This booklet contains three articles that explain the importance of English, mathematics, and science subjects in every student's career preparation. For students with an interest in or aptitude for a subject, the articles explain the link between that subject and a number of careers. Each article also describes how people use English, mathematics, and science in everyday life and lists occupations requiring various levels of competence in these subjects. (KC)
Students often wonder why they must study subjects that seem unrelated to their career goals. Why does a future engineer need to take English classes? How does math help an air traffic controller direct planes? When do chefs or cooks use science and technology in the kitchen?

The three articles that follow—“English and your career,” “Math and your career,” and “Science and your career”—explain the importance of these subjects in every student's career preparation. For students with an interest or aptitude in a subject, the articles explain the link between that subject and a number of careers. Each article also describes how we use English, math, and science in everyday life and lists occupations requiring various levels of competence.

Of course, students should consult detailed references, such as the *Occupational Outlook Handbook*, in making their career decisions. But these articles may serve as reminders that a good foundation is essential for the framework that succeeds.
Architects must describe their designs to clients in terms they can understand.

Social workers need excellent interpersonal skills to help clients cope with problems, such as disabling illness, substance abuse, financial crisis, unplanned pregnancy, and child or spousal abuse.

English and your career

by Nancy Saffer

Reading and writing are basic skills we begin learning at a young age. So why do we need to continue studying them in high school and beyond? Taking English classes improves our communication skills, which are essential to every job.

Communication is the ability to understand information other people give us and to have other people understand what we tell them. In addition to being fundamental for most jobs, the ability to communicate clearly and effectively can help us in every area of our lives. Every time we write a letter, make a phone call, or give someone instructions, we use our communication skills. Studying English helps us develop our reading, writing, speaking, and listening skills, all of which play some part in our everyday lives.

Nancy Saffer is an economist formerly with the Office of Employment Projections, BLS.
Taking English in high school and college

In high school English classes, most students study basics such as vocabulary, spelling, composition, reading, and grammar. Learning how to construct sentences and paragraphs lays the groundwork for writing effective letters, essays, term papers, and reports. English classes also include exposure to literature, which teaches students to analyze other people's words and provokes thought by providing insight into the human condition.

Advanced communication requires a strong ability to communicate both orally and in writing; college-level English courses are recommended.

College-level English courses are designed to refine the skills learned in high school. Subjects such as literature, writing, and grammar are taught as individual classes. These courses provide additional study and practice of communication.

How English relates to careers

You may think English classes only relate to a few occupations, such as writing or editing. But every job requires workers to understand instructions quickly and to explain problems to supervisors and other workers.

Good communication is essential for most occupations, even those that require little interaction with others. A problem cited by employers of engineers, for example, is that some technically competent workers are unable to explain what they are doing, to understand or explain what their part of a project is, or to relate their task to what others are doing.

Many occupations require frequent communication. Sales workers must be
Intermediate communication

- Adjudicators, investigators, and collectors
- Architects
- Clerical supervisors and managers
- Construction and building inspectors
- Construction and building managers
- Designers
- Employment interviewers
- Financial managers
- Health information technicians
- Health services managers
- Hotel managers and assistants
- Industrial production managers
- Insurance agents and brokers
- Library technicians
- Licensed practical nurses
- Paralegals
- Pharmacists
- Physical therapists
- Police, detectives, and special agents
- Private detectives and investigators
- Property managers
- Real estate agents, brokers, and appraisers
- Receptionists
- Recreation workers
- Recreational therapists
- Registered nurses
- Respiratory therapists
- Restaurant and food service managers
- Retail sales worker supervisors and managers
- Retail sales workers
- Secretaries
- Securities and financial services sales representatives
- Service sales representatives
- Social and human service assistants
- Travel agents
- Travel guides

Developing communication skills

The best way to begin developing communication skills is to take high school English classes. Reading outside of class is also a good way to develop those skills and to build an effective vocabulary. In addition, getting involved in extracurricular activities improves communication because of the interaction required. Some activities target specific abilities: Joining the school newspaper or yearbook staff is a good way to work on writing skills; the debate team is ideal for developing speaking skills.

