PHYSICS

Propose Theory of Liquids

The fluidity of liquids can be understood, a crystallographer believes, in terms of the packing of irregular polyhedra and not as an imperfect gas or solid.

➤ WHY A SOLID is a solid, and a gas is a gas is known. There are theories that account for them. In solids, the molecules are packed regularly; in gases, they move freely at random.

However, there is no satisfactory theory in terms of molecular structure which can explain why a liquid is a liquid.

Previous approaches have either treated a liquid as a solid with imperfections, or as a gas which is crowded. Few have attempted to treat a liquid as a unique structure.

Now, Prof. J. D. Bernal, crystallographer and head of the physics department at Birkbeck College, University of London, has developed a theory stating that the secret of the structure of liquids is organized irregularity. The molecules are coherently packed, but without any regularity.

The great problem has been to demonstrate this in a physical model, and to explain this model in mathematical terms.

He has attempted to construct by hand, using table tennis balls or plasticine, a physical model of organized irregularity.

He has also had to develop his own statistical geometry to make this mathematical model. Mathematicians have been unable to provide him with any short-cut formulae.

What he has done now is to examine more closely the "neighbor-relations" in irregular assemblies of molecules. He has had to find out what are the irregular arrangements of points in space that satisfy one condition, namely that no points can be nearer than a specified distance.

His conclusion is that the basic property of a liquid, its fluidity, can be most readily understood in terms of the packing of irregular polyhedra, as in a foam.

Recent experiments have shown that at high pressures there is a perceptible interval marked by high specific heat that separates liquids from gases. Prof. Bernal interprets this as a change from a loose but coherent arrangement of molecules to an incoherent arrangement of clumps of molecules.

He contradicts the commonly accepted view that a gas and a liquid form a single fluid phase. They are distinct states of matter, although one may pass into the other without visible discontinuity.

Prof. Bernal believes this is probably a very general phenomenon applying not only to all liquids and gases, but also to all conditions of critical mixtures.

From this arises a number of considerations. For example, he predicts that although mercury is a good conductor at a certain temperature (the hypercritical point) it would lose this property and become a good insulator.

If the picture he is showing proves to be closer to reality than the more formal ones of previous workers, then there will be practical applications in the fields of refrigeration, gas-liquid separation, and the flow of liquids.

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ENGINEERING

Inform Engineers-To-Be

➤ WITH A predicted shortage in 1967 of 20,000 engineering graduates, new career guidance and information are being offered teachers and potential engineering students.

Studies of engineering aptitude suggest that certain criteria are important in estimating the probable success of a teen-ager as an engineering student. A student's potential may be considered good if he is in the top third of his group in mathematics and science courses and in standardized mathematical achievement tests, scores above 100 on IQ tests, and shows several of the following: General and technical vocabulary ability; interest in science and technology, and related hobbies; participation in science competitions; membership in science organizations; ability to comprehend scientific materials and to visualize solid objects from flat plans; friendship with scientists and technologists; good work and study habits.

A study of successful engineering students turned up such additional characteristics as admiration for science teachers; interest in chess, puzzles and riddles; nonmember of athletic team and desire to be unlike athletes; lively curiosity and the use of the cause-and-effect approach.

These clues to engineering aptitude, as well as information about various careers in engineering, advice on high school and college course requirements and names of over 200 accredited engineering colleges, have been assembled in a Science Manpower Project monograph, "A Guide to Engineering Education" by Frank W. Eller, fellow of the Science Manpower Project, Teachers College, Columbia University, New York City.

Solid grounding in science, mathematics and liberal arts courses in high school is recommended since emphasis at the college level has shifted to include liberal arts as well as technical training.

A master's degree is usually necessary now for positions in research and development, according to Mr. Eller, with industrial and nuclear engineering specialties often requiring on-the-job training in addition.

It is pointed out that trained engineering technicians also are much in demand to implement the work plans of professional engineers. Prospective technicians may get their training on the job, or in courses given by industries, the Armed Forces, some junior colleges and technical institutes. Aptitude for technology is much the same as that for engineering, except that superior scholarship is not as necessary.

The Science Manpower Project monograph, first of a series directed toward improving science education, has been released by Teachers College of Columbia University. The Project is supported by a group of leading industries and industrial foundations.

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● RADIO

Saturday, Dec. 20, 1958, 1:35-1:50 p.m. EST
"Adventures in Science" with Watson Davis, director of Science Service, over the CBS Radio network. Check your local CBS station.

Mr. Davis will review the year's major science events.

MEDICINE

"Psychogenic" Fever In University Hospital

➤ A MYSTERIOUS small rise in temperature in patients with no discernible reason for fever has been found in 27.2% of patients in a university hospital.

This fever, which they call "psychogenic fever," is reported by Drs. Kerr L. White and Walter N. Long Jr. of the North Carolina Memorial Hospital of the University of North Carolina in the *Journal of Chronic Diseases* (Nov.). After a day or two in Memorial Hospital, they found, the patients' temperatures spontaneously drop down to normal.

The psychiatry service of the hospital has a higher than average proportion (29.9%) of patients with psychogenic fever, and on Medicine the incidence was even greater, 31.7%. The incidence on the obstetrics service was 0.0% but that was because labor itself is considered a cause of fever and so there were only two patients without "discernible reasons for fever."

This finding of psychogenic fever confirms an earlier report quoted by these investigators. It was found that the average temperatures of three psychoneurotic patients engaged in an exciting card game rose 1.5 degrees Fahrenheit during the first hour of the game. When the same game was repeated with all elements of gambling removed, no significant rise in temperature occurred.

Psychogenic fever has also been observed in men being examined for the draft; 67% of a group of 324 had temperatures above 99 degrees.

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