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BUREAU OF EDUCATIONAL RESEARCH
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LIVING IN THE ATOMIC AGE
A RESOURCE UNIT FOR TEACHERS
IN SECONDARY SCHOOLS

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PREFATORY NOTE

The material for this circular on atomic energy was prepared under the direction of Professor Harold C. Hand of the University of Illinois. It is published by the Bureau of Educational Research in accord with its policy of giving through its publications helpful information and suggestions to teachers and school administrators. The Bureau of Educational Research in issuing this circular believes it is rendering assistance to the schools on one of the most important and pressing topics of the postwar years. It should be understood, however, that this circular does not represent the work of the Bureau of Educational Research, and full credit for its preparation should be given to Professor Hand and the members of the committee who worked with him.

Unfortunately the availability of this circular of necessity has had to be limited. It will be distributed to schools in the State of Illinois to the limit of the number of copies available for this purpose. Because of the current limitations on printing only a small number of copies is available for distribution to other schools. For this reason the Bureau of Educational Research, upon written request, will grant permission to reproduce this circular in whole or in part provided the reproduction is exclusively for non-profit purposes.

Walter S. Monroe, Director
Bureau of Educational Research
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LIVING IN THE ATOMIC AGE

PART I

INTRODUCTORY COMMENTS

1. Why this resource unit was prepared. About midway through the Summer Session of 1946 the Director of the National Committee on Atomic Information asked Professor H. C. Hand whether the College of Education at the University of Illinois might not take the initiative in preparing a resource unit for the use of secondary school teachers who are interested in educating youth for more effective living in the Atomic Age. The teachers and administrators in Professor Hand’s summer school classes had been discussing the educational implications of nuclear energy and were keenly aware of the acute need for teaching aids in reference to this new demand upon the schools. Consequently, when the Director’s letter was brought before them sufficient volunteers were immediately secured to warrant the undertaking of the task.

2. What this resource unit contains. The content is indicated by describing briefly the five following sections:

Section II, “Orientation for the Teacher,” was prepared on the assumption that many busy teachers have not yet had sufficient time to ground themselves in reference to developments in the field of nuclear energy, the urgent problems posed by these developments, and what these imply for the school and other educational agencies. This orientation section has been tried out before various groups of teachers and is believed to be reasonably adequate to the purpose for which it is intended—that of supplying the teacher with sufficient information to enable him or her to proceed with reasonable equanimity in guiding pupils’ inquiries in this new field of study. It is recommended, however, that non-science teachers ask teachers of science to clarify for them the first several pages in this section if they feel the need of further information.

In Section III the Committee has attempted to set down in behavioral terms what it believes to be the “plus” qualities of the effective citizen in the Atomic Age—i.e., those qualities which the Atomic Age appears to require in addition to those heretofore commonly understood and accepted by good teachers everywhere in America. Over 75 experienced teachers and administrators supplied the initial list of such “plus” qualities which the Committee ultimately edited into its present
form. This section has likewise been tried out before groups of teachers, modified in consonance with their suggestions, and is offered herewith in the belief that it is a reasonably inclusive and valid formulation.

Section IV indicates the types of questions which high school boys and girls are actually asking in reference to nuclear energy, the atom bomb, and related matters. These questions the Committee did not make up; it secured them firsthand from pupils attending University High School. It should also be noted that no “loaded” device was utilized—i.e., no suggested answers were supplied for pupils to check. Instead, each pupil was asked to set down what he had to say in response to the question “What do you want to know about nuclear energy and the atom bomb?” This section is included for purposes of enabling teachers better to appraise the probable readiness of pupils to attack the various types of learning experiences suggested in Section V. From the gratifying inclusiveness of these questions it would appear that few serious problems of motivation are to be anticipated in the engineering of such pupil experiences.

Section V, “Suggested Learning Experiences,” is, of course, the heart of this resource unit. No claim to inclusiveness is, or can be, made for this section. It is believed, however, that a sufficient number and variety of worth-while learning experiences have been suggested to provide abundantly for most units of work which are likely to be undertaken at this stage of our knowledge and understanding. This is likewise the considered opinion of a group of Michigan teachers who devoted three days of workshop time to a careful examination of all suggestions in this section. As a result of this scrutiny, many of the original suggestions of the Committee were amended, some were deleted, and a few others were added. The list, thus improved, was later tried out before other groups of teachers in preschool conferences and is believed by them to be a practical formulation pregnant with fruitful potentials.

Section VI (bibliography) requires no extended discussion. In addition to books, pamphlets, magazine articles, film strips, films, recordings, plays, short stories, and compiled bibliographies, it also contains a list of action groups with whose programs the teacher should be familiar. This is a selected bibliography chosen from among well over 250 items.

3. How this resource unit should be used. Rarely, if ever, is any resource unit utilized in its entirety by any one teacher. Instead, the purpose of a resource unit is to supply a wealth of usable suggestions from among which the teacher selects those which he believes to be most appropriate for his particular situation (the maturity and interests
of his pupils, community considerations, his library and other resources, the time available, and so on). Further, the good resource unit is seldom, if ever, restricted to any one broad field area of the curriculum. Rather, teachers in most, if not all, fields will find it a fruitful source of practical help.

Thus, it is apparent that a resource unit is not a teaching unit. Instead, it represents a "storehouse" which any given teacher draws upon in building a teaching unit, or units, for his particular group of pupils. From this it follows that a resource unit will seldom, if ever, be placed in the hands of the class, though it might well be jointly consulted by the teacher and those representatives of the pupil group who together plan the on-going work of the class. From the wealth of suggestions which a good resource unit contains, such a teacher-pupil planning and steering committee can select activities sufficiently varied in type and difficulty to care quite adequately for the variety of individual interests and abilities which are represented, but too seldom taken into account, in most class groups.

Ideally, of course, the teachers who are to use any given resource unit should build it themselves. After any given problem has been selected by the school faculty for inclusion in the curriculum, one or more (preferably all) of the teachers from each broad-field area should sit down together and stock their joint storehouse—i.e., construct their own resource unit. No one would be happier than the authors were this resource unit to be utilized as one source of suggestions by such faculty groups. But building a good resource unit takes time, a commodity which teachers in most high schools find extremely scarce, and time is of the essence in reference to the learnings with which this resource unit deals. Hence the Committee feels justified in offering this work for immediate use by interested but overly-busy high school teachers everywhere. Employed with imagination and discrimination, they believe that its utilization will prove immediately beneficial in enabling teachers to discharge what is probably the most urgently critical task with which the schools of America and the world have ever been confronted.
PART II
ORIENTATION FOR THE TEACHER: NUCLEAR DEVELOPMENTS AND THEIR MAJOR SOCIAL IMPLICATIONS*

The concept of the atom first had its origin in the mind of man as far back as 400 B.C. when Democritus and his pupils held to the belief that there existed an ultimate to the process of dividing matter. This smallest particle which retained the characteristics of the starting substance was named "atom," meaning uncuttable. This theory was, in general, overshadowed by Aristotle's teachings of the universe. Aristotle recognized the four elements of earth, air, fire, and water as representing the four characteristics of wet, dry, hot, and cold. Earth was dry and cold, air was wet and hot, fire was dry and hot, and water was wet and cold. Aristotle's theory was the basis upon which the alchemists attempted their transmutation of matter to obtain gold.

It was not until early in the nineteenth century that the atomic theory again came to the fore. In 1803, John Dalton (British) advanced the theory that all chemical elements are made of atoms. It was at this time that modern science was born. Avogadro (Italian), in 1811, added a refinement by distinguishing between atoms and molecules. From this time on, an atom was considered as the smallest particle of an element which still retained the characteristic properties of that element. A molecule is the combination of two or more of these atoms to form a chemical compound. Thus an atom of sodium (Na) combines with an atom of chlorine (Cl) to form a molecule of sodium chloride (NaCl), which is ordinary table salt. Scientists were now able to explain many phenomena which previously had been relegated to the realm of mysticism. From this belief in the structure of matter, Mendeleeff (Russian) and Meyer (German) were able to develop a periodic table of the elements. Mendeleeff's table is the one usually used, and this was published less than 80 years ago, in 1871. He discovered that when the elements were listed according to atomic weights, similar characteristics could be observed periodically—specifically, every eighth element. For example, sodium, which is eight elements down from lithium, has many characteristics similar to lithium. The same holds true for potassium which is eight down from sodium. Scientists

*In the preparation of this part a member of the staff of the Department of Physics, University of Illinois, was consulted by the Committee. The Committee, however, is solely responsible for what appears here.
realized that these "like" elements must have something in common to produce the similarities.

Many years passed before Neils Bohr, a Danish physicist, suggested a hypothesis to explain this phenomenon adequately. In the intervening years, discoveries were made which formed the basis of Bohr's theory. Becquerel (French) discovered the phenomenon of radioactivity in 1896 while working with uranium ores. While making a study of these radiations, Rutherford (British) discovered that there are three types of rays given off in the process, which he designated as alpha, beta, and gamma rays. It was also during this time that Einstein published his first paper on relativity which included the equation \( E = mc^2 \) (this equation is explained on page 15), the equation used to compute the amount of energy released in atomic processes.

In 1913, Bohr devised a model of an atom with a central nucleus and with electrons rotating in orbits around it (see diagram, above). During this same year, Moseley (British) classified the elements according to atomic number by a study of their X-ray spectra. The atomic number is, by definition, the number of positive charges on the nucleus. However, for an element to be stable and electrically neutral, the number of electrons must be the same as the number of positive charges on the nucleus.

Difficulties were encountered immediately because of mass considerations. From the preceding diagram it can be seen that hydrogen, with an atomic number of 1, has one electron and one positive charge on the nucleus. It also has an atomic weight of approximately 1. Helium, however, with atomic number 2, has two electrons, two positive charges on the nucleus, but an atomic weight of about 4, i.e., 2 more than it should have. This led to the search for, and discovery of, an atomic particle with some mass but no electrical charge. This particle was named "neutron." It has since been determined that the mass of the neutron and proton, the name given the positively charged particle of the nucleus, is approximately the same, while the electron has only
about 1/1800 of this mass. For all practical purposes, therefore, the neutron may be considered as having a mass of 1 and a charge of 0, the proton a mass of 1 and a charge of +1, and the electron a mass of 0 and a charge of −1. The discovery of the neutron adequately explained the mass of 4 for the helium atom. Besides the two protons in the nucleus, there are two neutrons. Further investigation revealed that the alpha particles given off by radioactive substances were merely helium nuclei.

