PHYSICS

Avogadro Number Remeasured Differs From Textbook Value

Figure Represents the Number of Molecules in a Mass of Matter Equal to Its Molecular Weight

NEW measurements of the number of molecules in a mass of matter equal to its molecular weight, known as Avogadro's number (thus for monatomic hydrogen a mass of about one gram), confirm the accuracy of recent previous measurements, and their departure from an older, long-accepted value still carried in many textbooks.

The new measurements were made by Dr. R. T. Birge, professor of physics at the University of California, and reported at the meeting of the American Physical Society in Berkeley, Calif.

The latest Avogadro number, average of several determinations, is 6.02331 multiplied by 10 to the 23d power, which is 1 with 23 zeros written after it. Or we may say the number is 602,331 billion billion. This is the number of molecules contained in something less than an ounce of aluminum or in about a half a pound of iron. If all the inhabitants of the globe, about 2 billion, were to forget the war and start counting the molecules in an ounce of aluminum, and each counted at the rate of one a second and worked 8 hours a day, we should be blessed with universal peace for the next 30 million years.

The previously accepted value of Avogadro's number was 6.0230 times 10^{23}, also obtained by Dr Birge in 1936 as the most likely value based on all previous measurements.

The figure still appearing in many textbooks is 6.064 times 10^{23}, which was also obtained by Dr. Birge in 1929 as a correction to the earlier value (1913 and 1917) of 6.062 computed by Dr. R. A. Millikan of California Institute of Technology. These figures were based on the famous oil drop experiment by which Dr. Millikan determined the existence of the electron and the value of its charge. Previous to 1913, scientists had only a very vague idea as to the magnitude of Avogadro's number. They knew definitely only that it was the same for all substances, a universal constant, of which there are only about a dozen.

Various methods other than that of the oil drop have been tried, but the most modern and most accurate is an X-ray analysis of crystals, using X-rays of known wavelength. This is the method used by Dr. Birge. He complains, however, that nearly all of the previous measurements of this sort were made on the crystal calcite, because this was the only one the properties of which, particularly the density, were known with sufficient accuracy. Recent accurate determination of the densities of lithium fluoride, rocksalt and the diamond made it possible for Dr. Birge to use these substances. Only the most perfect crystals were selected, and the results they gave agreed very closely. The unweighted average 6.02331 differed by less than 1 part in 10,000 from the value he obtained from calcite, 6.02276. These numbers, it is understood, are all to be multiplied by 10^{23}, or 100,000 billion billion.

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MILITARY SCIENCE

Planes and Tanks Have Made Heavy Artillery Obsolete

NO MORE Big Berthas, no more super-long-range guns such as those that shelled Paris in 1918, not even any more 14-inch naval guns mounted on railroad cars. Planes and tanks have made them obsolete.

That is the belief of Col. Henry W. Miller, chairman of the department of mechanism and engineering drawing at the University of Michigan, set forth in the gun-makers' technical journal, *Army Ordnance*. (July-August)

Tanks make long-range firing unnecessary by rushing fire-power of machine-guns and light artillery up to front-line positions and on through to command headquarters and traffic nerve centers in the rear. Heavy bombers and Stukas deliver the explosive equivalent of heavy shells at longer ranges than any cannon, even of the specially designed freak-gun class, can possibly deliver them. Infantry, travelling in trucks and "cat-treaded" vehicles themselves, carry a great deal of artillery fire-power right with them, in the shape of mortars and light howitzers.

What will the artillery of the immediate future consist of? Col. Miller answers: almost anything that will destroy tanks and airplanes, because it must defend itself against these or be destroyed by them. Beyond that, artillery mobile enough so that its transport will not interfere with rapid movement of large army units. This means guns up to the caliber of about six inches, but not much beyond. Such pieces have considerable value because they can plant themselves solidly and pound, pound, pound away at objectives behind the firing front, such as roads up which supply trains must move. But even the six-inch longer-range guns may have disappeared in the next two years, Col. Miller adds.

"Mobility will be the urge to the point of obsession, and rightly so; for he who can move himself and all his equipment most rapidly, dependably, and for the greatest distances has the best chance of avoiding destruction and of being the victor."

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POPULATION

Africa May Take Europe's Surplus Population

AFRICA may play the role in the last half of the 20th century, and the beginning of the 21st, that America played in the 19th as absorber of Europe's population surpluses, suggests Prof. Frank J. Klingberg of the University of California at Los Angeles. Prof. Klingberg feels that one reason for the relatively peaceful state of the world for a hundred years after Waterloo was the availability of open lands in America, Australia and New Zealand for people crowded out of Europe.

Africa, although the second of the continents in area, has a population of only 150,000,000, he points out, and he is of the opinion that it could support at least double that number. Recognizing the existence of race-adjustment problems, he believes that they can be solved.

Nor would the migration of large numbers of white people to Africa necessarily mean the decline of the Negro race in its home lands, according to Prof. Klingberg. On the contrary, he is of the opinion that Africa needs and can adequately support a much larger Negro population than it now has.

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