

SCIENCE NEWS

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TRANSMUTATION OF THE ELEMENTS

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INTERPRETING the transmutation of the elements, by the changing of their atomic nuclei, must be considered from the old statistical point of view of thermodynamics rather than exclusively by the newer quantum theory, according to Professor Niels Bohr, of the Institute of Theoretical Physics at Copenhagen, who addressed the meeting of the American Physical Society at Durham, N. C., on February 19. Professor Bohr believes that modern atomic theories which treat the behavior of individual atoms, particles and nuclei are bound to fail when used on heavy atoms like lead which contain over 200 protons and neutrons in the nucleus. One must revert to the well-known laws of thermodynamics which have been used for a hundred years to treat physical phenomena where a large number of particles are involved.

In barest outline Professor Bohr examines mathematically a heavy atom like lead, forgets its individual internal particles and treats it as though it were a tiny drop of water or mercury with a myriad of particles in it. Such a theoretical droplet of muscels would have such an enormous density that if it were as large as one cubic centimeter, its weight would be over 100,000,000 tons. Under normal conditions the tiny droplet may be thought of being at a fairly low temperature. During experiments in which such a nucleus is bombarded with neutrons, however, the first effect of the impact is to raise the effective temperature to the inconceivably high temperature of some 50,000,000,000 degrees Centigrade. At such temperatures the particles within the nucleus go into a state of violent thermal agitation. Some of the nuclear particles will "evaporate" and be hurled off with energies amounting to several million volts. As soon as excess energy is liberated in this fashion the nucleus will "cool" down to lower temperatures and the evaporation will cease. Any residual energy will be radiated in the form of gamma rays until the nucleus has cooled to its normal temperature. The main point of Professor Bohr's theory is the idea that a nucleus can be thought of as having a temperature and that the evaporation of particles can be treated by thermodynamics. By making detailed calculations based upon this idea Professor Bohr was able to explain a number of phenomena which have been observed to take place when atoms undergo transmutation from one kind to another. In carrying out his calculations Professor Bohr finds it necessary to use some of the ideas inherent in the more modern quantum mechanics. There is little doubt that the new Bohr theory, if proved successful, will be quickly accepted and welcomed by all physicists.

ROBERT D. POTTER

A NEW TREATMENT FOR SPODUMENE

Few people probably ever have heard of the little-known, little-used lithium mineral called spodumene, but through a new process the mineral may soon help cool

your home, improve the dishes from which you eat, improve the production of lithia water you may drink, help to start your motor car and make a special extra tough glass. At the annual meeting of the American Institute of Mining and Metallurgical Engineers, Oliver C. Ralston and Foster Fraas, of the scientific staff of the U. S. Bureau of Mines, told of the simple method by which spodumene can be separated from other minerals with which it is associated in nature. Lack of use of the mineral has, in the past, been due to the absence of such a separating process.

Heating in a lime kiln reduces the spodumene to a chalky white mass which can be crumbled in the fingers while the remaining minerals in the ore remain strong. Even farmers and miners with home-made kilns can use the method with considerable success. The fine dust resulting from this treatment is about 80 to 90 per cent. pure, and from many localities this product will be of acceptable purity. It is much better adapted to use in making lithium chloride than the original hard, dense spodumene. It is also ready to be used in a glass batch, unless there are magnetic iron minerals in the ore, in which case a preliminary removal of iron minerals would be needed. The pottery makers have desired to use spodumene, but it has been unacceptable because of the fact that at the temperature of a lime kiln it tended to expand and tear pottery to pieces. The beta spodumene formed by the heating and now to be sifted out of the heated ore has already been expanded and does not have this disadvantage. Spodumene is the most plentiful of the lithium-bearing ores. It looks much like feldspar and behaves like it. Lithium and lithium salts, heretofore extracted from less common and more expensive ores, now promise to have several important new uses. Lithium chloride solutions, for instance, should find greatly increased use in the conditioning and drying of air in the fast-growing air-conditioning industry.

MEASUREMENT OF HEAT GENERATED BY COAL

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A NEW experimental method of determining how much heat coal will generate was announced at the New York meeting of the American Institute of Mining and Metallurgical Engineers. L. C. McCabe, of the Illinois Geological Survey, and Professor T. T. Quirke, of the University of Illinois, described a new method of coal analysis in a paper entitled, "Angle of Polarization as an Index of Coal Rank." Tiny cubes of coal are polished and brightly illuminated with a small lamp. The light reflected from the polished surface becomes polarized and is studied with Nicol prisms to determine the angle of polarization. By a fundamental rule of optics known as Brewster's Law, the angle of polarization of the reflected light can be related to the index of refraction. A final and significant step in the research was the discovery that the amount of heat in British Thermal Units

which a unit amount of coal can produce is related by a simple straight-line relationship with its index of refraction as measured in the apparatus.

