

Science and Living in God's World

Grade 8

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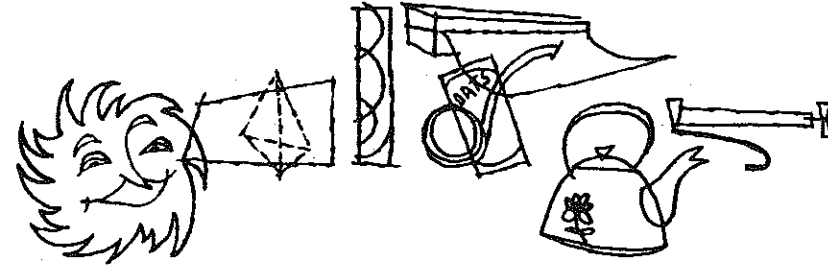
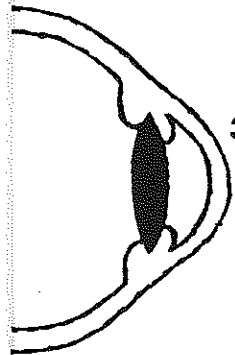
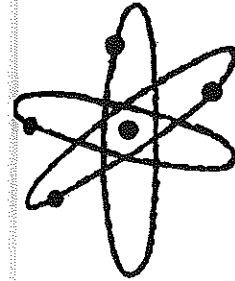
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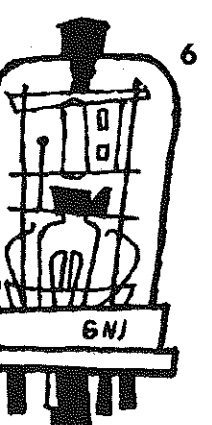
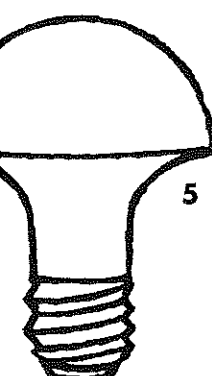
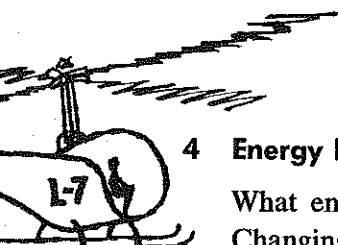
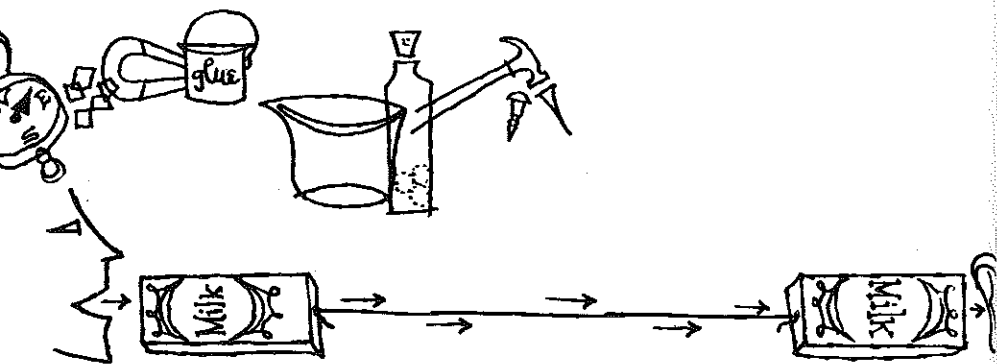
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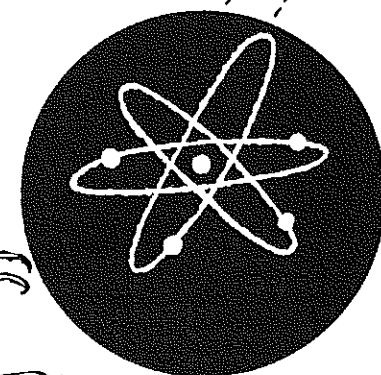
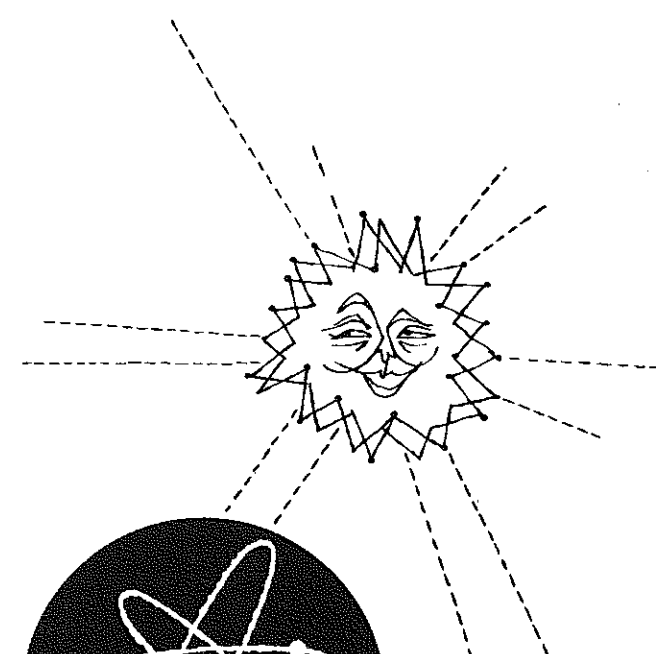
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Introduction