Rutherford had been using these particles for atom bombardment and had changed nitrogen into oxygen. This was accomplished in 1919 and was the first artificial transmutation of an element in history. About this same time was devised the mass-spectograph, an instrument used to measure the atomic weights of the isotopes of elements. Isotopes are forms of an element that differ from other forms only in atomic weights. These isotopes had caused considerable concern among chemists for a number of years due to the fact that the atomic weights of elements were so near to whole numbers and yet none was exactly a whole number except oxygen which was arbitrarily taken as 16. The discovery of isotopes helped to solve the difficulty and the isotopes themselves could be explained by the discovery of the neutron. Consider chlorine as an example. The atomic number is 17 and the atomic weight is 35.46. This would require 18.46 neutrons in the nucleus to account for the weight. It is now known that the atomic weight of 35.46 is an average of the atomic weights of the isotopes, one of which is 35, containing 18 neutrons, and the other 37, containing 20 neutrons.

The knowledge of isotopes and the desire further to investigate within the atom led to the invention of the cyclotron by Lawrence (American) in 1931. This instrument was necessary to accelerate the alpha particles and protons which were being used to bombard the nuclei of atoms. High speeds were required to overcome the resistive forces between the positive charges on the bombarding particles and the positive charges on the nuclei. In the following year, 1932, Cockcroft and Walton (British) found that mass is converted to energy when the lithium nucleus is bombarded with artificially accelerated protons. This caused a more intensive effort on the part of scientists to explore inside the atom. Another accelerating mechanism was designed by Van de Graff (American) known as the Van de Graaff electrostatic generator. Shortly after this, Fermi (Italian) was experimenting with the bombardment of atomic nuclei with neutrons and, in bombarding uranium nuclei, produced a new element with an atomic number 93 (neptunium) which had never been discovered on earth before.
In 1939, Hahn and Strassman, two German chemists, bombarded uranium with neutrons and found barium and krypton as two of the products of the reaction. These two men were unable to explain what had happened but Meitner and Frisch (German) suggested that the uranium atom had split (a process to which they gave the name fission) and predicted that enormous amounts of energy should be liberated in the process. Frisch (German) and Joliot (French) proved this prediction experimentally by showing that large amounts of energy are actually released in the process. It was found that the isotope of uranium with an atomic weight of 235 is the only one which will undergo the fission process. This was known by scientists in all countries in 1939 or 1940. Thus there is no basic scientific secret in reference to the fission process.

The realization that the process, with its enormous release of energy, might have military applications resulted in a self-imposed secrecy on the part of the scientists and eventually a government-imposed secrecy when the Manhattan District Project was begun in 1942. The next time that the public heard of the process was after an atomic bomb had been dropped on Hiroshima, Japan, on August 6, 1945.

The first problem which had to be solved by the Manhattan Project was how to separate the fissionable uranium-235 from natural uranium. Since U-235 comprises only .7% of natural uranium, the remainder being uranium with an atomic weight of 238 and traces of uranium-234, the process of separation had heretofore been very tedious.

Three methods for separation were devised which appeared capable of producing U-235 in large quantities. In fear of trusting to one method for separation, the plant at Oak Ridge, Tennessee, was built so that all three methods could be used. One of these is known as the "thermal diffusion method" in which liquid uranium is passed into a cylinder containing a central core. The outside of the cylinder is cold and the core is hot with the result that the liquid uranium circulates but tends to concentrate the lighter U-235 at the top. The "gaseous diffusion" method is based on the principle that lighter atoms or molecules can more easily pass through a barrier, so if gaseous uranium is passed through a long series of barriers, the final product is rich in the lighter U-235. The third method used was the "electromagnetic deflection" in which a stream of uranium particles is passed through a strong magnetic field with the result that the U-235 particles are deflected more than the heavier U-238 particles. A "splitter" was devised to separate the two streams. An appreciation of the engineering difficulties may be gained by the realization that all of these processes had to be performed
by remote control so that the operators would be protected from the
dangerous radioactivity of the uranium metal.

It was also discovered that the man-made element plutonium, with
an atomic number of 94 and an atomic weight of 239, was a fissionable
material and might be substituted for the hard-to-get U-235. The plant
on the Columbia River at Hanford, Washington, was built for the pur-
pose of manufacturing plutonium.

This process involves the addition of a neutron to the nucleus of a
U-238 atom. The steps are shown diagrammatically below.

A neutron attaches itself to the nucleus of a U-238 atom converting it
to U-239. This form is unstable and releases what is believed to be
nuclear electrons (the theory has been advanced that a neutron is com-
posed of a proton and an electron, since the neutron is slightly heavier
than the proton) with the result that one neutron is changed to a proton
and this is the element neptunium with atomic number 93. This element
also emits a nuclear electron giving plutonium, atomic number 94, as
the final product. This reaction is carried on in a unit known as a "pile"
in which rods of uranium, in aluminum cans, are placed in holes bored
in a block of graphite. Since tremendous amounts of heat are developed,
the whole unit is cooled with circulating water. This is one of the
reasons for the selection of the plant site. The cold water of the
Columbia River made an excellent coolant. The aluminum cans are used
to prevent corrosion of the uranium by the water, and the graphite is
used as a "moderator" to slow down the neutrons. It was found that
a slowly moving neutron is more likely to join with the nucleus than
one moving at great speed. The original source of the neutrons is the
U-235 present. When the U-235 atom undergoes fission, neutrons are
emitted in the process. The pile is so constructed that the fission of the
U-235 present is a constant process, hence supplying a constant amount
of bombarding neutrons for the transmutation of the U-238. Many
engineering difficulties were encountered here also because of the
necessity of shielding against the radioactive rays. Even the water used
for cooling had to be stored until it had lost the radioactivity acquired
in the pile before it could be dumped back into the river.

The construction and the various specifications concerning the bomb
have not been released, but enough is known to understand approximately how it works. It was discovered that there is a "critical size" for a block of U-235 or Pu-239 below which the element will not explode. This is caused by the excessive loss of neutrons from the surface. If, however, the size is increased, the volume increases faster than the surface area and the fission process is self-perpetuating and explosive when the critical size is exceeded. The process in the bomb, then, is to bring together two or more pieces of the fissionable material which are below critical size to form a block that exceeds the critical size at the instant the explosion is desired. It is also desirable to hold the pieces together as long as possible so that the initial "building up" process does not force the pieces apart so that the reaction is stopped. The mechanism for detonating the bomb at the right moment may be one of several types. As examples, mechanical time delay mechanisms, pressure mechanisms operative due to varying atmospheric pressure with height, or high frequency radio control so that they may be detonated from remote distances.

At the present time, uranium-235 and plutonium are the only known elements which can be used for making an atomic bomb. Thorium and protactinium may also be used in the future, but it is believed that either U-235 or Pu-239 must be used to initiate the reaction. It is, of course, possible that any or all of the radioactive elements may be used as a result of future developments. There are now known deposits of uranium and thorium in all the continents of the earth, so that it can be seen that no nation holds a monopoly of the source material. One way to prevent the possibility of an atomic war might be to form a world commission with control over all the world's supply of fissionable materials, both the known deposits and whatever deposits may be found in the future.

The amount of energy created by atomic disintegration is almost beyond comprehension by the human mind. The amounts of energy created may be computed by the use of Einstein's formula \( E = mc^2 \), where \( E \) is the amount of energy produced, \( m \) is the mass of the matter converted to energy and \( c \) is the velocity of light. In the centimeter-gram-second system of measurements, the \( c^2 \) term alone is equal to a factor of 900,000,000,000,000,000,000,000,000. The most common unit of energy used in this country is the kilowatt-hour, i.e., the amount of energy consumed by burning a 1000-watt electric light bulb for one hour. Using this unit, one pound of matter converted completely to energy would produce 11,400,000,000 kilowatt-hours. In the fission process of U-235 only about .001 of the mass is converted to energy, but this still gives
11,400,000 kilowatt-hours of energy per pound. An idea of the magnitude may be gained by a comparison with the electrical energy developed in the United States in 1939. Simple calculations will show that in the fission of slightly less than eight tons of uranium, the same amount of energy is produced. Since much of the electrical energy developed in this country uses coal as a fuel, the energy relations above may be better understood if it is realized that the same amount of energy can be obtained from one pound of uranium as from 1500 tons of coal or from 200,000 gallons of gasoline.

If means can be devised for performing useful work with the energy available, a new era is certainly in the offing. Nor is there any reason to believe that such means will not be devised. The present difficulties are concerned mostly with the shielding necessary to protect workers from the radioactive rays. This necessitates rather bulky mechanisms, but any energy-developing plant with large power-producing equipment may be using atomic power within the next ten years. Electrical plants, locomotives, and steamships are such possibilities. Atomic energy may also be used for heating large spaces and may, in the not-too-distant future, be used for heating homes.

One of the most important possibilities may prove to be in the field of medicine. In the preparation of plutonium, large quantities of radioactive elements are produced. During the war these were merely by-products and had to be disposed of, but before the war small quantities of these substances were being used in medical, biochemical, and physiological research. The high cost prohibited extensive use of these valuable tools. Nevertheless, considerable progress was made in using radioactive strontium and calcium in fighting bone cancer, and very good results were obtained using radioactive iodine in the treatment of toxic goiter. There is an actual case record of the apparently successful treatment of the dread leukemia with doses of radio phosphorus. Many of the now unknown processes of body chemistry may be explained by using artificially radioactivated elements as "tracers." Such substances may be injected into the body and their course followed by means of a "Geiger-Counter" which is an instrument for detecting the presence of sub-atomic particles. Indeed, the life process itself may eventually be made known to man by the use of these elements.

