either he must accept the complete idea of the relativity of all motion, of rotation as well as of translation, as professed by Milton, Mach, and Mr. Love; or else he must follow Newton, Maxwell, and the German writers Streintz and Lange (attacked by Mach in Appendix iv.), and distinguish between the relativity of the motion of translation and the absoluteness of rotation. Euler, it appears, was a waverer, and according to Lange never arrived at any settled and intelligible opinion upon the subject. The first theory appears more analogically complete, but introduces unnecessary complication at an early stage; and stronger arguments than those of Mach, and others that I have yet met with, will be required to convert me to their side of the question.

A. G. GREENHILL.

November 26.

Science Teaching in Schools.

IN the discussion on the teaching of science, and in the schemes put forward for reorganising this teaching, mathematics has so far been left out of consideration.

At present mathematics is taught for its own educational value, which has been traditional since the time of Plato; only in modern times has its great practical value been recognised. The teaching in schools takes little account, however, of the applications of mathematics, and whatever Prof. Greenhill may say (in his review of Prof. Mach's excellent book), there is still wanting complete harmony between those two points of view; not perhaps in the higher branches of the subject and its applications, but certainly in school teaching.

Boys, and girls too, in public schools are taught the elements of mathematics as if all were expected to become mathematicians, and the practical side is kept out of view. In the modern, or science side, which has been introduced at many schools, one finds too often chiefly those boys who show no talent either for classics or mathematics. Many of these have made little or no progress in Euclid; they cannot grasp the altogether abstract notions and symbols of algebra, and they therefore never come near trigonometry. But they are expected to understand the elements of chemistry, mechanics and physics; and it is instructive to find that they very often do understand a good deal of what is taught under these headings.

Now none of these subjects can be accurately taught—and inaccurate teaching is worse than waste of time—without the introduction of mathematical reasoning. Here we are in a vicious circle: the boys are considered incapable of learning mathematics, and therefore mechanics and physics have to be taught without any more than the most elementary notions of geometry and algebra; hence not much progress can be made.

In my opinion the order of procedure might be reversed. Mathematics might be taught through experimental science. If the boys themselves make, as they should do, experiments where they perform actual measurements, they will learn there are certain laws connecting various quantities; they will see that such laws can be expressed in simple symbols, and they will thus grasp in the concrete form the meaning of a formula or an equation which in the abstract form of pure mathematics remained a mystery to them.

Mathematics could in this manner be made very much easier and more interesting to the majority of boys. Geometry can be treated to a very great extent experimentally by aid of geometrical drawing and a development of the Kindergarten methods; the abstract logic of Euclid can then follow, or it can be treated at the same time.

Trigonometry need not be at once as fully gone into as is generally done, but the definitions of sine, cosine, &c., as names for certain ratios, can be easily and early introduced and made use of at once in mechanics or physics. Here also special experiments may easily be devised where measurements of angles or lines are made, and lines and angles calculated.

To explain fully what I mean I should require a great deal of space; in fact it would be almost necessary to draw up a distinct syllabus for a course on the above lines, or to give at least a great number of examples.

At present I wish only to urge that, while many attempts are being made to improve science teaching, and with it technical education, mathematics should be included, and to express my opinion that this science also allows of experimental treatment.

November 19. O. HENRICI.

MR. CRUMP (*vide* p. 56) though adopting a critical form and tone, really endorses the grounds of my suggestion that the Science and Art Department should dissever itself by an age limit from school science. He is inclined to be especially severe upon the defects of the Government examinations because they are controlled by scientific men, and to excuse the proper school examining boards because they have—according to Mr. Crump—attempted to examine in science without any qualification to do so. But I fail to see why eminent scientific men should be expected to be experts in elementary science teaching, any more than distinguished *littérateurs*, in the art of teaching to read, and it seems to me—in spite of Mr. Crump's "absolute" denial—that examining boards, neither professedly literary nor scientific but professedly educational, are more to blame in following and abetting the Department's premium upon text-book cramming. The fact remains that the London Matriculate ignores practical teaching of any kind, and that the "practical chemistry" of the Locals and College of Preceptors is essentially the same test-tube analysis as the South Kensington examination. Anyone who knows the London Matriculation examination—witness Miss Heath's concluding remark—will appreciate the quiet humour of Mr. Crump's allusion to it as "awakening and developing the powers of observation and reasoning."

H. G. WELLS.

The Explosion of a Mixture of Acetylene and Oxygen.

