

What Chemical Technicians Do¹

Chemical technicians monitor and adjust processing equipment at manufacturing facilities.

Chemical technicians use laboratory instruments and techniques to help chemists and chemical engineers research, develop, produce, and test chemical products and processes.

Duties

Chemical technicians typically do the following:

- Monitor chemical processes and test the quality of products to make sure that they meet standards and specifications
- Set up and maintain laboratory instruments and equipment
- Troubleshoot production problems or malfunctioning instruments
- Prepare chemical solutions
- Conduct, compile, and interpret results of chemical and physical experiments, tests, and analyses for a variety of purposes, including research and development
- Prepare technical reports, graphs, and charts, and give presentations that summarize their results

Most chemical technicians work on teams. Typically, they are led by [chemists](#) or [chemical engineers](#) who direct their work and evaluate their results. However, they may serve as mentors to chemists who are new to a lab or to a specialized area of research.

Technicians who work in laboratories may help conduct experiments that contribute to research and development. For example, some chemical technicians help chemists and other scientists develop new medicines. In this way, chemical technicians often bridge the gap in knowledge remaining when a chemist moves on to a new assignment.

Other chemical technicians work in manufacturing and assist in developing more efficient production processes.

¹ Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Chemical Technicians, on the Internet at <https://www.bls.gov/ooh/life-physical-and-social-science/chemical-technicians.htm>

What Physicists and Astronomers Do²

Physicists plan and conduct scientific experiments and studies to test theories and to discover properties of matter and energy.

Physicists and astronomers study the ways in which various forms of matter and energy interact. Theoretical physicists and astronomers may study the nature of time or the origin of the universe. Some physicists design and perform experiments with sophisticated equipment such as particle accelerators, electron microscopes, and lasers.

Duties

Physicists and astronomers typically do the following:

- Develop scientific theories and models that attempt to explain the properties of the natural world, such as the force of gravity or the formation of sub-atomic particles
- Plan and conduct scientific experiments and studies to test theories and discover properties of matter and energy
- Write proposals and apply for funding to conduct research
- Do complex mathematical calculations to analyze physical and astronomical data, such as data that may indicate the existence of planets in distant solar systems or new properties of materials
- Design new scientific equipment, such as telescopes and lasers
- Develop computer software to analyze and model data
- Write scientific papers that may be published in scholarly journals
- Present research findings at scientific conferences and lectures

Physicists explore the fundamental properties and laws that govern space, time, energy, and matter. Some physicists study theoretical areas, such as the fundamental properties of atoms and molecules and the evolution of the universe. Others design and perform experiments with sophisticated equipment such as particle accelerators, electron microscopes, and lasers. Many apply their knowledge of physics to practical objectives, such as developing advanced materials and medical equipment.

Astronomers study planets, stars, galaxies, and other celestial bodies. They use ground-based equipment, such as radio and optical telescopes, and space-based equipment, such as the Hubble Space Telescope. Some astronomers study distant stars, galaxies, and phenomena such as neutron stars and black holes, and others monitor space debris that could interfere with satellite operations.

Many physicists and astronomers work in basic research with the aim of increasing scientific knowledge. These researchers may attempt to develop theories that better explain what gravity is

² Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Physicists and Astronomers, on the Internet at <https://www.bls.gov/ooh/life-physical-and-social-science/physicists-and-astronomers.htm>

or how the universe works or was formed. Other physicists and astronomers work in applied research. They use the knowledge gained from basic research to effect new developments in areas such as energy storage, electronics, communications, navigation, and medical technology.

What Chemists and Materials Scientists Do³

Chemists and materials scientists study substances at the atomic and molecular levels and analyze the ways in which the substances interact with one another. They use their knowledge to develop new and improved products and to test the quality of manufactured goods.