There can be no doubts in the minds of rational men whether the atomic energy which has been released should be used to raise the standard of living to undreamed-of heights or be used as an instrument of war to destroy our civilization. The extreme destructiveness of the atomic bomb can scarcely be realized. A preview of World War III.
if there is one, may be had by considering the effects of one bomb on Hiroshima. It must be remembered, in this respect, that, in the event of another war, such bombs will not come singly but in hundreds and perhaps thousands.

The atomic bomb has been called a weapon of saturation, meaning that all defense is overwhelmed and that there is therefore little protection against it. At Hiroshima, the effective area of destruction was approximately 4 square miles. Buildings were destroyed by the concussion and by fires caused by the heat of the explosion (the temperature developed by an atomic bomb explosion is millions of degrees Fahrenheit, hotter even than the sun). People were injured and killed by the concussion, fires, and radioactive rays. It has been estimated that nearly a quarter of a million casualties resulted from this one bomb. Later and more conservative estimates have placed the number killed at 100,000 out of the 265,000 people now believed to have been in the city when the bomb exploded. Hiroshima was far from adequately able to cope with the situation. Hundreds of fires were started by the intense heat, but only 6 of 33 modern fire stations were able to function and three-quarters of the fire-fighting personnel were either killed or injured too severely to work. The injured could not be cared for since there were only 30 physicians out of 298 registered who had not been killed or injured, and only 600 nurses were able to work where 2400 had been available before the blast.

The test of the atom bomb in Bikini Lagoon amply demonstrated the tremendous forces released. In the report to President Truman by the Army-Navy Joint Chiefs of Staff, the following excerpt refers to the observation of the underwater explosion:

"The diameter of the column of water was about 2,200 feet, and it rose to a height of about 5,500 feet. Spray rose to a much greater height. The column contained roughly 10,000,000 tons of water."

In the same report, a comparison is made to conventional weapons. "It is necessary that a conventional bomb score a direct hit or a near miss of not more than a few feet to cause significant damage to a battleship. At Bikini the second bomb, bursting under water, sank a battleship immediately at a distance of well over five hundred feet."

Mr. William L. Laurence, who has witnessed four of the five atomic bomb explosions, feels that a wishful complacency has again settled over Mr. Average Citizen as a result of the Bikini tests because the whole of the fleet was not sunk and the personnel of Joint Task I were not all killed. The public must be reawakened to the fact that the atom bomb is not "just another weapon" but, in the words of Mr. Laurence, "the greatest cataclysmic force ever released on earth."
In *One World or None*, Phillip Morrison projects the explosion and the resulting experiences of Hiroshima on New York. He pictures the bomb exploding at the corner of Third Avenue and East 20th Street, near Gramercy Park. His portrayal of the destruction and chaos caused in the largest city in the United States is quite disturbing to those interested in the perpetuation of our civilization. Many cities in this country with a population of 25,000 to 30,000 do not cover an area more than 4 square miles and hence could be completely destroyed by the explosion of one bomb. Nor would our buildings be better able to withstand the blast than those in Japan. Surveys have shown that over 90% of our buildings would be just as susceptible as were those in Hiroshima. The number of people who could be killed by atomic bombs is appalling. Scientists whose opinions merit respect predict that at least one-fourth of all persons living in any city attacked by atom bombs would be killed. In this light, more than the almost infinite amount of destruction must be considered. Millions of the greatest thinkers of our times, on whom progress depends, would be killed. This would necessitate more than merely rebuilding material things destroyed. Our civilization itself, as we now know it, would not be rebuilt for generations. Try to imagine how long it would take to again make the radio, the automobile, the theater, medicine, and surgery a part of our everyday life. Great hosts of people would have to be educated and trained to carry on in those things in our culture which we now take for granted.

Many people feel that a defense can, and will, be devised against atomic bombs. Others contend that, since this country alone has the secret of the bomb, we will be safe if we keep the secret. To these people it must be pointed out that scientists anticipate no possible defense against such a weapon. Nor can secrecy serve as protection because the scientists of every nation understand the underlying principles and need only to overcome various engineering difficulties to be able to produce the bombs themselves. Estimates on the time necessary to accomplish this range from two to six years. Even if a defense is discovered, it may lull us into a false sense of security. There has never been a defense against any weapon that has been 100% effective and, to be adequate, atomic defense must be 100% effective. With further rocket developments, an atomic war might be fought with rockets using atomic energy for power and carrying atomic bombs in their noses. The improved German rocket, the V-2, travelling at supersonic speeds, was never shot down in World War II.

Unless a workable system of control is worked out and adopted, the atomic arms race which is already underway, could, and in all prob-
ability would, lead to the most devastating catastrophe in the history of man. Such an arms race can only end in a tie. When each nation has a stock pile of atom bombs sufficient to destroy all potential enemies, the race will be over. There would be no point in making 50,000 bombs to destroy a country if 5,000 bombs would do the job. At the conclusion of such an arms race, the United States would be one of the weakest nations in the world due to the vulnerability of its industrial areas. The easiest and best defense this country could use would be the decentralization of industry, which, it has been predicted, would cost 300 billion dollars and take 15 years to accomplish. An alternative to dispersal might be to build all large cities underground. Such an arrangement would not be satisfactory since more powerful bombs may be developed which would penetrate the protective covering and the present bombs would probably destroy any ventilation system and disrupt communications between cities.

A huge force of "security police" or a "gestapo" would be required to prevent sabotage. With the present undoubtedly crude knowledge of construction, anything as large as a packing case for a piano could contain an atomic bomb shielded so that detection by radioactive rays would be almost impossible. Saboteurs might assemble such a bomb a small part at a time. They could be "planted" and detonated by enemy powers decades later if the occasion arose. The "inspectors" and necessary precautions would do away completely with personal freedom and civil rights as we know them today.

It is very doubtful if our civilization could survive an atomic war and therefore imperative that steps be taken to prevent such a happening. At present, it appears that the idea and practice of unlimited national sovereignty is the great barrier to a workable and acceptable solution. In the world today, any nation on the face of the earth has the right and authority to make whatever changes within its borders are deemed necessary or desirable regardless of the effect on other nations of the world. With the existing principle of national sovereignty, let us see how we, as citizens of the United States, would be affected by the various possible solutions to the problem of preventing atomic wars. Also worthy of investigation are the feasibility of these plans and the likelihood of their success.

The first thing that will come to the minds of some is isolation. Let us close the door on the rest of the world and be sufficient unto ourselves. This, however, is no longer a possibility. We are now living in one world whether we accept it or not. We are dependent upon many places outside our own boundaries for things which we accept as part of our life. With radio and telegraphy, we are literally within
minutes of any place on the globe. With the airplane, we are able to travel to any place on the globe in a comparatively few hours. In the future, travel time may be lessened to minutes by the use of rocket transportation. It has been aptly put that there are, today, no significant national problems which are not international problems. Such things as currency evaluation and tariff regulations have world significance, wars are world-wide, depressions are world-wide, yet some still cling to the hope that we may survive in isolation. Many advocated isolation before World War II. It is granted that most people in this country did not want war but that does not alter the fact that this country was one of the participants. In this shrinking world of interdependency, it seems apparent that isolation is not the answer.

Treaties of one sort or another must follow all wars. Many people feel that the treaties resulting from World War II can be made to work. A lasting treaty is indeed something to be hoped for, but history can not predict much success. Treaties have been made, and broken, ever since man has taken up arms. With the rights granted by national sovereignty, a nation is obligated to abide by the provisions of a treaty only as long as it is inclined to do so, either because of advantages resulting therefrom or because of weakness. If one of the party nations no longer needs the advantages or becomes strong enough to voice an opinion of its own, treaties become null and void. Since treaties have not functioned as desired in the past, it is too much to hope that they will in the future. A problem which has resisted solution can be expected to be solved only by hitherto untried methods. Treaties do not fall in this category.

If we wish to prevent wars by quick action, the United States is now in a relatively strong position to start on the conquest of the world. People have been heard to say, "Let's use the atomic bomb on all potential enemies and get it over with." Such a plan might be a way out of the present crisis. A long-range view of this plan must be considered to realize what would be entailed. To prevent uprisings in conquered lands would require millions of our men in the troops of occupation. Billions of dollars would be required to finance such an undertaking and there could be little hope of the cost decreasing with the passage of time. Such a continued expenditure might impoverish the United States to such an extent that even survival would be precarious. In the final analysis, it is almost unbelievable that the people of the United States, whose social institutions are based on the Christian Ethic, would countenance such a willful aggression on the part of their country.

Emery Reves has stated in The Anatomy of Peace, "War takes
place whenever and wherever non-integrated social units of equal sovereignty come into contact.” Let us now consider what might be done on an international basis. One possibility might be to outlaw the atomic bomb by international law as poison gas was outlawed after the first world war. Japan used poison gas in China in the war just ended and it is highly unlikely that any other nation would have refrained from using it had they thought the results would have been worth while. Again is seen the need for relying on the good faith of a nation-state with its sovereign power. Can one nation rely on the good faith of another if the two are at war?

The United Nations may be a step in the right direction if it can avoid the pitfalls which the League of Nations encountered. The underlying principle of collective security is still a doubtful basis since it depends primarily on the unanimous participation of sovereign nation-states. Is there any reason to believe that individual states will not withdraw from the United Nations if a conflict arises which is prejudicial to what they consider their best interests? Remember that nations withdrew from the League of Nations under circumstances similar to those above.

Also to be considered are plans such as the one embodied in the Acheson Report. The committee recommended the establishment of an International Atomic Development Authority which would have control over the raw materials necessary for the fission process and the plants operating to produce fissionable material, and would direct the research in the field of atomic physics. This Authority would license those using atomic energy for commercial, non-dangerous purposes and would also conduct a limited inspection to see that the provisions of the license were being observed. By what authority could this group function? Again, it would be dependent upon the unanimous support of all nations. If one nation withdrew its support, it would no longer feel itself subject to the regulations.

The same argument will hold for an international police force or an international inspection system. Again, support is dependent upon the individual nations.