Using the wide range of different kinds of coal found in Illinois from woody lignite to soft bituminous and so on to harder bituminous it was found that as the heating qualities of the coals increased, so too, did their index of refraction. The method is still in the experimental stage and the accuracy of the technique could be increased ten or one hundred times with better equipment. This investigation, however, with improvised equipment imperfect in many particulars, has discovered what appears to be a physical criterion for rank identification of coal.

WEATHER CONDITIONS IN THE UPPER AIR

AN intensive, one month investigation of weather conditions in the upper air, the first comprehensive study of its type attempted on the intricate vagaries of New England weather, has been inaugurated by Harvard University and the Massachusetts Institute of Technology. The first of a series of radio meteorographs, a combined flying weather observatory and radio broadcasting station, are being sent aloft. The aim of the project is to obtain a complete record of temperature, humidity and air pressure from the earth up into the stratosphere and thus shed more light on the forecaster's problem of how weather is "manufactured." New England was chosen for the research because of its interest to meteorologists as an unplumbed weather-breeder. Airplane flights have been conducted in New England for the past six years, and much valuable information has been gathered.

In fog or snowy weather, however, when such information is most desired, airplane ascents have been too hazardous and it was to eliminate this loophole that the radio meteorographs were developed. They also have the added advantage of easily tripling the 20,000-foot airplane ceiling and thus reaching the really important heights in weather-formation. In preliminary tests, for example, one instrument reached the amazing height of 71,000 feet, well into the stratosphere and just below man's all-time ascension record. How far the first balloon went is not known for the automatic signals of the transmitting apparatus were only followed as high as 25,000 feet. At that time a temperature of 40 degrees below zero Fahrenheit was recorded, in comparison with 24 degrees at the top of the Guggenheim Laboratory of the institute where the balloons were released.

AIR MOISTURE AND INSULATOR EFFICIENCY

LOSSES in high-tension power transmission are expected to be considerably reduced through the discovery at the Harvard Graduate School of Engineering that moisture in the air is the hitherto unsuspected cause of the costly inefficiency of the porcelain and glass insulators used on the lines. The discovery, made by Professor Chester L. Dawes and Dr. Reuben Reiter, was enabled by their perfection of a high-voltage bridge with which it is possible to detect the smallest flaws in high-voltage insulation, a problem that has troubled electrical engineers for

some time. With the instrument, an entirely new field of research in insulation is opened out which possibly may bring man closer to his dreams of managing tremendous amounts of power safely and efficiently by revealing the causes of insulator "flashovers" which so frequently paralyze power lines.

Tentative findings also indicate that one of the causes of radio interference is due to high-voltage "static" discharges over the surface of these insulators. That moisture in the air could cause such flashovers and short-circuits was unknown during the thirty years that insulators of this type have been in use until the series of delicate measurements with the Dawes bridge was made. These showed that atmospheric humidity, or moisture in the air, produces not only a pronounced power loss over the insulator, but that the loss is greater over a period of time than with a clean insulator. The greater the moisture in the air, it was found, the greater is the loss. Cleaning the insulator by vigorous rubbing with a chamois cloth, however, was found to return the power to its initial value. This led to the assumption that a permanent deposit forms on the surface of the insulator and decreases its efficiency, an assumption later confirmed by observations through a special "dark-field" microscope which readily reveals minute surface irregularities. The deposit, it was found, takes the form of millions of tiny islands which, because of difficulties of observation, are not visible with an ordinary microscope.

SCIENCE IN ADULT EDUCATION

PREDICTING that we are now entering a period of greatly increased interest in the spread of new knowledge and the fruits of recent research and discovery, Dr. F. P. Keppel, president of the Carnegie Corporation of New York, in an address given before the American Philosophical Society in Philadelphia, suggested a wide-spread effort to provide educational opportunities for adults in the field of science. He pointed out that science is a neglected field in adult education even though our civilization is "based to a degree unimaginable in the past upon the applications of science." Dr. Keppel reviewed the resources of educational and scientific America made available not alone to the children and youth in schools and universities, but to adults. He said: "Institutions must open their doors and in particular more colleges and high schools must throw open their laboratories and study collections. For use in communities where it is now available, we must have suitable science material 'on the road' just as we have our traveling exhibitions of pictures and our traveling orchestras." One liability in the proposed program is "a curious shyness on the part of our males about being caught at improving themselves culturally." Until recently adult education in the fine arts represented "what the geneticists would call a sex-linked character." One serious liability in diffusing science more adequately is the traditional attitude of so many men of science, the very men who should be leaders, not only in the advancement but in the diffusion of knowledge. "Most of those who are themselves advancing the frontiers of scientific knowledge are frankly not interested in the popular diffusion of such knowledge when approached upon the sub-