The accompanying lists show occupations that require advanced, intermediate, or basic communication skills. Advanced communication requires a strong ability to communicate both orally and in writ-
Basic communication
Bank tellers
Bus drivers
Cashiers
Correctional officers
Counter and rental clerks
Court reporters, medical transcriptionists, and stenographers
Dispatchers
Flight attendants
Funeral directors
General office clerks
Homemaker-home health aides
Hotel and motel desk clerks
Interviewing and new accounts clerks
Loan clerks and credit authorizers, checkers, and clerks
Nursing aides and psychiatric aides
Occupational therapy assistants and aides
Physical and corrective therapy assistants and aides
Postal clerks and mail carriers
Prepress workers
Preschool teachers and child care workers
Proofreaders
Receptionists
Reservation and transportation ticket agents and travel clerks
Routing and receiving clerks
Service representatives
Taxidrivers and chauffeurs
Telephone operators
Title searchers
Typesetters
Typists, work processors, and data entry keyers
Visual artists

Basic communication requires
the ability to interact with
others and to follow simple oral
and written instructions; high
school English classes are
helpful but not essential in
developing this level of skill.

For more information on the level of
education and training needed for specific
occupations, consult the Occupational
Outlook Handbook, available in most li-
braries, career centers, and placement of-
Math and your career

by Nancy Saffer

Math skills help us cope with today's complex world. We use math to carry out everyday tasks such as balancing a checkbook, shopping for groceries, cooking, and creating a personal budget. Other important skills we learn from studying math include problem solving, analysis, and estimating. And math knowledge is essential for earning a living in many occupations, including most higher-paying occupations.

There are about 15,500 mathematicians employed in the United States, but millions of workers have jobs in which mathematics is a necessary part. In fact, almost all jobs require at least some understanding of basic mathematics. For example, carpenters must be able to measure lengths and angles when installing wood trim. Machinists need to understand and manipulate angles and dimensions. Loan officers must determine applicants' debt-equity ratios before approving mortgage applications. And math skills are required for any science, engineering, computer, and technical occupation.

Math is also an important part of a well-rounded education. Most high schools require students to take at least 2 years of math to graduate. And most colleges require some proficiency in math for all applicants, regardless of their intended majors.

Nancy Saffer is an economist formerly with the Office of Employment Projections, BLS.
Careers for people interested in math
Although most occupations require basic math skills, some jobs rely on math more heavily than others. If you have taken many math courses, have a high aptitude for math, or major in math in college, you might be interested in some of the following occupations.

**Actuaries.** Actuaries answer questions about future risk, formulate investment strategies, and make pricing decisions. They may design insurance, financial, and pension plans by calculating probabilities of events such as sickness, disability, or death based on known statistics.

A bachelor's degree in mathematics or statistics is required for an entry-level position in a life or casualty insurance company. Applicants must be proficient in several mathematics subjects, including calculus, probability, and statistics, and have passed the beginning actuarial exams.

**Mathematicians.** Mathematicians use their mathematical knowledge and computational tools to create mathematical theories and techniques. They use these theories and techniques to solve economic, scientific, engineering, and business problems. Mathematicians often work with computers to solve problems, develop models, analyze relationships between variables, and process large amounts of data.

Mathematicians need a minimum of a bachelor's degree. People with bachelor's degrees may assist senior mathematicians or work on less advanced problems. Most mathematicians in the private sector need a master's or doctoral degree.

**Operations research analysts.** Operations research analysts are problem solvers who usually work for large organizations or businesses. They help these organizations operate more efficiently by applying mathematics principles to organizational issues. They work on problems

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**Occupations in the advanced or theoretical math skills category require an understanding of more complex math concepts such as calculus and linear algebra.**