It appears that some form of world government is the most likely to succeed in bringing lasting peace to all nations of the earth. Not a world organization which counts its members as nations but one which deals directly with individuals. The people of the United States have a voice in national affairs; why could they not go a step further and have a voice in world affairs? This would necessitate our conforming to our professed belief that all men are created equal; certainly not with re-
gard to intelligence and potentialities and capabilities but definitely with regard to moral worth. We must realize what great contributions other nationalities and races can make to our culture and how much we would gain. We must be willing to compromise, moreover, if we are to live in peace in the small neighborhood which the world has now become.

Let us investigate the logic of forming a world organization. In bygone times, families were warring groups until this was resolved in the clan. War between clans was finally resolved in the city-state and war between city-states was resolved in the nation. Would not the next logical step be to resolve war between nations by the organization of a world government? Many will cry out that nothing so radical should be attempted; they will say that, in the time of such a crisis, we must be "practical." But, as Disraeli once said, "A practical man is a man who practices the errors of his forefathers." In this light, let us not be practical men.

OBJECTIVES: "PLUS" QUALITIES OF THE EFFECTIVE CITIZEN IN THE ATOMIC AGE

In addition to those commonly understood qualities of citizenship heretofore striven for in all good schools, the effective citizen in the Atomic Age:

1. Has a sufficiently good command of the scientific terminology commonly used in newspaper, radio, and other discussions of nuclear energy, the atom bomb, and related matters to understand what is being said.
2. Has a sufficient elementary knowledge of the fission process to enable him to detect as false any statement, claim, or prophecy appreciably at variance with the facts of this process.
3. Knows at least the principal high points in the history of the development of nuclear energy to date.
4. Knows that, if properly controlled, nuclear energy promises great benefits to all mankind, especially in reference to power, heat, and medicine.
5. Knows that, if used as a weapon, nuclear energy completely dwarfs all pre-atomic explosives in its power to destroy life and property.
6. Knows that the atom bomb is par excellence the weapon of saturation; that it can not be coped with once it has struck because of its almost unbelievable heat, terrific blast and concussion, and deadly gamma rays.
7. Knows that, per unit of destruction, atom bombs are only from 1/10 to 1/30 as expensive to produce as pre-atomic type explosives, and that any small nation that can afford an army or a navy can afford them.
8. Knows that, in consequence, the size and wealth of a nation no longer bears any necessary close relationship to its power to kill and destroy.
9. Knows that there is no basic scientific secret in reference to the fission process; that this is common knowledge among the leading scientists in all countries of the world.
10. Knows that the U.S.A. has no monopoly on the fissionable materials, the scientific brains, or the engineering skills necessary to produce atom bombs.
11. Knows that the atomic scientists are in general agreement that other nations will be producing atom bombs in from two or three to six or seven years.
12. Knows that its concentrations of industry, government, communications and transportation centers, and population make the U.S.A. very vulnerable to atomic attack.

13. Knows that, in the event of an atomic war, the U.S.A. is almost certain to be the first nation attacked.

14. Knows that there is no adequate military defense against the atom bomb; that if war breaks out atom bombs will come, not in one’s as at Hiroshima, Nagasaki, and Bikini, but in hundreds; and not in man-piloted planes but in radio-controlled planes or, more likely, in the noses of rockets that can be neither seen nor heard in flight.

15. Knows that the best possible military defense, though unavoidably inadequate, would probably cost fifty cents in taxes on each dollar of income, and would almost completely destroy certain of our cherished freedoms.

16. Knows that scientists whose opinions merit respect predict that from one-fourth to one-half of all city-dwelling persons in this country and elsewhere would probably be killed or incapacitated in the event of an atomic war.

17. Believes with General H. H. Arnold that man’s “warring power is [now] too great to be allowed to continue” and that “through international collaboration we must make an end to all wars for good and all.”

18. Knows that we today live in a world which science and technology have made so highly interdependent that peace and war, prosperity and depression have become indivisible; hence he knows that isolation (whether economic, political, or social) and effective unlimited national sovereignty are in reality myths—extremely dangerous myths in that they give us a completely false sense of security and control.

19. Knows that all nations of the world, our own included, nevertheless, are still clinging tenaciously to the idea and practice of unlimited national sovereignty.

20. Knows that history is replete with instances of the generalization that war occurs when non-integrated social units of equal sovereignty clash in reference to their basic interests, and that peace is assured when such units are integrated under a higher sovereignty. (Wars between families resolved in the clan; wars between clans resolved in the city-state; wars between city-states resolved in the national state. He knows that what is indicated is that wars between national states will only be resolved in a world state.)

21. Knows that there is no body of true world law at the present time.
22. Realizes, therefore, that a state of international anarchy exists in today's highly interdependent world — a state of anarchy in which any national state is legally free to do whatever it wants to and can do, regardless of the effects on other nations.

23. Realizes, further, that it is this fact of international anarchy in a world of highly interdependent national states that is primary among the causes of modern wars — that, comparatively speaking, Hitler, Mussolini, Tojo, and other "devils" were relatively but dwarfs so far as the causes of World War II are concerned.

24. Realizes, still further, that unless and until this condition of international anarchy is remedied, continuing world peace is very unlikely, if not impossible.

25. Believes, in consequence, that at least a limited type of world government (sufficient, at least, to control fissionable materials) under true world law is a necessary condition for peace.

26. Believes that the well-being (economic, political, social) of all peoples everywhere will be enhanced — that all ultimately stand to gain and not to lose — when, and if, the sphere of true world law is enlarged to cover all actions through which one nation may injure another in any way.

27. Knows that, given science and technology (and especially the atom bomb) and their imperatives, some type of world integration is inevitable — that the only real choice is whether we (peoples of the earth) shall permit ourselves to drift into an atomic war in which, if any power survives, some national state achieves by conquest a slave-type of world integration, or whether we (peoples of the earth) shall devote every energy to the progressive achievement of world government through consent.

28. Commits himself to the latter alternative.

29. Realizes that this alternative is possible of achievement to the degree that the peoples of the earth are helped through education (press, radio, movies, pulpit, school) to know and understand one another, to see themselves as others see them, to realize that all peoples must be regarded as equally important and that none can be exploited or discriminated against, to recognize that compromise is essential, and to accept cooperation as the only method which can obviate war.

30. Realizes, therefore, that racial, religious, ethnic, or any other brand of bigotry, prejudice, and discrimination are enemies of peace and hence of mankind.
31. Knows the basic elementary facts of anthropology to the effect that no race is innately either superior or inferior to any other; knows that all the observable differences in racial groups—even skin color—were environmentally induced during long ages of geographic segregation; hence, knows that there is no scientific basis whatsoever for "white" or any other type of "supremacy" and that to hold to, and to act upon, this fallacy is ultimately to divide the world into two warring camps in which the "whites" will be outnumbered more than three to one.

32. Is aware of national, racial, religious, and other "other groups" stereotypes and their vicious effects in creating misunderstanding, suspicion, and distrust; consciously strives to divest himself of these distortions and actively works to eradicate these stereotypes from the press, radio, motion pictures, and vaudeville.


35. Knows the basic principles and major proposals of the U.S.A. proposal for the world control of fissionable materials (the "Baruch Proposal" to U.N.; the so-called Lillianthal or Acheson Report) and supports those of its provisions which he believes to be sound.

36. Recognizes that nuclear and related developments are likely to come thick and fast, knows the major pertinent sources of such information, and keeps himself effectively up to date in this regard.

37. Actively works in every way possible for a realistic solution of the problem of winning world peace; he not only "studies about" and keeps abreast of current developments, but he also engages vigorously in appropriate social action.
PART IV

PUPILS' QUESTIONS: WHAT HIGH SCHOOL BOYS AND GIRLS WANT TO KNOW ABOUT NUCLEAR ENERGY, THE ATOM BOMB, AND RELATED MATTERS

The interests of boys and girls are revealed in the questions they ask. The following questions, asked by high school youth,* indicate some of the things a group of pupils may wish to know about atomic energy. The teacher can also sample the interests of pupils in his own classes by conducting a discussion and then asking students to list the questions in which they are interested.

1. How long have our scientists worked on atomic energy?
2. Before the war did scientists know that such a bomb could be created?
3. What men and women are credited with discovering the atom bomb?
4. How are the cyclotron and betatron used in atomic research?
5. What materials are contained in the atom bomb?
6. What is plutonium?
7. How is the bomb made?
8. What is the size of the bomb?
9. How is the bomb set off? (How does it work?)
10. How long does it take to prepare an atom bomb?
11. Is there enough material in the earth to make much atomic power?
12. Where do the materials in the atom bomb come from?
13. Is there any way to gauge the power of atomic energy?
14. What is the expense of atomic energy?
15. When an atomic reaction occurs, what stops it or does it go on indefinitely?
16. Does the atomic bomb destroy things completely?
17. What substances or metals can withstand the heat and force of atomic energy?
18. What is radioactivity? How does it affect human beings?
19. How long after the bomb explodes is there radioactivity around the spot?