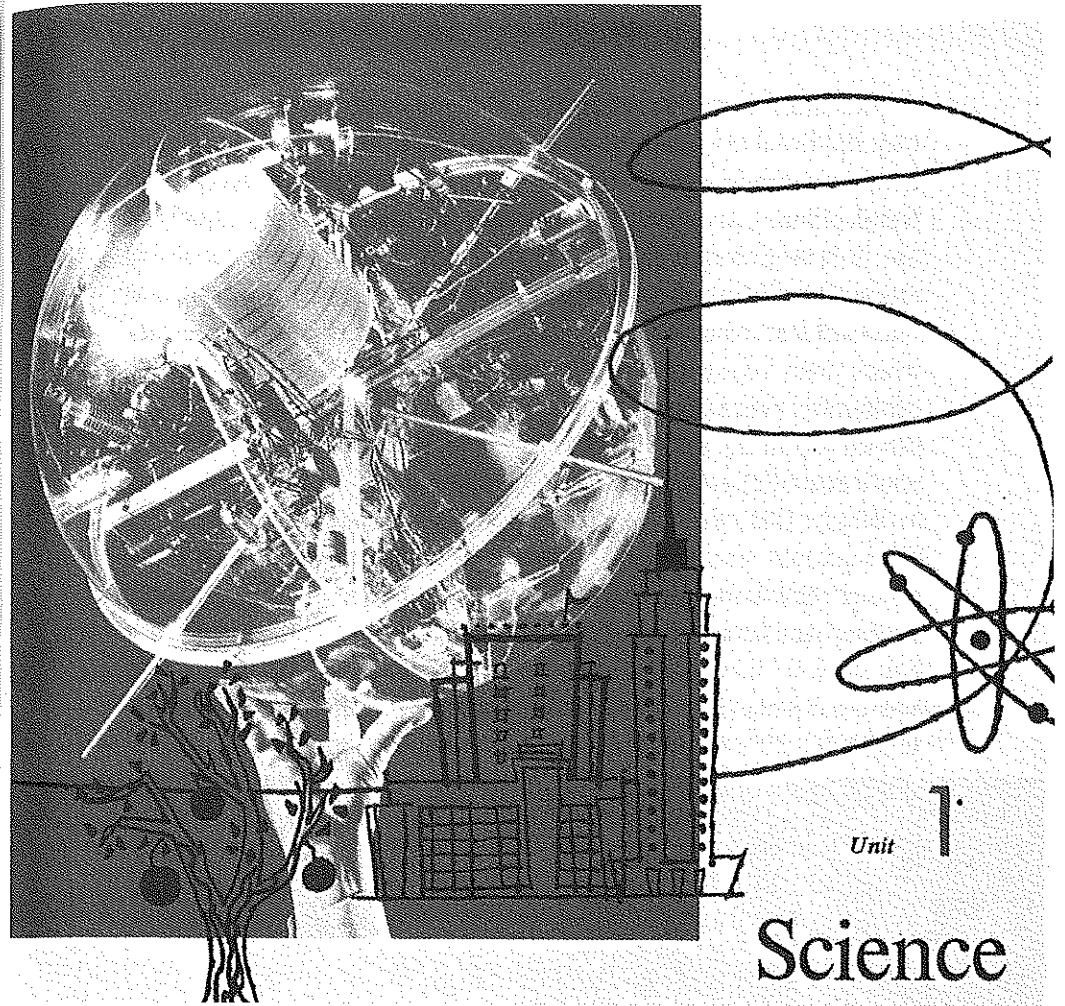
Of all the creatures in the visible world, man is the only one that thinks. Dogs roam around the streets. Many birds fly south in the fall to keep warm. Sheep use grass in the field for eating and water in the brook for drinking. Man, too, is interested in satisfying his hunger and thirst, in walking on the solid earth, and in protecting himself from the extremes of weather. But beyond that, man has a power that no lower animal has. He can think. He wants to know what causes the earth, the weather, the grass, and the water.

When man thinks about something, he is trying to explain it by finding its causes and reasons for being. Throughout this whole series of science books, *GOD'S WORLD*, you have seen how the scientist explains things—the weather, rock formations in the earth, the movement of the stars overhead, the structure of matter, the various functions of living things, and the control of disease and of other dangers. In each case, the scientist has been looking for the causes and reasons for things.