<table>
<thead>
<tr>
<th>Advanced or theoretical mathematics</th>
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<tbody>
<tr>
<td>Actuaries</td>
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<tr>
<td>Agricultural scientists</td>
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<tr>
<td>Architects</td>
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<tr>
<td>Biological and medical scientists</td>
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<tr>
<td>Chemists</td>
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<tr>
<td>Computer scientists, computer engineers, and systems analysts</td>
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<tr>
<td>Economists, and marketing research analysts</td>
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<tr>
<td>Engineering, science, and data processing managers</td>
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<tr>
<td>Engineers</td>
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<tr>
<td>Foresters and conservation scientists</td>
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<tr>
<td>Geologists, geophysicists, and oceanographers</td>
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<tr>
<td>Mathematicians</td>
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<td>Mathematics teachers (secondary school and college)</td>
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<tr>
<td>Meteorologists</td>
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<tr>
<td>Operations research analysts</td>
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<tr>
<td>Physicists and astronomers</td>
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<tr>
<td>Social scientists</td>
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<tr>
<td>Statisticians</td>
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</tbody>
</table>
Occupations in the applied math skills category include those in which workers need to understand mathematical concepts and be able to apply them to their work; in these occupations, knowledge of statistics and trigonometry may also be needed.

Applied mathematics
Accountants and auditors
Administrative services managers
Aircraft pilots
Budget analysts
Chiropractors
College and university faculty (nonmathematics)
Computer programmers
Construction and building inspectors
Construction contractors and managers
Cost estimators
Dentists
Dispensing opticians
Drafters
Education administrators
Engineering technicians
Farmers and farm managers
Financial managers
General managers and top executives
Government chief executives and legislators
Industrial production managers
Insurance agents and brokers
Insurance underwriters
Loan officers and counselors
Management analysts and consultants
Optometrists
Pharmacists
Physician assistants
Physicians
Podiatrists
Psychologists
Real estate agents, brokers, and appraisers
Respiratory therapists
School teachers, kindergarten, elementary, and secondary
Science technicians
Securities and financial services sales representatives
Special education teachers
Surveyors and mapping scientists
Urban and regional planners
Veterinarians

such as facilities layout, personnel schedules, forecasting, and distribution systems. They often use mathematical models to explain how things happen within an organization and to determine how to organize things more effectively. Most employers prefer to hire analysts who have a master’s degree in operations research, industrial engineering, or management science.

Statisticians. Statisticians collect, analyze, and present numerical data and design, carry out, and interpret the results of surveys and experiments. Statisticians use mathematics techniques to predict things such as economic conditions or population growth, to develop quality control tests for manufactured products, and to help business managers or government officials make decisions and evaluate the results of new programs.

For most beginning jobs in statistics, a bachelor’s degree in mathematics or statistics is the minimum requirement. Many research positions require a master’s or doctoral degree.

Careers requiring strong math skills
Some other jobs require a strong background in math. The following occupations are among those in which strong math skills are very important.

Physical and life scientists. Physical and life scientists, including biologists, physicists, chemists, and geologists, work to discover the basic principles of how the earth, universe, and living things operate. The ability to use mathematical relationships to understand and describe the workings of nature is vital.

Most scientists need a doctoral degree in their field, especially those who work in basic research, but some scientists in applied research may need only a bachelor’s or master’s degree.

Social scientists. Social scientists perform research that helps us understand
Occupations in the practical math category may require algebra and geometry in addition to general math skills.

Practical application of mathematics
- Air traffic controllers
- Aircraft mechanics, including engine specialists
- Automobile mechanics
- Automotive body repairers
- Blue collar worker supervisors
- Boilermakers
- Broadcast technicians
- Carpenters
- Concrete masons and terrazzo workers
- Diesel mechanics
- Dietitians and nutritionists
- Electric power generating plant operators and power distributors and dispatchers
- Electricians
- Electronic equipment repairers
- Elevator installers and repairers
- Farm equipment mechanics
- Funeral directors
- General maintenance mechanics
- Heating, air-conditioning, and refrigeration technicians
- Industrial machinery repairers
- Inspectors, testers, and graders
- Jewelers
- Landscape architects
- Machinists and tool programmers
- Millwrights
- Mobile heavy equipment mechanics
- Motorcycle, boat, and small-engine repairers
- Ophthalmic laboratory technicians
- Photographers and camera operators
- Purchasers and buyers
- Sheetmetal workers
- Stationary engineers
- Tool-and-die makers
- Water and wastewater treatment plant operators
- Welders, cutters, and welding machine operators

how individuals and groups make decisions, exercise power, and respond to change. Many social scientists, especially economists, describe behavior with mathematical models. Also, much of social scientists’ research depends on gathering and understanding statistics that describe human behavior.