*Since any attempt to collate or select among the many questions submitted by the University of Illinois University High School pupils might make it appear that the Committee was coloring their responses, everything that these pupils said they wanted to know about nuclear energy and the atom bomb is given below. Questions concerning the peace-time uses of atomic energy were in the majority so far as frequency of mention is concerned. Some questions, it will be noted, reflect misinformation. Others, alas, are unanswerable at the present time. But most are indicative of potentially useful "psychological handles" of which the good teacher will lay hold.
20. How harmful is the light reaction of the explosion and how long does it last?
21. What was the purpose of the atomic bomb test?
22. What results were obtained from the Bikini test?
23. If the atomic bomb is so powerful why wasn't the damage at Bikini greater?
24. Is the bomb more powerful on land or sea?
25. Why did the underwater bomb sink more ships than the one in the air?
26. Why did the men at Bikini wear special glasses?
27. Why were the salves and ointments used on the skins of animals at Bikini Lagoon? Could the same principle be used for humans in case of atomic war?
28. Are there medicinal properties to counteract the effects of the bomb on humans?
29. If atomic energy is made powerful enough could it destroy the world?
30. Could any one nation completely wipe out another nation or the entire world if it had control of the atom bomb?
31. How many bombs would it take to destroy the U.S.?
32. What would be the destructive force of an atomic bomb in a city like New York as compared to a city like Hiroshima?
33. Would it be possible to have an atomic war in which spies planted atomic bombs in large cities?
34. Which country would be most powerful in an atomic war ten or twenty years from now?
35. How long and how destructive would an atomic war be?
36. Is there any immediate danger?
37. Is there any defense against the bomb?
38. How many bombs do we have now?
39. If Russia develops an atom bomb is there likely to be a war?
40. How far is Russia from the discovery of the atomic bomb secret?
41. What effect will the atom bomb have on making peace?
42. What are they doing now in the plant at Oak Ridge, Tenn.?
43. Why do we keep on making atom bombs?
44. Is the U.S. strong enough to control atomic energy alone?
45. How will the bomb be used in the future?
46. Should the secret of the bomb be given to all the nations of the world?
47. Is the atomic bomb the concern of everyone?
48. How should atomic power be controlled and by whom?
49. Will the power of the atomic bomb cause man to love his fellow man because he knows an atomic war could destroy civilization?
50. Can the atom bomb be world-controlled?
51. Will atomic energy create universal Socialism?
52. Will the atomic bomb be outlawed in the next war as poison gas was in the last war?
53. Will the U.N. bury the secret of the bomb or give it to the world?
54. If atomic power is harnessed by the U.N. Safety Council will it be possible to continue domestic research?
55. Are steps being taken to discover the useful properties of atomic energy? If so, what are they?
56. How can atomic energy be used in peace time?
57. Can atomic energy be used to cure certain diseases?
58. Could atomic power replace electricity?
59. Could atomic energy be used to benefit plants and animals?
60. Will atomic energy be used in transportation?
61. If we use atomic energy for automobiles would we have to build a completely new motor to take the fuel?
62. If atomic energy is used for heating purposes how can it be controlled so as to produce heat without an explosion?
63. Can atomic energy affect industrial trade?
64. Will atomic energy create new occupations?
65. If land is eroded by the explosion can it be used for agriculture or other purposes later?
66. Is there any relation between atomic power and jet propulsion?
67. Can the atom bomb be used in rockets?
68. How much atomic energy would be required to send a rocket ship to the moon?
69. About when will we be using atomic energy?
70. Will college and high school students experiment with atomic energy?
71. Will atomic energy help or hinder civilization?
72. Why don't people just forget about atomic energy?
73. Will a greater power than atomic energy be developed?
PART V
SUGGESTED LEARNING EXPERIENCES

Note to the Teacher: If you have had little or no experience in using a resource unit, you will probably find it advisable to reread Section three of PART I before attempting to utilize the suggestions given below. The important thing to be remembered is that this is not a teaching unit. Rather, it is a storehouse of sorts to which you can fruitfully turn for vital and workable suggestions in building a teaching unit tailored by you to fit your particular class group. In building such a unit, you would, of course, select from among the following activities only those which you believe to be appropriate for this purpose.

A. Initiatory Activities

1. Have book jackets from materials dealing with nuclear energy, the atom bomb, need for world government, and related matters displayed on bulletin boards and in classrooms.


3. Display selected pages from the "atomic bomb" issue of Look Magazine on bulletin boards. Reprints are available for a few cents from the National Committee on Atomic Information, 1749 L Street, N.W., Washington 6, D.C.; a copy is also included in the "Study Kit on Atomic Energy," which is available for $1.00 from this organization.

4. Examine recent issues of other magazines for pertinent pictorial materials to display on bulletin boards.

5. Show the cartoon film strip, "How to Live with the Atom." This and the accompanying dialogue may be secured for $2.50 from the National Committee on Atomic Information (see above).

6. Display newspaper cartoons dealing with the atom bomb and related questions.

7. Ask your local Kiwanis, Lions, Rotary, or other service club to secure a good outside speaker on some question related to the Atomic Age and to loan him to the school for a talk to the pupils. The NCAI (National Committee on Atomic Information) main-
tains a roster of such speakers, some of whom may live near your locality. Speakers on such subjects can also usually be obtained from the nearest college or university.

**B. “Finding Out About It” Activities**

8. Stimulate the pupils to collect, report, and discuss the statistics regarding the destruction at Hiroshima and Nagasaki (*One World or None, Must Destruction Be Our Destiny? Dawn Over Zero*, and John Hersey’s article in *The New Yorker*) are especially good sources for this purpose. See Bibliography, below). Through this discussion, help the pupils understand why the atom bomb is called the “weapon of saturation.” Also invite them to reflect upon the fact that but one atom bomb (each quite primitive and now obsolete) exploded in each of these destroyed cities, and that it is improbable that single atom bombs will ever again be used should there be another war.

9. Encourage the pupils to apply their findings from their study of Hiroshima and Nagasaki to their own community or to a neighboring city. One way to do this is to have them prepare two maps of the community or city in question and mark on one the spots of an imaginary atom bomb explosion or explosions. Hospitals, fire stations, newspaper offices, radio stations, power stations, water works, railroad stations, factories, business areas, residential districts, schools, parks, thoroughfares, etc. should be plotted on one of these maps — the “before” map. On the other, the area or areas of probable destruction should be charted by means of pins, sketches, and the like. This last map should be translated into words, figures, graphs, etc., giving the details of this probable destruction (the references noted in “8” above will also be helpful for this purpose). The probable effects upon those aspects of social and economic life most familiar and vital to the pupils concerned should be emphasized in the discussion.

10. The second map noted in “9” above might well be superimposed by the pupils upon a wall map of the surrounding territory. This larger map should show the types of agriculture, forestry, manufacture, etc., which are related to markets, banks, factories, stores, and so on, in the city. The probable consequences of the imaginary destruction in the city should then be charted, made explicit in figures, graphs, and words, and discussed by the group.
11. The pupils might also be encouraged to carry out a number of projects similar to "9" above, but in reference to the particularly crucial cities of the U.S.A. (New York, Chicago, Detroit, San Francisco, Pittsburgh, St. Louis, Washington, D.C., for example). In this regard, the pupils should be led to list and discuss the probable effects upon their lives and those of the rest of the country's population if our great centers of finance, manufacture, shipping, and government were destroyed.

12. The consensus of the pupils' opinions which derive from the projects noted above might well be expressed by some members of the group in a dramatic skit entitled "Life in ________ One Year After an Atomic War." Other pupils may wish to present cartoons, sketches, themes, poems, or articles for the school and/or community newspaper centered around the same theme. Still others may prefer to express their ideas in this respect in "before" and "after" models in wood or clay.

13. Lead the pupils to study and discuss the results of the Bikini atom bomb tests. In particular, have them contrast what the official boards (the President's Civilian Commission and the Army-Navy Joint Chiefs of Staff) actually reported and the generally erroneous opinion which most people appear to hold regarding the destructiveness of these test explosions. Again, be certain that the pupils take into account in their discussion the probability that several, instead of single, atom bombs will be used in any attack should we permit another war to occur.

14. If one or more of the above projects has been carried out, there is certain to be a great deal of pupil curiosity regarding the power resident in the atom. Have the pupils collect photographs and statistics and make graphs or charts showing the difference in explosive power and in cost (see General H. H. Arnold's chapter in *One World or None*) between the conventional and the atom bomb. Encourage the pupils to make charts or graphs to compare nuclear energy with other forms of energy. Have them actually compute energies and convert from the c.g.s. system to the English system. For example, apply the formula \( E = mc^2 \) and show how many tons of coal would have to be burned to produce the equivalent of the nuclear energy in an ounce of this fuel. (If you are not a teacher of mathematics, you might ask a colleague in this field to help you out.) Have the pupils consider what the relative cheapness of atomic explosives means in terms of the changed ratio between the potential warring powers of "big" and "little" nations.
15. Direct the pupils in compiling a glossary of "atomic terms" in pupil-formulated definitions. All the words commonly used in newspaper, radio, and other discussions of atom bombs, nuclear energy and related matters should be included in this list. The formulating of this list might well be a whole class project. If you are not a science major, you should probably have your pupils consult some teacher in this field for verification of their definitions.

16. Many of your pupils will probably want to construct models of atoms; all will be helped by having such models before them. For simpler atoms, sponge rubber balls or wooden balls can be used to represent the nuclei and electrons. Strands of wire can be utilized for mounting and for representation of electron orbits. For more complex atoms, have the pupils make representative drawings. Example: U-235 and possible fission products.

17. Encourage the pupils to prepare disintegration charts for radio-active elements, showing which particles are released and what elements are left from the reaction. Have them trace the steps all the way from uranium to lead. Also have the pupils show the integrative steps necessary to make neptunium and plutonium.

18. Explain to your pupils how the fission process is apparently induced in the atom bomb; discuss this sufficiently to insure that the elementary principle involved is understood by all members of the group.

19. Have the pupils read about and discuss the various methods by which the U.S. Government produced fissionable materials in the atom bomb project. Charts, diagrams, and photographs will prove helpful in this undertaking.

20. Suggest to the pupils that they examine the numerals on a luminescent watch dial under a magnifying glass in a dark room. Have them observe the individual flashes of light and tell what causes them. What radioactive substance is present?

21. Encourage the pupils to make a chronological table of the scientific developments leading to the discovery of fission. Have them make a similar table showing the atomic developments in this country between the time of the fission discovery and the time atom bombs were produced. See to it that the names and nationalities of the people who made the discoveries are included by the pupils in both of these tables. Then have them discuss the question of the degree to which these discoveries were "purely American."

22. One outgrowth of "21" above might well be the making of a "Who's Who" booklet containing brief biographies and, if possible, the pictures of the leading nuclear scientists.
23. Another desirable outgrowth might well be the construction of a time line chart showing the development of nuclear energy. Have the pupils choose a small enough scale so that the scientific acceleration due to the war may be clearly shown. This graph might also be projected by the pupils to afford some estimate of the probable rate of future developments.