But the scientist is not content with *any* explanation of causes. Man does not like to be in a state of doubt. He is always looking for *sure* answers to his questions. When you make a mistake, you are not satisfied just to know that you have made a mistake. You want to know what the mistake is and why you made it. A scientist is not content until he reaches the true and sure explanation for things and thus finds true and real causes.

Oftentimes the scientist is unable to find sure knowledge of the causes of things. In such cases, he makes up a supposition about the causes and tests it by means of facts. Such a supposed explanation is called a theory and is the best explanation that the scientist can find under circumstances present. But whenever a scientist accepts a theory about the causes for things, he proceeds to try to test his theory or to find a better one. He is not content until he finds certainty. A scientist is a man who wants to know the why of things, and he wants to know this for sure. Science is a sure knowledge of things in terms of causes.

A mind that looks for causes will one day have to ask whether there is a Supreme Cause of all the world. In this fashion, reason can prove something that we already know by faith—that God exists. God is *the* explanation for everything in this world because He is *the* Supreme Cause of each thing in this world. That is why this series of science books can be called *GOD'S WORLD*.



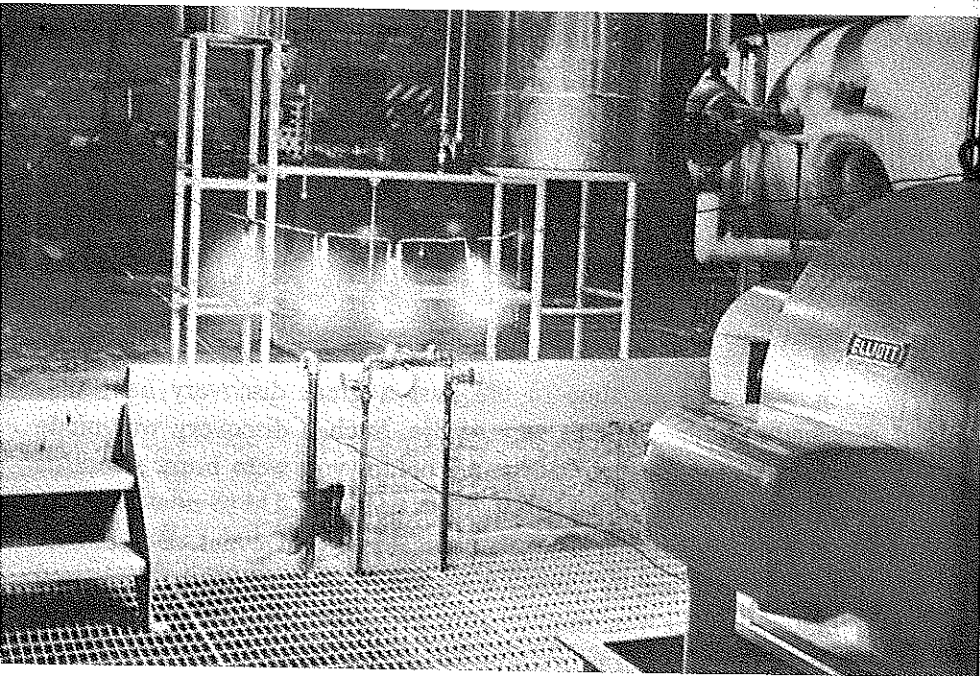
Science in today's world

From time to time in the past, a great discovery has completely changed man's way of life. Just prior to the time that most of your parent's were born, for example, scientists discovered how to get power from the atom. This has affected our lives in a number of ways, and there is still so much to learn about the atom. Consider the silicon chip, which made microcomputers possible. We don't realize all the ways in which computers affect our lives. Food is delivered to your grocery store, airplanes fly on designated routes, and traffic lights continuously cycle through green, yellow, and red, all because of computers.

The most important way that a great discovery affects man's way of life is by giving him a new way of looking at the world. Columbus made a great discovery when he sailed into the Western Hemisphere. This discovery opened a rich land to exploration and use. But more important still, it changed the way people looked at the world. Before the voyage of Columbus, people believed in a flat world surrounded by a fearful, unknown, empty space into which rash voyagers would plunge to destruction. Think of the excitement when the people heard about Columbus' discovery of America and his safe return. People looked at the world in a new way because they had learned more about it.

Within 120 years after Columbus' discovery, another discovery gave people a new way of looking at the universe itself. The theory that Copernicus formed that the planets revolve around the sun was first made public in 1543. By 1610, Galileo had used

These electric light bulbs show the first use of electric power from atomic energy. This picture was made in 1951. It shows a discovery as great as any ever made.



his newly-invented telescope to prove the theory. This discovery gave people a better picture of the world they lived in than they had ever had before.

You probably can think of other great discoveries that changed man's way of living. Each of them added in some way to our knowledge of God's world and the creatures in it. Each of them gave people a different way of looking at the world and of understanding it.