As with physical and life scientists, many jobs involving research require a doctorate. However, many social science jobs involving applied research require only a bachelor’s or master’s degree.

Computer scientists and systems analysts. Workers in computer science occupations design computer systems and perform research to improve these systems. They may also program computers. Advanced mathematics skills might not be necessary for computer programming; however, training in mathematics helps develop an ability to think logically—a necessary qualification for working with computers.

Most of these workers have bachelor’s degrees in computer science, information systems, or computer engineering. Some research positions require a master’s or doctoral degree.

Engineers. Engineers use the theories and principles of mathematics to help solve technical problems. They also use mathematics to design machinery, products, or systems. Most entry-level engineering jobs require a bachelor’s degree.

Science and engineering technicians. Science and engineering technicians use the principles and theories of science, engineering, and mathematics to solve technical problems in research and development, manufacturing, and other areas. Their jobs are more limited in scope and more practically oriented than those of scientists and engineers, but technicians rely heavily on mathematics techniques in their work.

There are many different ways of qualifying for a position as a science and engineering technician, but most jobs re-
Occupations in the general math skills category require basic arithmetic such as addition, subtraction, multiplication, and division.

General mathematics
Bank tellers
Billing clerks and billing machine operators
Bindery workers
Bookkeeping, accounting, and auditing clerks
Bricklayers and stonemasons
Brokerage clerks and statement clerks
Cashiers
Counter and rental clerks
Drywall workers and lathers
Glaziers
Interviewing and new accounts clerks
Library assistants and bookmobile drivers
Loan clerks and credit authorizers, checkers, and clerks
Manufacturers' and wholesale sales representatives
Medical assistants
Metalworking and plastic-working machine operators
Order clerks
Payroll and timekeeping clerks
Plasterers
Postal clerks and mail carriers
Precision assemblers
Prepress workers
Printing press operators
Private detectives and investigators
Reservation and transportation ticket agents and travel clerks
Roofers
Secretaries
Stock clerks
Structural and reinforcing ironworkers
Taxidrivers and chauffeurs
Teacher aides
Tilesetters
Traffic, shipping, and receiving clerks

Other careers that require math skills
Math skills are useful in a number of other occupations. For example, most jobs in the financial industry use math skills. Bank tellers must have strong math skills to be both accurate and efficient. Accountants need proficiency in math to calculate and analyze numbers. Air traffic controllers need to understand maps and geometry when directing planes. Managers of all kinds use math skills; for example, hotel managers and assistants must be able to estimate costs for items the hotel needs to order, such as food and drinks.

Preparing for careers in math
The accompanying lists show occupations that require different levels of math skills: Advanced, applied, practical, or general. Occupations in the advanced or theoretical math skills category require an understanding of more complex math concepts such as calculus and linear algebra. Occupations in the applied math skills category include those in which workers need to understand mathematical concepts and be able to apply them to their work; in these occupations, knowledge of statistics and trigonometry may also be needed. Occupations in the practical math category may require algebra and geometry in addition to general math skills. Occupations in the general math skills category require basic arithmetic such as addition, subtraction, multiplication, and division.

For more information on the level of education and training needed for specific occupations, consult the Occupational Outlook Handbook, available in most libraries, career centers, and placement offices and on the Internet at http://stats.bls.gov/oco/home.htm.
Pilots apply math and science when they assess weather reports and create flight plans.

Physicians employ their extensive knowledge of biology and biochemistry in treating illness.

Science and your career

by Nancy Saffer

Studying science helps us understand the discoveries that affect our daily lives. Every time we use a telephone, television, or computer, we are using a product of science. We use our knowledge of science when making decisions about our health and diet. Even common hobbies, such as cooking, gardening, and photography, rely on scientific principles.

By studying science, we learn how the universe works; we learn to observe, classify, measure, predict, interpret, and communicate data; and we develop the ability to think logically and solve problems. The skills and knowledge that come from studying science are important in many occupations.

