmaceutical manufacturing firms are expected to continue to devote money to research and development, either through in-house teams, or, increasingly, by contracting to scientific research and development services firms, spurring employment growth of chemical technicians in that industry. An increasing focus on quality assurance will require a greater number of process technicians, further stimulating demand for these workers.

Employment of environmental science and protection technicians should grow much faster than average to help regulate waste products; to collect air, water, and soil samples for measuring levels of pollutants; to monitor compliance with environmental regulations; and to clean up contaminated sites.

There will be limited demand for forest and conservation technicians at the Federal and State government levels, leading to slower-than-average growth, due to general downsizing and reductions in timber harvesting on Federal lands. However, increased emphasis on specific conservation issues, such as environmental protection, water resources preservation, and control of exotic and invasive pests, may provide some employment opportunities.

Employment of agricultural and food science technicians should grow more slowly than average, mainly due to limited growth in agriculture and the food processing industry. However, research will still be necessary, particularly biotechnological research in the private sector, as it becomes increasingly important to balance greater agricultural output with protection and preservation of soil, water, and the ecosystem. Specifically, research will be needed to combat insects and diseases as they continue to adapt to pesticides and as soil fertility and water quality continue to need improvement.

Jobs for forensic science technicians are expected to increase about as fast as average. Crime scene technicians who work for State Public Safety Departments may experience favorable employment prospects if the number of qualified applicants remains low.

Little or no growth in employment of geological and petroleum technicians is expected because employment in the oil and gas extraction and mining industries, among the largest employers of geological and petroleum technicians, is expected to decline. Job opportunities will be more favorable in professional, scientific, and technical services firms, as geological and petroleum technicians will be needed to consult companies regarding environmental policy and Federal Government mandates, such as those requiring lower sulfur emissions.

Job opportunities are expected to be best for graduates of applied science technology programs who are well trained on equipment used in industrial and government laboratories and production facilities. As the instrumentation and techniques used in industrial research, development, and production become increasingly more complex, employers are seeking individuals with highly developed technical and communication skills.

Along with opportunities created by growth, many job openings should arise from the need to replace technicians who retire or leave the labor force for other reasons. During periods of economic recession, layoffs of science technicians may occur.

**Earnings**

Median hourly earnings of science technicians in 2002 were as follows:

Nuclear technicians .....	\$28.84
Forensic science technicians .....	19.73
Geological and petroleum technicians .....	18.96
Chemical technicians .....	18.00
Environmental science and protection technicians, including health .....	16.98
Biological technicians .....	15.73
Forest and conservation technicians .....	14.90
Agricultural and food science technicians .....	13.74

In 2003, the average annual salary in nonsupervisory, supervisory, and managerial positions in the Federal Government was \$30,440 for biological science technicians; \$44,068 for physical science technicians; \$55,374 for geodetic technicians; \$40,781 for hydrologic technicians; and \$52,585 for meteorological technicians.

**Related Occupations**

Other technicians who apply scientific principles at a level usually acquired in 2-year associate degree programs include engineering technicians, broadcast and sound engineering technicians and radio operators, drafters, and health technologists and technicians, especially clinical laboratory technologists and technicians, diagnostic medical sonographers, and radiologic technologists and technicians.

**Sources of Additional Information**

For information about a career as a chemical technician, contact:

► American Chemical Society, Education Division, Career Publications, 1155 16th St. NW., Washington, DC 20036. Internet: <http://www.acs.org>

For career information and a list of undergraduate, graduate, and doctoral programs in forensic sciences, contact:

► American Academy of Forensic Sciences, P.O. Box 669, Colorado Springs, CO, 80901. Internet: <http://www.aafs.org>

For general education information on forestry technicians and lists of schools offering education in forestry, send a self-addressed, stamped business envelope to:

► Society of American Foresters, 5400 Grosvenor Ln., Bethesda, MD 20814. Internet: <http://www.safnet.org>