We, too, are living in an age of discovery. Our new knowledge about atomic science shows us that the world has a wonderful order in its make-up. In this science course you will learn more about this order. You will learn how some scientists have searched for and discovered facts about the world around us. You will share some of their knowledge and experience. You will discover things for yourself by experiences of sight, sound, touch, taste, and smell. The facts that you learn will be useful to you, and should be interesting. You will gain skill in using the scientific way to solve problems. You will find a new way of looking at the wonderful world into which God has put us.

Science in the news

Every day you learn about the wonders of science. Magazines and newspapers report new discoveries. You hear radio and watch television programs about science. People talk about science. When you hear reports, discussions, and stories about science, you should be able to connect them with what you already know. You already have learned a great deal about science. When you come across a piece of information about science, you should think about how it applies to you. What will a new discovery mean in your future? Will you know enough science to make use of it or understand it? You should also think about the great work and knowledge that scientific discoveries require.

On the next few pages you will read about five newspaper and magazine reports of scientific discoveries and events. As you read, think about how each is connected with the science that you know. Also think about the science knowledge you need to understand these reports better. Be ready to discuss the importance that each may have for you.

REPORT 1

The Dead Sea scrolls

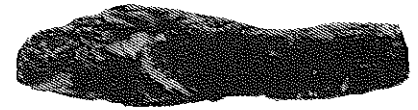
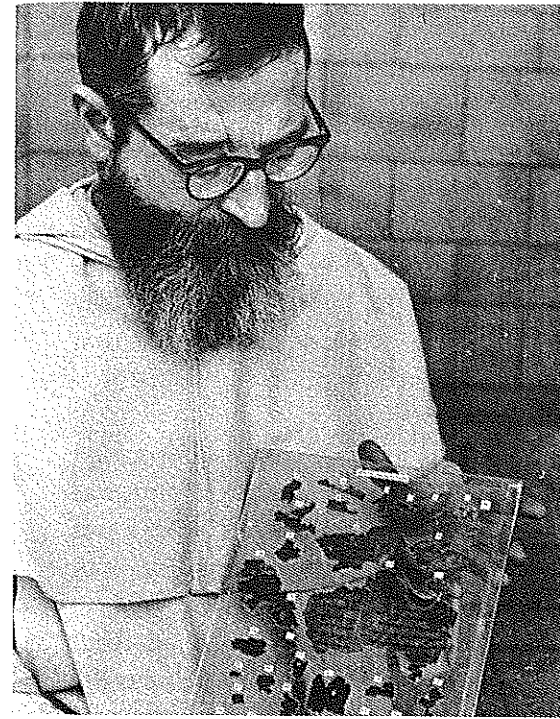
Science is often needed to discover traces of past ages, to restore and preserve them, and to learn their meaning. Science is especially important to an *archaeologist* (är'ki ol'ə jist). It is his job to discover remains from the past, to classify them, and to study them to find out how men lived in the long-ago days.

An exciting discovery for archaeologists and everyone interested in Biblical times was made in 1947. Young Arab shepherds found some ancient scrolls in a cave near the Dead Sea in Jordan. Hebrew scholars saw that several of the scrolls were copies of books of the Old Testament. From the way the letters were formed and from the words used, the scrolls appeared to date from about a century before the time of Christ.

When many caves in the Qumran cliffs near the Dead Sea were explored, more scrolls and many fragments of manuscripts were found. The best preserved scrolls were sealed in stone jars.

Near the caves were ruins of an ancient settlement. Archaeologists dug into the ruins to try to learn what kind of people had lived there, when they had lived, and why they had buried their scrolls in caves. Coins found by the archaeologists helped date the time when the scrolls were used.

Piecing together the evidence, the scientists concluded that the scrolls had belonged to the library of a Jewish community living near the Qumran caves. From Roman history sources, scientists know that there were groups, such as the Pharisees, Sadducees, and Essenes, among the Jews who lived during the time when the scrolls were made. The Qumran group seems more closely related to the Essenes than to any other group now known.



Father Roland de Vaux, an expert archaeologist of the Biblical School of the Dominican Fathers, was placed in charge of restoring the Dead Sea scrolls. He and others spent many years of careful work separating small parts, as shown in the glass he is holding, from rolls like the one above.

All the Dead Sea scrolls seem to have been made or to have been used from about 100 years before the birth of Christ until the destruction of Jerusalem 170 years later. The scrolls are a valuable find for Biblical scholars.

REPORT 2

The discovery of a polio vaccine

Infantile paralysis, or paralytic poliomyelitis (POH-lee-oh my-uh-LIE-tis), is a disease that seems to attack infants and children more frequently than it does adults. After it was discovered earlier in this century that polio was caused by a virus, many scientists tried to find a way to prevent or cure it. One of them, Dr. Jonas Salk, succeeded in producing a vaccine to prevent polio. In 1954, a large-scale test was carried out to see how effective his discovery would be.

