THE GREATNESS OF COMMON THINGS.

By JAMES R. POUND, D.Sc.,
School of Mines, Ballarat, Victoria.

MANY discoveries are lost through laziness, a fact of which we are well aware; or if every soldier carries a marshal's baton in his knapsack (as Napoleon thought), few soldiers take the trouble to unpack their kits.

The atmosphere had been "investigated" for centuries, so that by 1890 surely we knew all about it; at that time Lord Rayleigh was determining with the greatest possible accuracy the densities of the common gases—oxygen, hydrogen and nitrogen. A waste of time? So most people would have thought then, even scientists and practical men: surely the properties of those gases were known accurately enough! But Rayleigh found out that nitrogen, prepared from ammonia, was lighter than "atmospheric nitrogen" by one-half *per centum*. The atmospheric nitrogen was "dry air minus oxygen," and at that time was thought to be a homogeneous substance and identical with chemically prepared nitrogen. Clearly, however, it was not! Then Lord Rayleigh and Sir William Ramsay proved that atmospheric nitrogen contained an inert gas, heavier than pure nitrogen, and this gas they called argon (*argos*, inactive, idle). Argon, indeed, constitutes one *per centum* of the atmosphere.

Thus our old air was imperfectly known even in 1890. Moreover, Ramsay, following up the above work, found four other gases in the atmosphere: helium (which was discovered in the sun's "atmosphere" in 1868), neon, krypton and xenon. Only one part of xenon occurs in 170,000,000 parts of air; helium has now become most important on account of our discovery of its continuous production by the radio-active elements (such as radium), and neon, indeed, is now one of the glowing tools of the advertiser, and any article—from bread to boots—may be brought before our lethargic minds by the neon signs. To what common uses do men put the marvellous!

The old familiar things are mines of gold—to those who will dig deep. The arts, the philosophies and the sciences are based on this. A great artist takes a common subject and so presents it to us that we see a hundred fresh beauties; and the scientist finds laws of the widest importance from the commonest illustrations. Earth, air, fire and water, those "elements" of the old Greeks, still provide us with new facts and new ideas.

Modern chemistry dates from the latter years of the eighteenth century, arising particularly from the study of combustion ; chemistry is indeed the Promethean science. In that century chemists at last became familiar with many gases and, finally, with the oxygen in the atmosphere ; soon combustion and respiration were recognized as oxidations, and these common processes were removed from under the dark and magical cloud of alchemy into the rational and clarifying light of chemistry, thus furthering both their own elucidation and a great development of the young and growing science. The composition of water (as well as the nature of air), was unravelled by the close of the century, whilst the earth's crust—our most fruitful source of raw materials—was being scientifically prospected for the first time ; and the number of the chemical elements (those simplest substances from which all other substances may be obtained) was steadily and certainly growing.

A century later it was thought that only a few rare and unimportant elements remained to be discovered—or, literally, to be unearthed. Lo ! then the radio-active elements were laboriously extracted from their hiding places by the Curies and others ; and, again, not only the unexpected, but the most marvellous appeared from common earth.

Chemistry and all the natural sciences received a new impetus from these radio-active, self-disintegrating elements ; earth again demonstrated further possibilities, and evolution entered the inorganic world. The chemist himself was galvanized to new activities, the results of which are not yet by any means exhausted, for we, or at least some us, are ever stirred to greater efforts by the complexities of common things.

Now we believe that all the elements are known, numbered, if not named. There are ninety-two of them, of which eighty-nine have been isolated. Fortunately, perhaps, for students of chemistry, most of these elements are rare : the bulk of the world's work is done with a mere dozen of them. Yet we now know that there are remarkable variations in most of the elements ; we deal with each element *in the average* ; but any one element has its own variations. When we have learnt to unravel the average, or to separate the elements by the methods of a neo-chemistry, then we may make more wonderful substances than those which we have learned to make by the ten thousand or more after the rules of the ordinary chemistry of today. *Ordinary ?* There is no *ordinary* !

The latest work on fire, on combustion and on explosion abundantly proves that these common phenomena teem with rare wonders and unexplained corners. The production of most of our mechanical energy—of our civilization, in short—is still on a crude basis ; and the energy that drives our motors is yet imperfectly understood. The beautiful propagation of the explosive wave in a mixture of gases must be seen—by masterly photography—to be appreciated.

Traces are the elusive genii of the chemical world (and everything is chemical). These catalysts of laboratory and technical chemistry, these vitamins and hormones in living bodies, these insignificant impurities (as they have been labelled in the past)—these traces often hold the keys of chemical reactions : without them there is passivity ; with them—activity. Indeed it may be said that our chemical control of the world is just beginning, and what we have done in the past century with the aid of chemistry is but a slight intimation of what we shall do in the future.

Water is so much with us, and it has been so carefully studied, that surely we know all about it ! Water, however, is not the simple liquid that simple students imagine : it is by no means plain H_2O. Water contains varying proportions of particles or molecules—H_2O, $(H_2O)_2$ and $(H_2O)_3$: these proportions vary with the temperature, and to these variations are due the anomalous properties of water, such as its temperature of maximum density and its expansion on freezing. But the latest careful work on our old friend, or enemy, indicates further complexities. By electrolysing water for several months G. N. Lewis has found that " lighter waters " are decomposed first and " heavier water " last, and he has obtained a residual water (from the electrolytic cells) of much greater density than that of ordinary (or average) water. The explanation of Lewis's work lies deep. But the story becomes too complicated to unfold further here ; we simply indicate that the commonest liquid, water, still has much to teach us—if we will learn.[1]

Here we have briefly hinted at the wonderful nature of common things and at the far-reaching work that is being done with them. To live gloriously we must appreciate the sublimity of common things.

[1] See the article "A New Kind of Hydrogen," by D. P. Mellor, page 7.