ject, are likely to reveal a fear that if it were known by their scientific colleagues that they were developing such an interest, they would lose face, and this despite excellent examples to the contrary to be found in England and elsewhere. Certain other leaders point out that the unevenness of preparation in any adult group adds enormously to the difficulties of laying any solid foundation of fact upon which a structure of worth while understanding can be erected by the individual. This liability deserves serious consideration. If it is proposed merely to carry over the classroom technique based upon uniformity of previous preparation, one can well understand the doubts and fears of these leaders. We do know, however, that excellent results are actually being obtained when instruction is individualized, and more important when the adviser has skillfully limited the student's own objective to a degree of understanding which his factual structure can safely carry. Even when the leaders in science are willing to talk to the laymen about these matters, it often develops that the two groups are not talking about the same thing. What the scientist has in mind is a broader spread throughout the American people of a belief in the importance of science and of the scientific method in modern life. Now this is admittedly more desirable. Indeed it is hardly reasonable to expect that in the long run funds will be forthcoming for the support of scientific research in adequate amount from taxation and corporate or private sources, unless there is developed a more general understanding of the objectives of science on the part of the public."

ITEMS

THE comet discovered by Dr. F. L. Whipple, of Harvard Observatory, has increased in brightness some six and one quarter times and moved a distance about six times the apparent size of the sun at noon, according to latest observations. When first noted on photographs on February 4 and again on February 7, the Whipple comet was of the twelfth magnitude. Now it has increased in brightness until it is of the tenth magnitude. It will not be visible to the naked eye until it reaches the sixth magnitude, which will require a further increase in brightness of some thirty-nine times over what it is now. Astronomers have not yet computed an orbit that will tell whether the comet will attain naked-eye visibility. Latest position of the comet is at right ascension 13 hours, 30 minutes and 5 seconds; declination plus 38 degrees, 39 minutes and 13 seconds. This position is near the minor constellation Canis Venatici, the hunting dogs. The tail of the comet is less than one degree long. For comparison, the apparent size of the full moon's diameter is a little over one half degree.

WINTER wheat in the fields seems to have escaped the hazards of winter and flood with less harm than had been anticipated, according to regular weekly summary of crop weather, compiled by the U. S. Weather Bureau. Those of the Ohio Basin show most of the wheat alive and reviving, as the water recedes. Such harm as was done was caused principally by erosion. In the upper Mississippi Valley grain region, where the fields have for

weeks been sealed over with ice, there has been less loss than observers have been fearing. In eastern Nebraska, melting snow fed the crop. Snow cover still persists in the grain fields of the Pacific Northwest. Only in the dustbowl area of the nearer Southwest is the situation really unfavorable.

\$1,500,000 has been allotted by the Japan Broadcasting Corporation for television research during the coming year. A laboratory to house the experiments of Professor Takayanagi, television expert, will be completed next month. He is reported to be 90 per cent. successful in experiments to use a daylight television receiver instead of the present fluorescent-light.

CONFIRMING observations made by Dr. W. Buengeler, Dr. J. E. Davis, of the University of Chicago, has found that bits of tumor tissue, liver, abdominal muscle and lymph nodes taken from mice of the cancer or tumor strain used less oxygen than similar tissues from mice of a non-cancer strain. Along with the lower oxygen consumption of the tissues of their bodies, the cancer-strain mice had larger livers, fewer red blood cells, less hemoglobin and lower red cell volume. The cancer-strain mice also had more calcium in their soft tissues. Dr. Davis believes that these differences are not the result of cancer but predispose to it. These, and possibly other factors, make up the tumor disposition. He concludes that in the cancer-strain mice the presence of calcium in the tissues suffering from oxygen deficiency may have been the deciding factor as to whether a tumor would or would not result.

SCIENCE's newest aid to law enforcement comes through the ingenuity of Dr. Francis F. Lucas, of the Bell Telephone Laboratories. Dr. Lucas had noticed that on many fingerprints the fine powder commonly employed by the police technicians does not stick. He knew that a slight deposit of the body's natural oil holds the powder on a "good" fingerprint. The problem therefore was to find something to make even a slight trace of this oily material highly visible. Paper bearing suspected fingerprints is first treated with Flemming's solution, and then dipped into a dye which, under ultra-violet light, glows with a brilliant blue-green hue. The fingerprint stands out black and stark against this shining background. Its finest details can be examined under a low-power microscope, or it can be photographed up to any enlargement desired. If the paper bears print or handwriting, filters over the camera lens can cut off the ink from registering on the film, leaving only the boldly showing fingerprints.

THE invention of airplane seats that are probably more than 90 per cent. air in bulk has been patented by F. G. Manson, of Dayton, Ohio. The patent is for an airplane seat which looks like an overstuffed living room chair. However, no wood, steel or stuffings enter into its construction; only air-proof, rubberized fabrics that can be inflated. By controlling the amount of inflation, the softness of the seat and also its height can be regulated.