The National Foundation for Infantile Paralysis directed a plan to vaccinate about 650 thousand school children. Of these children, 440 thousand were given the Salk vaccine. Two hundred ten thousand others were given a harmless pink fluid. More

than 1½ million school children, including those who had been vaccinated, were then observed until the beginning of 1955 for any signs of polio. Only those who kept the records knew which children had received the Salk vaccine and which children had received a plain liquid without vaccine. Even the doctors who gave the vaccinations did not know, because the material they used was labeled only with numbers. Records kept in a central office showed which numbers applied to vaccine and which applied to the plain liquid.

It took three months for scientists to study all the information that had been gathered. On April 12, 1955, their report was made public. They had compared the numbers of polio cases among those who had been vaccinated with Salk vaccine with the cases among those who had not.

The results showed that Dr. Salk's vaccine had protected about 90 per cent of the children who had received it. Those who did get polio after vaccination had it in a milder form than those among the unvaccinated who got it. The vaccine was licensed by the U.S. Public Health Service as "safe, pure, and potent" as a result of this great field test.

The test was the greatest mass vaccination in history. It gave hope that the crippling disease might be wiped out of the world by widespread use of Dr. Salk's great discovery.

What have you learned already about the causes and prevention of disease? Did your science prepare you to understand how vaccinations help? What effect on your future will Dr. Salk's great discovery have? Has it had any effect on your life today?

REPORT 3

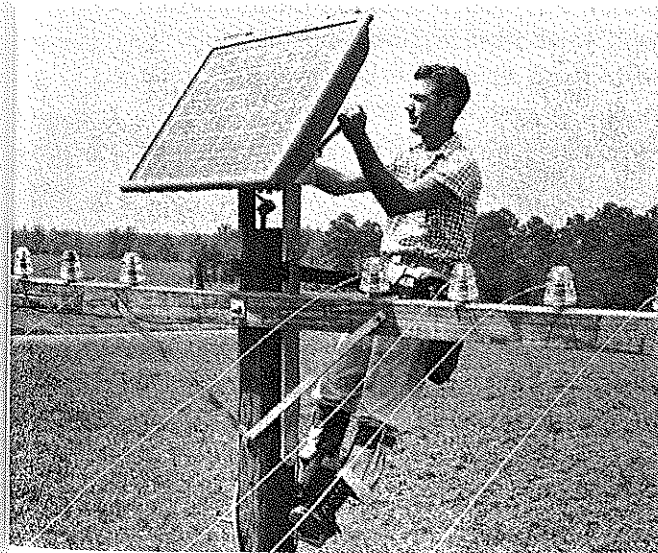
The discovery of new uses for solar energy

Many changes in man's life have come about through the discovery of a new form of energy or a new way to use energy. For a long time scientists have been searching for new ways to use energy from the sun, which is the source of all energy that we have learned to use. You may have used one device that changes energy from sunlight into motion—the photographic light meter.

These have been around for decades, but a more recent use of direct use of sunlight for energy is the solar-powered hand-held calculator. In both cases, sunlight passes into a *photoelectric* or *photovoltaic* cell, which transforms the light energy into electrical energy. It was Bell Telephone Laboratories which pioneered this concept in the 1940's and 50's. At that time, it was referred to as a "solar battery," and was bulky and inefficient. Now these photovoltaic cells are highly efficient, reasonably priced, and commonly available for both commercial and residential power generation purposes.

Photovoltaic cells change the energy of sunlight into electricity by making of a substance called silicon, the same substance used in computer microchips. Thin disks of silicon, about the size of quarters, are spread on a board and exposed to sunshine. When the light strikes the silicon disks, a flow of electricity results. From a set of silicon disks covering a square yard, about 100 watts of electrical power can be generated. Several modules can be connected to provide sufficient power for homes and businesses.

Once the electricity is generated, most solar power systems charge banks of batteries. The energy is stored in the batteries for Direct Current (DC) power at low voltages, or wired through an



The Bell solar battery was the first successful device made that could change the sun's energy directly into enough electrical power to operate a rural telephone line. It used photovoltaic cells similar to those mass produced today for both industrial and residential solar energy use.

inverter, which changes DC to Alternating Current (AC), for higher voltages.

Reputable companies such as Siemens and Solarex are conducting continuous research to make photovoltaic cells even more efficient with new materials called *semicrystalline* cells. The cost of these photovoltaic cells is much more affordable than it has ever been before. Still, when factored over the twenty-five year expected life of the solar cells, the cost per kilowatt hour of solar energy is not yet competitive with energy provided by your local electric company.

Has your previous science study prepared you to understand this report on solar cells? Can you explain why this way of using solar energy has not yet replaced the making of electricity by water power, fossil fuels, or nuclear fission? If science can discover improved ways to apply solar energy, what changes could result?