There are almost 400,000 scientists employed in the United States, but 21 million workers use science on the job. For example, mechanics use scientific procedures when repairing or testing equipment. Physical therapists use biology and physics to rehabilitate patients. Journalists use scientific knowledge when writing about technology, health, or the environment. And scientific problem solving skills are necessary for most computer occupations.

Science courses are also important if you want an advanced education. College admissions officers

Nancy Saffer is an economist formerly with the Office of Employment Projections, BLS.
Advanced science occupations require a thorough knowledge of scientific principles; a bachelor's degree with a number of college science courses is usually the minimum requirement. But many of these positions require a master's or doctoral degree.

Careers for people interested in science

Although science skills are helpful in many occupations, some occupations rely heavily on science. If you have a strong interest in science, you might want to consider one of the following occupations.

**Biologists.** Biologists study living organisms and their relationship to each other and the environment. Most biologists specialize in one branch of biology—for example, microbiology, the study of microscopic organisms; zoology, the study of animals; or botany, the study of plants. These branches are then subdivided. For example, types of zoologists include mammalogists, who study mammals; ichthyologists, who study fish; ornithologists, who study birds; and herpetologists, who study reptiles and amphibians.

**Chemists.** Chemists search for new chemicals and find uses for existing ones. Their discoveries might be used to pro-

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Advanced science

- Agricultural scientists
- Architects
- Archivists and curators
- Biological and medical scientists
- Chemists
- Chiropractors
- Computer scientists, computer engineers, and systems analysts
- Dentists
- Engineering, science, and computer systems managers
- Engineers
- Forensic scientists
- Foresters and conservation scientists
- Geologists and geophysicists
- Landscape architects
- Meteorologists
- Pharmacists
- Physical therapists
- Physician assistants
- Physicians
- Physicists and astronomers
- Podiatrists
- Respiratory therapists
- Teachers, secondary and college (sciences)
- Veterinarians

often favor individuals who have taken science classes. Many colleges require at least 2 years of high school science courses, regardless of your intended major. If you want to be admitted into scientific and technical programs, you will probably need 3 or 4 years of high school science.
**Applied science**

- Aircraft mechanics, including engine specialists
- Aircraft pilots
- Broadcast technicians
- Cardiovascular technologists and technicians
- Clinical laboratory technologists and technicians
- College and university faculty
- Construction and building inspectors
- Construction contractors and managers
- Dental hygienists
- Dental laboratory technicians
- Dietitians and nutritionists
- Dispensing opticians
- Drafters
- Electroneurodiagnostic technologists
- Emergency medical technicians
- Engineering technicians (all specialties)
- Health information technicians
- Health services managers
- Licensed practical nurses
- Nuclear medicine technologists
- Occupational therapists
- Occupational therapy assistants and aides
- Photographers and camera operators
- Physical therapists
- Psychologists
- Radiologic technologists
- Recreational therapists
- Registered nurses
- Respiratory therapists
- Science technicians
- Electronic semiconductor processors
- Speech-language pathologists and audiologists
- Surgical technologists
- Surveyors and mapping scientists

**Applied science occupations**

require workers to understand scientific principles and apply them to their work; some posthigh school science training is needed.

**Agricultural scientists.** Some types of scientists work to improve agriculture. Crop scientists study the genetic breeding and management of field crops. Soil scientists use soil physics, soil chemistry, and soil microbiology to enhance soil fertility and the growth of plants. Agronomists develop practical applications for discoveries in plant and soil science to produce high quality food.