Duties

Chemists and materials scientists typically do the following:

- Plan and carry out complex research projects, such as the development of new products and testing methods
- Instruct scientists and technicians on proper chemical processing and testing procedures, including ingredients, mixing times, and operating temperatures
- Prepare solutions, compounds, and reagents used in laboratory procedures
- Analyze substances to determine their composition and concentration of elements
- Conduct tests on materials and other substances to ensure that safety and quality standards are met
- Write technical reports that detail methods and findings
- Present research findings to scientists, engineers, and other colleagues

Some chemists and materials scientists work in basic research. Others work in applied research. In basic research, chemists investigate the properties, composition, and structure of matter. They also experiment with combinations of elements and the ways in which they interact. In applied research, chemists investigate possible new products and ways to improve existing ones. Chemistry research has led to the discovery and development of new and improved drugs, plastics, fertilizers, flavors, batteries, and cleaners, as well as thousands of other products.

³ Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Chemists and Materials Scientists, on the Internet at <https://www.bls.gov/ooh/life-physical-and-social-science/chemists-and-materials-scientists.htm>

What Electro-mechanical Technicians Do⁴

Electro-mechanical technicians combine knowledge of mechanical technology with knowledge of electrical and electronic circuits. They operate, test, and maintain unmanned, automated, robotic, or electromechanical equipment.

Duties

Electro-mechanical technicians typically do the following:

- Read blueprints, schematics, and diagrams to determine the method and sequence of assembly of a part, machine, or piece of equipment
- Verify dimensions of parts, using precision measuring instruments, to ensure that specifications are met
- Operate metalworking machines to make housings, fittings, and fixtures
- Inspect parts for surface defects
- Repair and calibrate hydraulic and pneumatic assemblies
- Test the performance of electro-mechanical assemblies, using test instruments
- Install electronic parts and hardware, using soldering equipment and hand tools
- Operate, test, or maintain robotic equipment
- Analyze and record test results, and prepare written documentation

Electro-mechanical technicians test and operate machines in factories and other worksites. They also analyze and record test results, and prepare written documentation to describe the tests they performed and what the test results were.

Electro-mechanical technicians install, maintain, and repair automated machinery and computer-controlled mechanical systems in industrial settings. This kind of work requires knowledge and training in the application of photonics, the science of light. The technological aspects of the work have to do with the generation, control, and detection of the light waves so that the automated processes can proceed as designed by the engineers.

Electro-mechanical technicians also test, operate, or maintain robotic equipment at worksites. This equipment may include unmanned submarines, aircraft, or similar types of equipment for uses that include oil drilling, deep-ocean exploration, or hazardous-waste removal. These technicians also work on energy projects involving solar power and wind.

Important Qualities

⁴ Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Electro-mechanical Technicians, on the Internet at <https://www.bls.gov/ooh/architecture-and-engineering/electro-mechanical-technicians.htm>

Analytical skills. Chemists and materials scientists carry out scientific experiments and studies. They must be precise and accurate in their analyses because errors could invalidate their research.

Communication skills. Chemists and materials scientists need to communicate clearly with team members and other scientists. They must read and write technical reports and give presentations.

Interpersonal skills. Chemists and materials scientists typically work on interdisciplinary research teams and need to work well with others toward a common goal. Many serve as team leaders and must motivate and direct other team members.

Math skills. Chemists and materials scientists regularly use complex mathematical equations and formulas, and they need a broad understanding of math, including calculus, algebra, and statistics.

Organizational skills. Chemists and materials scientists need to document processes carefully in order to conform to regulations and industry procedures. Disorganization in the workplace can lead to legal problems, damage to equipment, and chemical spills.

Perseverance. Scientific research involves substantial trial and error, and chemists and materials scientists must not become discouraged in their work.

Problem-solving skills. Chemists and materials scientists research and develop new and improved chemical products, processes, and materials. This work requires a great deal of trial and error on the part of chemists and materials scientists before a unique solution is found.

Time-management skills. Chemists and materials scientists usually need to meet deadlines when conducting research. They must be able to manage time and prioritize tasks efficiently while maintaining their quality of work.