REPORT 4

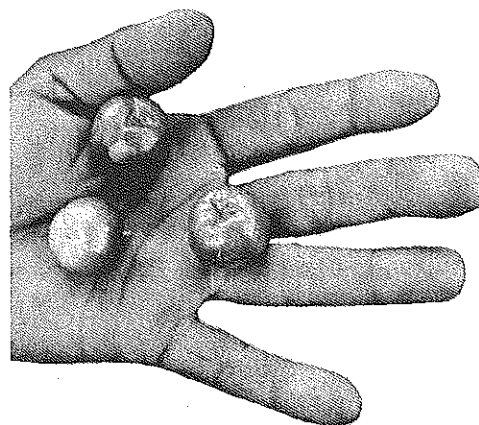
Finding a reliable source of vitamin C

In the days of sailing vessels, a disease called scurvy became particularly troublesome. Sailors got scurvy because of a deficiency in their diet. Proper foods were not available to them because no one knew enough about nutrition to stock the right foods on the ships. Besides, it was often a matter of months before the ship could stop at a port where fresh supplies were available.

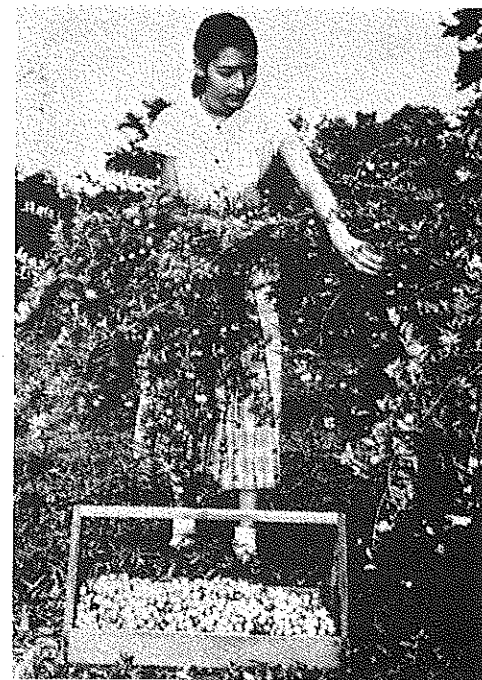
From science you will recall that Captain Cook, the great English sailor, was one of the first to do something to control scurvy among his crews. Without understanding all that we now know about the value of citrus fruit, Captain Cook included lemons in the provisions aboard his ships. Lemons contain ascorbic acid, also called vitamin C, the food material needed to prevent the disease of scurvy. Captain Cook's crews soon ceased to get scurvy.

Today, oranges generally are accepted as the best source of vitamin C. They are produced in large quantities in the United States and are pleasant to eat. But science recently has discovered a new kind of fruit juice that has eighty times as much vitamin C in it as an equal amount of orange juice.

Most people have not even heard about the fruit that contains this juice. It is called the acerola (ah-sir-OH-luh) cherry. It grows



Orchards of acerola trees are being cultivated to supply the world with the richest known source of vitamin C.



wild on a tree that is found in Puerto Rico. Scientists are helping the Puerto Ricans to grow it as a cultivated plant that will produce reliable crops of fruit in large quantities.

The juice of the acerola cherry has become available in more quantity over the last few decades. Scientists have experimented with mixing acerola juice with that of rose hips and cranberries, both of which are also high in vitamin C. The food value of all three of these plants is so high in vitamin C that just a little of it will do the job of keeping a person from having a vitamin C deficiency.

Does this report recall to you other facts that you have learned about food deficiencies?

REPORT 5

New explorations

The latter part of the twentieth century has seen new explorations previously only dreamed of or written about in science fiction. Undersea research and space exploration have led to a huge increase in what we know about our world and the planets.