24. Still another desirable outgrowth of "21" might be to have the pupils make a list of the important persons whose talents were lost to Germany by her policy of discrimination and suppression. Encourage the pupils to speculate as to what bearing this probably had on the outcome of the war, but insist that they give their reasons for their estimates.

25. Suggest to the pupils that they collect and discuss the opinions of atomic scientists concerning the question of whether or not America possesses some essential basic scientific secret which scientists in other countries do not know, and without which their governments can not manufacture atom bombs. Also have them collect the opinions of these scientists in reference to the time it will take other nations to begin producing atom bombs.

26. Ask the pupils to look up, report, and discuss what atomic scientists have to say about the probabilities of sabotage within our own borders should the atomic armament race continue, noting particularly the counter-measures which are believed to be necessary and how these would destroy various personal freedoms which Americans treasure.

27. Encourage the pupils to poll the published opinions of the atomic scientists and of our military leaders in reference to whether or not any adequate scientific or military defense against the atom bomb is likely within the foreseeable future. Have them list and discuss the implications of what they will thus discover — namely, that no scientific or military defense is anticipated by these experts, that the only defense they can envisage is political (i.e., world government, at least enough to control fissionable materials), and that the only other alternative is a policy of decentralization (of cities, industry, government agencies, universities, etc.). Help the pupils to envisage what this last alternative would entail — time required, cost, loss of personal freedoms, effects on real estate values, effects on commerce and industry, etc.

28. Ask the pupils to prepare reports outlining what various organizations and individuals are doing to prevent an atomic war. Have them consult the bulletins of the National Committee on Atomic
Information, the *NEA Journal*, and whatever guides to periodical literature the school and community libraries may contain. Do not overlook the work of the Campaign for World Government (505, 343 South Dearborn, Chicago, Illinois), of Americans United for World Government, Inc. (1860 Broadway, New York, N.Y.), or of Chancellor Hutchins's group at the University of Chicago. Also have the pupils read and discuss the press and other criticisms of the work of these organizations and individuals.

29. Suggest that the pupils make a survey of newspaper and other editorials concerning the atom bomb, nuclear energy, world control of fissionable materials and related matters. Encourage them to evaluate these editorials in terms of what the effects on world peace would probably be were the action either expressly urged or implied in each translated into government or other policy.

30. Ask the pupils to collect, display, and evaluate the probable effects of newspaper and other cartoons treating some aspect of the atom bomb, nuclear energy, world government, and related matters.

31. Encourage the pupils to consult the radio guide section of some city newspaper for the past four or five months, note the programs which dealt with some phase or aspect of the atomic crisis, and write to the broadcasting companies concerned for mimeographed copies of these broadcasts. Parts could then be assigned to each of the members of a committee or of the class and the broadcasts thus read to the total group. This should, of course, be followed by discussions in which the pupils would evaluate what was either explicitly or implicitly urged by the broadcast.

32. Suggest that the pupils make either a group or individual scrapbook of current information (articles, editorials, pamphlets, photographs, cartoons, etc.) concerning the atom bomb, nuclear energy, world government, and related matters. The scrapbook might contain such section headings as the following: Technical Developments; Results of the Hiroshima and Nagasaki Bombings; Results of the Los Alamos and Bikini Tests; The Atomic Scientists and Their Contributions; Nuclear Compared with Other Forms of Energy; Proposals for the Control of the Atom Bomb; Peace-Time Uses of Nuclear Energy. The scrapbook should be loose-leaf in order that it may be more easily kept up-to-date.

33. Suggest to the pupils that they prepare, keep up-to-date, and make available in some popular spot in the library a "Guide to Reading Materials" in which they list with brief annotations current articles, editorials, pamphlets, and books bearing on any aspect of the
Atomic Age. For the most part, these listings should be from materials which are available in the local school and community.

34. Ask the pupils to prepare, keep up-to-date, and post conspicuously a "Guide to Coming Broadcasts" which deal with any aspect of the atomic question. The Sunday editions of metropolitan newspapers and the bulletins of the National Committee on Atomic Information will prove very helpful in this regard.

35. Have the pupils prepare, keep up-to-date, and post conspicuously current cartoons, photographs, and other pictorial materials which treat of any aspect of the atomic problem.

36. A committee of the class might well be stimulated to call regularly upon the managers of the local cinemas for purposes of preparing a continuing weekly or monthly list of "Coming Movies" (newsreels, shorts, other features) dealing with any phase of the problem of nuclear energy. The titles on this list should, if possible, be briefly annotated and should, of course, indicate time, place, and price. Obviously, it should be posted in some conspicuous spot.

37. Direct the pupils in preparing a skit in the form of a radio quiz program or "Man on the Street" interview in which members of the class present the views of prominent men by impersonation. This could be presented in assembly and before lay adult groups as well as before the class.

38. Some members of the class might be stimulated to write a play concerning racial discrimination and intolerance to show the adverse relationship of these special forms of ignorance to world peace in the Atomic Age. This might then be given before assembly and lay adult groups as well as before the class.

39. Stimulate the pupils to conduct symposiums or panel discussions on the following questions related to world government:
   a. By definition, what does the term "unlimited national sovereignty" mean?
   b. To what degree do national states today have effective control over what goes on within their respective boundaries in reference to such things as:
      (1) Prosperity.
      (2) Depression.
      (3) Currency regulation.
      (4) Armaments.
      (5) Being involved if war breaks out.
      (6) Epidemics.
c. To what degree is "effective unlimited national sovereignty" in reality a myth in today's world?
d. To what degree does the attempted practice of unlimited national sovereignty spell international anarchy today? Regardless of the consequences to other nations, what things is each national state legally free to do today?
e. Is continuing peace possible or likely in a world of closely interdependent national states, given the present facts of international anarchy?
f. Reves (see his Anatomy of Peace) enunciates the principle that war occurs when non-integrated social units of equal sovereignty clash in their interests; that peace is assured only when these units are integrated under a higher order of sovereignty. Does this appear to have been historically true in reference to the resolving of wars among clans and among city-states? If so, what is implied in reference to the necessary machinery for peaceably resolving the present clashes of interests among today's 70 or more non-integrated national states of equal sovereignty?
g. How long would peace obtain within the U.S.A. were there no laws definitive of rights and responsibilities and backed up by a police power sufficient to coerce offenders? Is it reasonable to expect world peace and the control of atomic energy under similar conditions?
h. Actually, under effective world government, would any given national state (our own, for example) gain or lose in its real power to control the actual conditions which result in prosperity or depression, peace or war, for its citizens?

40. Ask the pupils to consider what part America's great industrial strength played in the defeat of the aggressor nations in World Wars I and II. Then have them discuss the question of whether or not these two lessons of history are likely to be overlooked in the event of another war. What nation would in all probability be the first to be attacked should World War III be permitted to occur?

41. Lead the pupils to make a study of the revolutionary effects of former inventions (for example, the automobile, airplane, radio, steam engine, etc.) whose consequences were not anticipated and planned for by social scientists, statesmen, and educators. Which of the evil effects could probably have been prevented or softened, and which of the benefits more widely enjoyed, had such prophecies been attempted and had they resulted in the indicated social action
(laws, changed school curriculum, etc.)? Ask the pupils to discuss what they believe the moral to be so far as the new discovery of nuclear energy is concerned.

42. Let the pupils interview four or five people in each of the following occupations and ask them what they think the effects of an uncontrolled atomic armaments race is likely to have on people in their respective lines of work: merchandising, real estate, the ministry, mechanics, newspaper work, salesmanship, scientists, utilities work, and teachers. Then have the pupils compare these answers with the predictions in this regard given in the reprint from *Look Magazine* which is contained in the Study Kit on Atomic Energy of the National Committee on Atomic Information. Have the pupils indicate what they conclude from these two findings in reference to the need for adult education in their community.

43. Let the pupils conduct a carefully planned poll among the adults and high school youth of the community to discover their attitudes toward keeping the "secret" of the atom bomb, how long they think it will take other countries to produce such bombs, whether or not there is likely to be an adequate scientific or military defense against the bomb, and whether or not fissionable materials should be controlled by some type of world government. See to it that the pupils review their findings against the background of what the atomic scientists, military leaders, educators, and other men prominent in American life say about these matters. Have the pupils note what, if any, needs for community-wide education this review brings to light.

44. Interest the pupils in studying and discussing the historical development of attempts at international cooperation to date. This should include the Hague Conference, the League of Nations, the Kellogg Plan, the International Food Conference, Bretton Woods and its outcome, U.N.R.R.A., U.N., and U.N.E.S.C.O. What did, or does, each attempt to do? What was, or is, being accomplished? What were, or are, their successes and failures — and why?

45. Suggest that the pupils compare and contrast the League of Nations and the United Nations. Who was, or is, represented? How was, or is, each structured? To do what? By what was, or is, each most seriously limited? Was either intended to yield real world government under true international law?

46. Have the pupils list and discuss the present barriers to international understanding, reciprocal good will, and world government under true international law. What and where are the most crucially
needed natural resources, and who controls them? In what other respects, and where, do the economic interests of various national states clash? How do the unflattering and inaccurate stereotypes which each national group has of the others affect the situation? The self-assumed superiority of each national group over the others? The ignorance on the part of each national group of the history, traditions, mores, folkways, customs, hopes, fears, frustrations, problems, and needs of other national groups? The lack of an international history? Language barriers? The assumption of "white superiority"? Differences in economic and political systems? The assumption of self-righteousness on the part of all national groups, with the consequent unwillingness to compromise? Insecurity? Fear of political, economic, or military aggression?

47. Direct the pupils to read pp. 1-23 in Reves, The Anatomy of Peace, to note how very differently the peoples of various national states conclude from the same set of objective facts. Then have them try their hand at describing how various recent events (such as the Bikini tests, Russia's behavior at the Peace Conference, the behavior of the U.S.A. at the Peace Conference, the U.S.A.'s claim to island bases, Britain's behavior in Palestine, and so on) probably appear to the respective peoples of the major national states of the world.