**Other scientists.** There are many other branches of science. Geologists study the history and composition of our planet, including volcanoes and earthquakes. Oceanographers study the oceans and their movements. Meteorologists study the atmosphere, and some make weather predictions. Astronomers study the universe, trying to gain knowledge about the stars, planets, and galaxies.
Practical application of science
Automotive body repairers
Automotive mechanics
Barbers and cosmetologists
Boilermakers
Chefs, cooks, and other kitchen workers
Dental assistants
Diesel mechanics
Electricians
Electronic equipment repairers
Elevator installers and repairers
Farm equipment mechanics
Farmers and farm managers
Firefighting occupations
Fishers, hunters, and trappers
Funeral directors
General maintenance mechanics
Heating, air-conditioning, and refrigeration technicians
Home appliance and power tool repairers
Industrial machinery repairers
Jewelers
Landscaping, groundskeeping, nursery, greenhouse, and lawn service occupations
Machinists and tool programmers
Medical assistants
Millwrights
Mobile heavy equipment mechanics
Motorcycle, boat, and small-engine mechanics
Nursing aides and psychiatric aides
Ophthalmic laboratory technicians
Pest controllers
Pharmacy technicians
Photographic process workers
Physical and corrective therapy assistants
Plumbers and pipefitters
Prepress workers
Printing press operators
Stationary engineers
Structural and reinforcing iron workers
Tool-and-die makers
Urban and regional planners
Vending machine servicers and repairers
Water and wastewater treatment plant operators
Water transportation occupations
Welders, cutters, and welding machine operators

Although many scientists specialize, most need to have knowledge in more than one branch of science. Agronomists, for example, combine their knowledge of biology, geology, chemistry, and mathematics to find better ways to grow food and conserve soil. They may also work closely with other scientists, such as microbiologists, biochemists, meteorologists, and entomologists.

Engineers. Engineers use the principles and theories of chemistry, physics, and mathematics to solve practical problems. They develop new products and improve systems and processes. Engineers design computers, generators, helicopters, spacecraft, and other devices. Engineering has many specialties. The largest are mechanical engineering, electrical and electronics engineering, and civil engineering.

Mechanical engineers design and develop power-producing machines, such as internal combustion and rocket engines. Others design and develop power-using machines, such as refrigeration systems.

Electrical and electronics engineers design, develop, test, and supervise the production of electrical equipment. This includes computers, automobile ignition systems, and wiring and lighting in buildings. They also design communications, video, and radar equipment.

Civil engineers design and supervise the building of roads, bridges, tunnels, buildings, airports, harbors, and water supply, flood control, and sewage systems.
Technicians and technologists. Science and engineering technicians carry out the plans of scientists and engineers—setting up experiments, recording results, or testing product quality. They may also design simple experiments. These workers use testing and measuring devices and have a solid understanding of laboratory techniques.

Other technician occupations include drafters, who prepare technical drawings of structures and products; broadcast technicians, who install, repair, and operate radio and television equipment; and air-conditioning, refrigeration, and heating technicians.

Understanding the physical properties of materials helps firefighters combat different types of fires.

Other careers that use science
Science skills are useful in many other occupations. For example, there are numerous occupations in health care, and all require knowledge of biology and other sciences. Physicians, nurses, dentists, veterinarians, and emergency medical technicians are just a few of the health occupations that require an understanding of science.

Many workers use chemistry and physics in their work. Chefs and cooks use chemistry when creating recipes and preparing food, because cooking ingredients are chemicals. Dietitians and nutritionists are also concerned with chemical content of foods. Farmers and horticulturists use fertilizers and pesticides, the products of chemistry. Electricians apply the principles of physics when wiring a building, and aircraft pilots use physics and meteorology to plot flight paths and fly planes.

Preparing for careers in science
Careers in science require orderly thinking, systematic work habits, and perseverance. If you are a student who is interested in scientific and technical careers, you should take as many science classes in high school as possible. Basic courses in earth science, biology, chemistry, and physics will form a solid foundation for further study. A strong background in mathematics is also important for those who want to pursue scientific, engineering, and technology-related careers.

The lists show occupations requiring different levels of scientific skill: Advanced, applied, or practical application. Advanced science occupations require a thorough knowledge of scientific principles; a bachelor’s degree with a number of college science courses is usually the minimum requirement. Many of these positions require a master’s or doctoral degree. Applied science occupations require workers to understand scientific principles and apply them to their work; some posthigh school science training is needed. Practical application occupations require familiarity with the basic principles of biology, chemistry, or physics; high school courses in these areas should be sufficient.

For more information on the level of education and training needed for specific occupations, consult the Occupational Outlook Handbook, available in most libraries, career centers, and placement offices and on the Internet at http://www.stats.bls.gov/oco/home.htm.
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