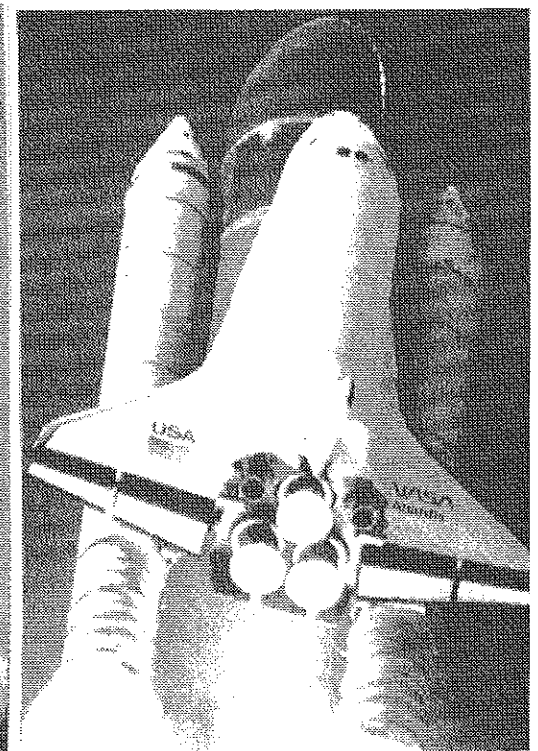
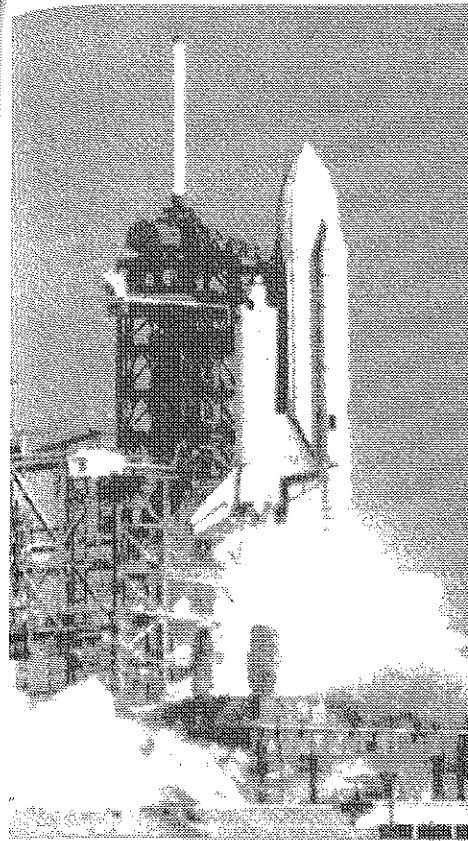
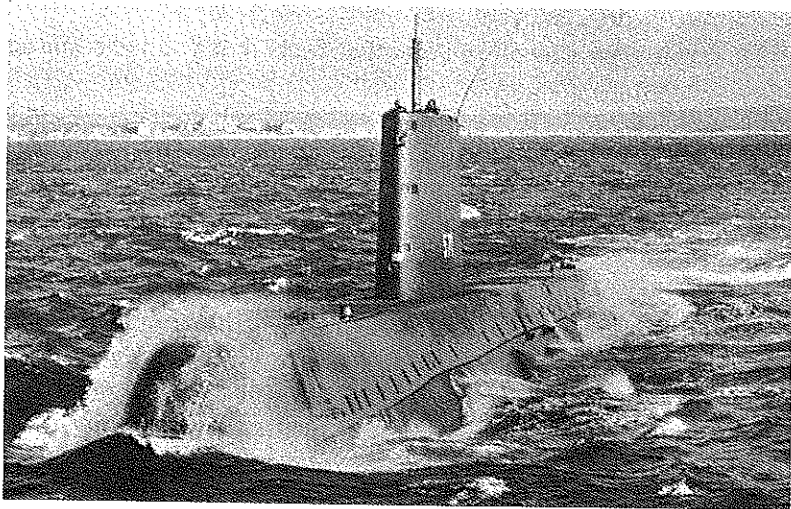
Geophysics, oceanography, and astronomy are just three examples of scientific disciplines which could benefit greatly from

the infusion of Catholic ideals and principles (as all of science could) by entry of young Catholic professionals into those fields.

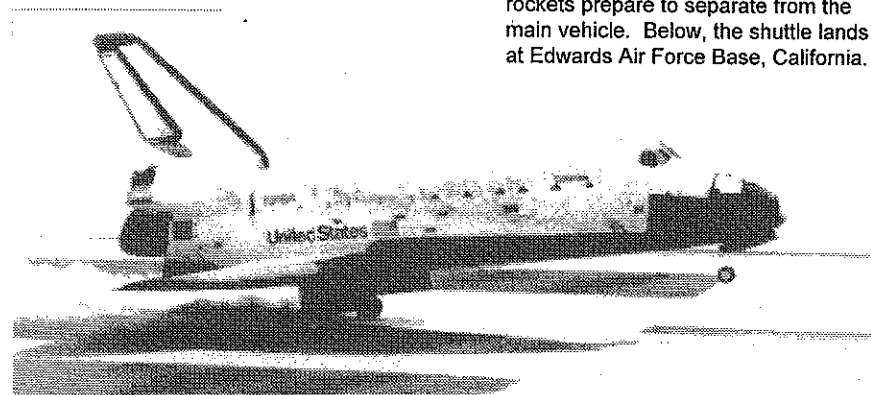
Exploration of the sea and the sea floor has moved ahead with the development of deep-submergence vehicles which have charted, and conducted geological testing of, the bottom of the ocean. From the first Arctic voyage of the first nuclear powered submarine in the world, the USS Nautilus, in the 1950's, to the deep-sea research of the 1990's, man has learned so many things. It has only been a little more than four decades since the USS Nautilus made its historic journey under the Arctic ice cap. For the first time in history, a vessel went from the Pacific Ocean to the Atlantic Ocean by the polar route. The Nautilus, and other submarines and submersibles that have followed in those intervening years, gathered important information about the depth of Arctic waters, the thickness of polar ice, and the contours of the ocean floor. Yet there is so much more to learn about those oceans which cover three-fourths of the earth's surface.