48. In the light of the above, have the pupils estimate how the people of the U.S.A. probably appear to other national groups, particularly to the Russians. The question should be raised as to whether we would behave any more rationally than do the Russians were our situations reversed, i.e., were they in effective possession of island bases a few hundred miles from Los Angeles, San Francisco, and Seattle; were they in exclusive possession of the atom bomb; had they destroyed two cities with such bombs; had they recently still further demonstrated the awful destructiveness of this weapon; were they presumably continuing to stock-pile atom bombs; were we a great industrial power with no warm water port; had they the greatest industrial machine on earth; had they the greatest navy and air force; were they said to be training and equipping an army in a country immediately adjacent to ours; had they sent troops into our country to coerce our people as recently as 1919-1921. The raising of such questions should in no way imply a "whitewash" of any and all Russian actions; instead, the pupils should be encouraged to be properly critical of any threat to world peace, Russian or otherwise. But if war now means atomic war, if atomic war means
destruction, and if peace can be maintained only on the basis of mutual understanding and reciprocal good will, it is essential that we estimate how we look to the other fellow, and vice versa. And if what we see when we look at ourselves from the other fellow's point of view is not altogether flattering, then the thing to do is to make amends or change our ways — not bury our heads in the sand.

49. Help the pupils to make a study of our stereotypes ("pictures in the head") of other nationals. For example, the "British stereotype." Have them collect cartoons and report on radio programs, motion pictures, and vaudeville programs in which Englishmen are portrayed. Then have them list the adjectives which best describe this portrayal, and note how few are complimentary in character. Then, if possible, invite somebody who really knows England and Englishmen to comment on this list — most of the items will probably be false as far as most Englishmen are concerned. If an Englishman can be secured, ask him to characterize the way in which Americans are portrayed in British vaudeville, cartoon strips, and popular opinion. This stereotype will likewise be mostly false so far as most Americans are concerned.

50. Let the pupils investigate the probable peace-time uses of nuclear energy which promise to benefit mankind. This investigation might well be organized under the following headings:

a. Medical uses.

b. Heat — to counteract cold weather; to generate electricity, etc.

c. Power for transportation.

d. Power for manufacture.

e. Saving of coal and petroleum for use in synthetics.

f. Speculations regarding changing the weather.

g. Speculations regarding the direct synthesizing of the elements (i.e., the by-passing of pastures and sheep in producing clothing, of corn and pigs in producing food, of forests and sawmills in producing shelter, etc.).

51. Individual pupils with active imaginations might be asked to prepare themes, sketches, cartoons, or dramatic sketches showing how the application of nuclear energy to peace-time pursuits may change our occupations, our fight against disease, our food, clothing, and shelter, our recreations, our transportation, our home life, our government, etc.

52. Lead the pupils in discussing the benefits likely to accrue if scientists the world over are free to carry on nuclear research related to beneficial uses of this new type of energy. Have them note how
nuclear developments to date are international in scope, and estimate how seriously progress will be impeded in the future if scientists are forced to work in isolation from one another, and in secrecy, under conditions of military security. Also see to it that the inherently international character of science is understood and appreciated (Wylie's "Blunder" will be found helpful here. See Bibliography).

33. Suggest that the pupils study and discuss the ways in which science, invention, and modern technology (in industry, transportation, communication) have made the peoples of the earth closely interdependent and effected a virtual revolution of which most people are too little aware. (Staley's World Economy in Transition and Chapter I in Melby's Mobilizing Educational Resources are especially helpful in this regard.)

34. Have the pupils conduct a round-table discussion of the question "Are there today any important national problems which are not also international in scope — i.e., the resolution of which do not affect the well-being of peoples in other national states?"

35. Interest the pupils in studying and discussing what social scientists, especially anthropologists (e.g., Ruth Benedict, Margaret Mead) have to say about the innate capacities of racial and national groups. Then have them consider the costly consequences in today's world of the special form of ignorance which leads each national group, our own included, to assume that it is innately superior to the rest.

36. Suggest that the pupils study the various great religions of the world with a view to discovering what each teaches in reference to "being your neighbor's keeper," "the brotherhood of man," etc. The purpose here should be to appraise the degree to which each is in harmony with the idea of world government.

37. Watch the press for an announcement of the proposed structure for world government on which Chancellor Hutchins and a committee of distinguished professors at the University of Chicago and elsewhere have been at work since November, 1945. When this appears, secure one or more copies and have these studied and discussed by the pupils.

38. Have the pupils study and discuss the plan for the world control of atomic energy proposed by the Committee on Atomic Energy of the U.S. Department of State (see Bibliography). Especially, have the pupils list and discuss the basic principles and the key provisions here put forth.
59. Be alert for all news items and other information concerning the recently (July, 1946) authorized Atomic Energy Commission. See to it that the pupils keep themselves abreast of its work through reading, radio listening, and class discussion.

60. Let the pupils study and discuss the charter provisions and the continuing work of the United Nations, of the United Nations Educational, Scientific, and Cultural Organization, and of the United States Atomic Energy Commission.

61. Secure materials descriptive of the purposes and program of the division of International Educational Relations of the U.S. Office of Education and have these studied and discussed by the pupils.

62. Suggest that the pupils write to the President of the Youth Committee on the Atomic Crisis of the Oak Ridge, Tennessee, High School for information concerning the significant educational work the Y.C.A.C. has done and is doing. Then have the class decide which of these activities suggest things which it could and would like to do. (The Y.C.A.C. represents a project which originated in the English classes of Mr. Philip E. Kennedy.)

C. "Doing Something About It" Activities

63. Direct the pupils to list the organized groups in the community which support educational programs of any sort (service clubs, labor unions, P.T.A.'s, churches, etc.) and then have them suggest to the program chairmen of these organizations that they each schedule one or more meetings devoted to the problems of atomic energy. These suggestions could be conveyed by small committees of the class or by letters written by the pupils. The class might be able to "borrow" some of the speakers thus utilized and have them speak at school assemblies. Further, it might be suggested to these community organizations that one or more pupils from the class be invited to be present at the suggested meetings as reporters for the class.

64. Interest the pupils in preparing talks or dramatic skits on various of the topics or problems noted in Section "B" above and have these presented before as many interested community organizations as possible. These could also be included in assembly programs in your own and other schools, and given before other class groups.

65. Suggest that the pupils write articles or editorials for the school paper. This might take the form of a weekly column devoted to current atomic and related developments.

66. Let those pupils who have the knack draw cartoons dealing with atomic problems for the school paper or for posting on bulletin
boards. All members of the class might well assist in formulating the ideas for these cartoons.

67. Suggest that the pupils prepare posters calling attention to forthcoming radio programs devoted to various phases of the atomic problem. This information might well be supplied to the school and community newspapers.

68. As the pupils uncover particularly significant articles or other printed items dealing with problems of the atomic age they might attempt to induce the editors of local newspapers to reprint them for the education of the public.

69. It should be possible for the pupils to put on a round-table discussion on local radio stations from time to time concerning problems of living in the Atomic Age which they have studied in class. Similar broadcasts might also be given over the school’s public address system.

70. Suggest that the pupils arrange for an exhibit space in the window of the public library, a store, newspaper office, etc., for displays of materials (books, posters, photographs, cartoons, notices, etc.) bearing on atomic problems; these displays the pupils should plan, prepare, set up, and maintain.

71. Letters to the Editor might be prepared by the pupils giving their views and questions concerning various aspects of the atomic problem.

72. Letters to Congressmen expressing the views of the group in reference to the control of nuclear energy and related matters might also be written by the class.

73. Arrangements might be made through the Junior Red Cross, or through the Division of International Educational Relations of the U.S. Office of Education, for correspondence with class groups in European, African, Asiatic, South American, New Zealand, Australian, Scandanavian, and other countries in reference to atomic control and related problems.

D. Evaluative Activities

74. At the beginning of the unit have pupils list the questions which they would like to have answered concerning the atom bomb, nuclear energy, and related problems. At the conclusion of the unit, or at any desired time in process, have the pupils list the questions the answers to which they feel every effective citizen in the Atomic Age must have or be attempting to secure. Then compare — better yet, have pupils compare — these two sets of questions to note evidences of (a) growth and (b) “blind spots” which still remain.
75. Have the pupils draw up a list of generalizations or conclusions which grew out of their study — items variously touching upon as many as possible of the types of learnings suggested in Part "B" above. These should be as simple and specific as possible and include only what the pupils are prepared to defend. At whatever time or times this evaluative device is utilized it will afford a reasonably valid indication of the pupils' status of development in reference to the area concerned.

76. File dated pupil work samples as the unit progresses and scrutinize these for evidences of growth.

77. File dated anecdotal accounts of significant things noted in pupils — evidence of a fact grasped, a generalization formulated and accepted, etc. Examine these for indications of growth.

78. As a summarizing activity, have the pupils compile a handbook on atomic energy. This should include in brief form what the pupils believe to be the minimum essentials of factual information, the principal reasons why the problem is of real concern to everybody, the conclusions or generalizations which they have formulated, and the unanswered questions or problems of which they are aware. In addition to affording significant evaluative evidence, this document will be of real value to other pupils if put to use in other classes or in the school library.

79. Develop an inventory of attitudes, administer it at the beginning and again at the conclusion of the unit, and contrast the results. Such an inventory should contain items touching upon all of the types of considerations to be dealt with. The following might perhaps serve as samples:

(1) How do you regard the atom bomb? (Check one)
   ____ a. It has no special significance (meaning) except that it ended the war with Japan.
   ____ b. It is important only as a new weapon of warfare which is of little concern to the average man.
   ____ c. It is a weapon which is so destructive that the majority of the civilians on both sides would be killed or incapacitated in an atomic war.
   ____ d. I have no opinion concerning the atom bomb.