Perhaps the most exciting accomplishments which have occurred in recent memory have been associated with the push into space. Beginning with the X-15 flights of the 1950's, the manned

The U.S.S. Nautilus was not only the world's first atomic-powered submarine. but it was also the first sub to go from the Pacific Ocean to the Atlantic Ocean by the polar route.



Above left, the Space Shuttle, Atlantis, takes off from Cape Canaveral, Florida. Above right, Atlantis' booster rockets prepare to separate from the main vehicle. Below, the shuttle lands at Edwards Air Force Base, California.



space program culminated with the Apollo 11 mission, when Neil Armstrong became the first man to walk on the moon on July 20, 1969. Even as more Apollo lunar missions were being flown, plans for the Space Shuttle were being fine-tuned. First tested in the late 1970's by taking off piggy-back on, and being launched

inflight from, a modified Boeing 747, the shuttle now makes regularly scheduled flights into earth orbit for various purposes, including the placement of satellites in orbit, and the repair of ailing satellites. The shuttle returns to earth to land as an airplane, but without power.

Meanwhile, unmanned probes such as Magellan and Voyager have increased our knowledge about the solar system, particularly the other planets and their moons. Manned missions to Mars or Venus, launched from an orbiting, permanently manned space station, are a distinct possibility as we stand on the threshold of the twenty-first century.

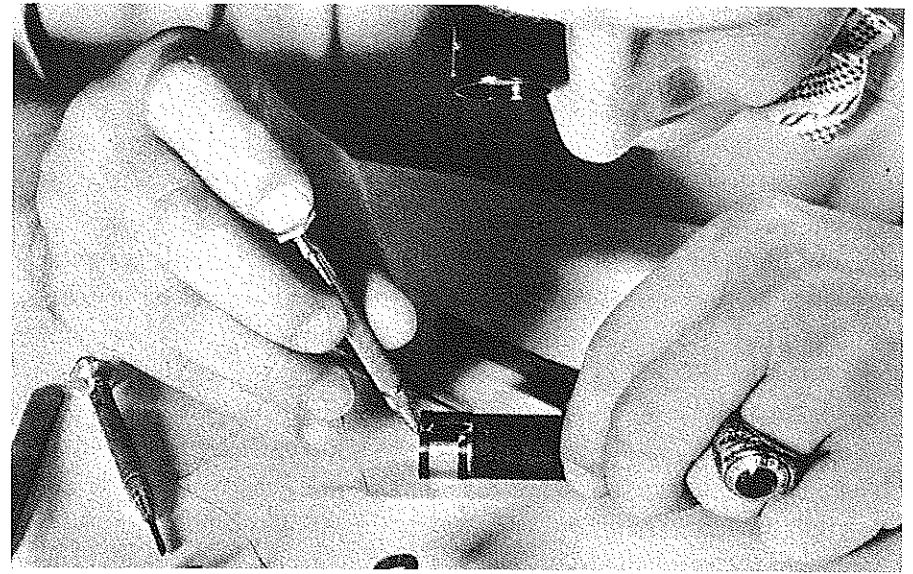
Thinking it over

- 1 How did you first hear about some recent scientific discovery? How could it change your way of living?
- 2 What have you learned in science that helped you to understand a science story in the news?
- 3 What are some of the things that make a good scientist?
- 4 In what circumstances would you like to have solar power? Why?
- 5 What are two advantages of solar power over fossil-fuel or nuclear generated power?
- 6 Do you agree that it is important to explore space? Justify your response.

What science is

To fit science news in with what you know about science, you must understand what the whole of science is. To know where you are going in science, you must know how science is related to you. To explore any part of science very thoroughly, you must know what is required of a good scientist.

Sometimes new scientific material is difficult to understand. So as not to be discouraged by it, and to help understand it better, look at new information in the context of how it fits in with all of science.



This man is working with the main part of a tiny motor designed for use in a miniature gyroscope. The work and ideas and many hours of effort on the part of many scientists were required to produce this tiny machine.

What science includes

Science is our knowledge about all of God's world, including the whole universe and all the creatures in it.

Before much science was known, one person could understand all of it. As more science was discovered, it became necessary to divide science up into special fields. Galileo experimented with weights, measures, and temperatures, invented instruments, made observations of objects in space, studied medicine and philosophy, and taught mathematics. Today these activities require a team of scientists made up of engineers, physicists, inventors, astronomers, doctors of medicine, philosophers, and mathematicians.

To be an expert today, a scientist has to concentrate time and energy in one special field. He also must know what the whole of science is and how his special field is related to it. To do this, he uses a classification of science into special fields.

Schools classify science into special fields that can be taught separately. For example, *general science* introduces you to the