(2) Will war always be inevitable (unavoidable) because it is human nature to fight? (Check one)
   ____ a. Yes.
   ____ b. No.
   ____ c. I don't know.
(3) Are Americans innately superior (born superior) to other people? (Check one)
   — a. Yes.
   — b. No.
   — c. I don’t know.
(4) Are white people innately superior (born superior) to colored people? (Check one)
   — a. Yes.
   — b. No.
   — c. I don’t know.
(5) How would you describe the average Englishman? (Check all statements which tell what you think.)
   — a. He has a poor sense of humor.
   — b. He is "stuck up" or "high hat" or "snooty."
   — c. He is cold and unfriendly.
   — d. He doesn’t pronounce words the way they should be spoken.
   — e. He likes to suppress other people.
   — f. He isn’t as intelligent as most Americans.
   — g. He won’t pay his debts.
   — h. He wants everybody else to do his fighting for him.
   — i. He doesn’t make as good a soldier as the average American.
   — j. He isn’t democratic.
   — k. The average Englishman is about as nice, as able, and as democratic as the average American.
   — l. I don’t have any opinion about the average Englishman.
(6) Is the peace-time use of nuclear energy likely to change our occupations? (Check one)
   — a. No, I don’t think so.
   — b. Yes, but not very much.
   — c. Yes, a great deal.
   — d. I don’t have any opinion about this.

80. Develop a factual test covering the important points concerning the atom bomb covered in the unit (regarding the fission process, methods of producing atomic materials, developments in nuclear research, contributions of the principal scientists, destruction at Hiroshima and Nagasaki, results of the Bikini test, important dates, how fission is induced, comparative strength derived from nuclear
as contrasted with other sources of energy, etc.) and administer this instrument before and after the unit.

81. Develop a factual test covering what has been said and done about the problems growing out of the development of nuclear energy (probable consequences of an atomic war, estimates of likelihood of developing an adequate defense against atom bombs, development of supersonic aircraft, possibilities of sabotage, necessity for rigid inspections, consequent loss of personal freedoms, need for world control of atomic energy, proposals for world control, estimates of time remaining, etc.) and administer this instrument at the beginning and again at the conclusion of the unit.

82. Develop a factual test covering what has been predicted and what has been achieved to date concerning the beneficial effects of nuclear energy if and when it is applied to peace-time uses (medical uses, heat, power, transportation).
PART VI
SELECTED BIBLIOGRAPHY

The following references include the more significant books, articles, films, recordings, and so on which appeared before December 1, 1946. Since the subject of atomic energy is extremely important to the people of the United States and to the whole world, books, articles, and other materials will continue to be produced and the teacher will want to keep abreast of these new developments. The magazines, newspapers, and other agencies mentioned in this bibliography will be likely to issue useful bibliographical material in the future. Hence this bibliography can be used as a guide in looking for more recent references and teaching aids. It is suggested also that students be encouraged to look for new articles, books, pictures, and the like and to report them to the class.

A. Books

   A discussion of what America faces, and should do, in today's highly interdependent world.

   "A conservative discussion of the atom bomb, its potentialities as a weapon, its political consequences, and the necessity for intelligent control of atomic power in order to prevent world chaos, by five members of the Yale institute of international studies. For the general reader."
   —A. L. A. Booklist.

   A discussion of the destruction of Hiroshima and Nagasaki and what it means to the world. The problems which have arisen and the possible solutions which have been suggested since Aug., 1945, are presented in clear, very readable fashion.

   Description of purposes, structure, and functioning of the United Nations organization. Written on two levels; one suitable for upper elementary and secondary school pupils, the other for adults.

   An enlarged version of the editorial published in the Saturday Review of Literature, Aug. 18, 1945.


The gripping story of six human beings who survived the Hiroshima bombing.


A discussion of the completely revolutionary implications of nuclear energy by the President of the National Industrial Conference Board.


“The science reporter for the New York Times tells the story of the atomic bomb's conception, its first three explosions, the concerted research effort of Allied scientists and some of the outlook for the future.”

— Publishers' Weekly.


This supplements the Smyth report which does not touch on the military aspect of atomic energy. It presents the problems of world control and some of the solutions which have been suggested. The material is presented by the scientists themselves.


Abe Spitzer was the radioman on the bombing of Hiroshima and Nagasaki. Merle Miller is a former editor of Yank in the Pacific area and on the continent.


"John J. O'Neill, science editor of the Herald Tribune, was the first newspaper man to understand the implications of atomic power when it was first revealed in esoteric experiments at Berlin and at Columbia University in January, 1940. . . . The first half of the book makes no mention of atomic bombs; but is a careful step-by-step account of the researches which led up to the splitting of the atom and the release of its energy . . .”

— Weekly Book Review.


"Postwar aspects of the international situation commented upon by a number of authorities." — Publishers' Weekly.
   An excellent book which covers the problems and some of the possible solutions being discussed very widely. Keyed to the lay reader. Profusely illustrated, including an illustrated glossary of terms used in atomic production.

   To be released during 1946-1947.

   "The purpose of this book is to demonstrate that as long as the human race continues to be divided into separate and independent states, there can be no enduring peace. According to Mr. Reves nothing can abolish war except a genuine world government with power to establish a system of universal law and limit national sovereignty . . . ."
   — Book Review Digest.


   As the title indicates, this is an account of the scientific research and technical development that went into the making of atomic bombs.

   "Originally published in 1940 explaining the why and how of atom smashing, and covering investigation and research of 50 years. This volume adds three chapters of material brought out by later discoveries including information revealed in the Smyth report. For the layman."
   — A. L. A. Booklist.

   "Electrons and their job in technology by means of relatively simple, accurate terms and similes . . . Chapter on the atomic bomb . . . ."
   — Library Journal.

   "World political movements, human needs and wants, the role of Soviet Russia and the role of the United States, the shadow of the atom bomb; Leland Stowe's deductions from his wide travels and years of reporting." — Publishers' Weekly.

Radio broadcasts on the release of atomic energy.


"Published first in 1942 and reissued, with a new introduction, because of the significant accomplishments in atomic energy which may prove to be important in solving many of the most difficult biological and medical problems. The cyclotron is described by its inventor and the importance of 'surface film technique' in medicine and biology explained. Authoritative, but specialized." — A.L.A. Booklist.

B. Pamphlets and Reprints


A table of terms: "The atomic language." Maps, unusually dramatic diagrams, etc., are included.


The science student will find the illustrations and diagramatic drawings of scientific equipment such as Geiger counters, atomic pile, etc., of value.


34. Gustavson, Reuben, and Others. *The Implications of Atomic Energy*; a radio discussion broadcast from the Sixteenth Institute for Education by Radio in Columbus, Ohio; including excerpts from the United States proposal for the international control of atomic energy. Transcript No. 424. Chicago: University of Chicago Round Table, [1946]. 37 p., bibl.


"Here we have with excellent diagrams, a concise statement on: 'How atom-splitting releases energy; Creating and isolating the high-power atoms; Dollar-wise thoughts on atomic energy; What to expect (and what NOT to expect) from atomic energy; and Peace-time applications.' Both informative and understandable." — *Science Education Review*.


Contains the addresses delivered at the annual Nation Association’s forum at the Hotel Astor, Dec. 1 to 3, 1945; in two parts, Part II.


The high school paper covering the organization and work of the Oak Ridge Youth Council on the Atomic Crisis, known as the Y.C.A.C.
   "Reprint from the New York Times (above date), includes such headings as: 'Young scientists are needed'; 'Freedom of science is vital'; 'Science moves quickly' . . . ."—Science Education Review.


   Excellent presentation of the consequences of the atomic bomb with emphasis on the urgency with which we must act if we expect peace and security in the future.

C. Magazine Articles on Hiroshima and Nagasaki


D. Other Magazine Articles on the Atom Bomb, Nuclear Energy, and Related Topics


90. Laurence, W. L. "Is Atomic Energy the Key to Our Dreams?" Saturday Evening Post, 218:9-10, April 13, 1946, illus.


**E. Plays and Short Stories**


123. WYLIE, PHILIP. "Blunder"; a story, *Collier's*, 117:11-12, January 12, 1946.

**F. Pageants**


**G. Film Strips**

125. DELANO, JACK. *How to Live with the Atom*, National Committee on Atomic Information, 58 cartoons, 35mm, black and white. $2.50.


Based on a 32-page pamphlet, *Races of Mankind*, by Dr. Ruth Benedict and Dr. Gene Weltfish of Columbia University.

127. *World Control of Atomic Energy*. National Committee on Atomic Information, 25mm, with speech notes and guide. $2.50.

**H. Motion Picture Films**

128. *Atom Bombs: Bikini* (Bomb no. 5), Paramount News, 1 reel, 16mm sound, black and white, news short.

129. *Atom Bombs: Hiroshima* (One Year After — August 6, 1946), Paramount News, 1 reel, 16mm sound, black and white, news short. Made up of pictures taken by the Japanese at the time of the Hiroshima bomb blast; released in the U.S.A. in August, 1946.

130. *Atom Bombs: Bikini Underwater . . . "* RKO-Pathe News, 1 reel, 16mm sound, black and white, news short.

**I. Recordings**

J. Bibliographies


   "Short, annotated list of recent books on race relations and related topics." — A.L.A. Booklist.


K. Action Groups (Sources of Information)

138. Americans United for World Government
   1710 I St., N. W.
   Washington, D. C.

139. Atomic Scientists of Chicago
   Room 6, Social Science Building
   University of Chicago
   Chicago, Illinois

140. Campaign for World Government
   608 South Dearborn St.
   Chicago, Illinois

141. Emergency Conference for Civilian Control of Atomic Energy
   1710 I St., N. W.
   Washington, D. C.
142. Federation of American Scientists
W. A. Higinbotham, Chairman
Washington, D. C.

Many organized groups of scientists are affiliated with the Federation of American Scientists. Both the national and local or area groups are issuing scientific material such as newsletters, reprints, etc. Ask for the addresses of the affiliated groups in your area.

143. National Committee on Atomic Information
1749 L Street, N. W.
Washington 6, D. C.

Chief source of material on atomic energy. One dollar will bring a Kit for Discussion Leaders containing the latest issues of the newsletter, Atomic Information; a variety of reprint items; a bibliography, etc. A donation to the committee will place you on their mailing list for the future issues of the newsletter which is published on alternate Thursdays. The donation, one dollar or more, covers cost of mailing. Other items are available for small charges.

144. Oak Ridge Youth Council on the Atomic Crisis
Oak Ridge High School
Oak Ridge, Tennessee

145. World Federalists
29 East 28th Street
New York, New York