WITH reference to your note in last week's NATURE, I may say that, whilst the thanks of chemists, and particularly of those whose duty it is to perform lecture-experiments, are due to Prof. Lothar Meyer for once more drawing attention to the dangerously explosive nature of mixtures of acetylene and oxygen, it may be assumed that the facts already known concerning acetylene account sufficiently well for the great violence of the explosion, and hence for the circumstance that the mixture will shatter even the open cylinder in which it is detonated. What M. Berthelot terms the molecular rapidity of the reaction, as distinguished from the rapidity of propagation, in the case of mixtures of acetylene and oxygen is very high. The heat of the reaction, too, is nearly five times as much as in the cases of electrolytic gas and of carbonic oxide, and more than twice as much as that of methane. It is slightly exceeded by that of ethylene, but, on the other hand, the theoretical temperature of the change with acetylene is enormously greater than in the case of any other explosive mixture of gases. The temperature, too, required to initiate the change is, as Prof. Lothar Meyer showed indirectly some ten years ago, much lower in the case of acetylene than in that of the other gaseous mixtures of which he speaks. All the conditions tend to make the duration of the reaction so nearly instantaneous that the initial pressure cannot be far removed from the theoretical pressure, and this is sufficient to smash a much stronger envelope than a glass cylinder, even if the "tamping" be nothing more than the air. Everything we know about acetylene combines to show that it is extremely "sensitive" as an explosive, and that in this respect, as in its destructive action, it resembles mercuric fulminate.

T. E. THORPE.

"Newth's Inorganic Chemistry."

THERE are one or two points in Mr. Pattison Muir's review, upon which I should like to be allowed to say a few words.

Criticising the general plan of the book he says:

"It seems to me that the method of the author is radically wrong. Descriptive statements of facts ought surely, neither to precede, nor to follow, but to accompany the reasoning on these facts whereby general principles are gained."

It is not easy to see how the *descriptive statements of facts*, and the *reasoning on these facts* are to be printed in a book at all, unless one either precedes or follows the other. I can only suppose that my reviewer means, that such theoretical and other considerations as I have included in part i., and have called "introductory outlines," should in his opinion not be collected together either at the beginning or at the end of the book, but should be sprinkled among the descriptive chapters. It seems to me that the plan I have adopted, besides being a

more orderly arrangement, and one more convenient for reference, is also the one that best enables the student to study the subject in the way advocated by my reviewer; and in order to impress upon the student that the study of descriptive facts should *accompany* the study of the reasoning on these facts, he is directed to "slowly and carefully" read part i. *while he is studying the descriptive chapters*. I venture to think also, that this method tends far less to "perpetuate the vicious and unreal distinction between chemistry and chemical philosophy" than that of obliging the student to gain his information of facts from one book, and his knowledge of theory from another.

Commenting upon the fact that part ii. is devoted to the study of four typical elements, Mr. Muir says:

"But hydrogen, oxygen, nitrogen, and carbon are not treated as typical elements; they are not compared and contrasted with other elements."

This criticism is not true. Chapter ii. of part iii. is prefaced with a short general account of the elements oxygen, sulphur, selenium, tellurium, in which the typical element oxygen is compared and contrasted with its *confrères*. Chapter iii. is prefaced with a similar brief sketch of the elements nitrogen, phosphorus, arsenic, antimony, bismuth, wherein the typical element nitrogen is compared and contrasted with the others of the group; and similarly at the beginning of chapter ix. the typical element carbon is compared and contrasted with silicon, germanium, tin and lead.

My reviewer is good enough to say: "The descriptions in this book of the members of each group of elements seem to me to be exceedingly well done; many portions of the chapters treating of principles and theories . . . are admirable." And again, a few lines further on: "The purely descriptive portions of the work are often extremely good, as far as they go. The facts, or rather half-facts, are stated in a clear and orderly way."

I am a little curious to know what *half-facts* are; and whether if such things can be, it would be possible to state them "in a clear and orderly way." If my reviewer merely means that there are so many more facts known than I have stated, that roughly speaking it may be said that I have only described one half of the known facts, I can only reply that I have endeavoured to select "from the overwhelming burden of so-called facts" such as seemed to me to be most important for the student, and which could be conveniently included within the limits of a small text-book.

Mr. Muir finds fault with my book because he does not discover in it "some fair and fitly fashioned building," which he says "ought to rise on this broad superstructure." I regret that this objection has not been stated in rather more explicit terms; I have tried to understand it, but cannot—perhaps it is poetical. In ordinary language one does not speak of a building as rising upon a superstructure. In no text-book of chemistry with which I am acquainted, is any trace of such a phantom edifice to be found, and it is sincerely to be hoped, that when the Joshua appears, who by raising such a "fitly fashioned building" shall "rescue chemistry from the overwhelming burden of so-called facts beneath which the science is in danger of being buried," he will choose some more suitable vehicle for making his views known to the scientific world than that of an elementary text-book on inorganic chemistry.

G. S. NEWTH.

I STILL hold that Mr. Newth's method is radically wrong. I admit it is not easy to make the descriptive statements of chemical facts accompany the reasoning on these facts; but although not easy it can be done.

As regards Mr. Newth's treatment of the four typical elements, hydrogen, oxygen, nitrogen, and carbon, I can only repeat that the comparisons and contrasts made between these elements and those of which they are representative are, in my opinion, worth very little.

I cannot enter into a discussion of the meaning of the term "half-fact"; but I can assure Mr. Newth that in saying he had stated "half-facts in a clear and orderly way," I did not mean to say he had stated about half of the known facts and omitted the rest. It is characteristic of half-facts that they are very amenable to clear and orderly arrangement.

When I spoke of "some fair and fitly fashioned building" rising "on this broad superstructure," of course I should have written "broad substructure." I am much obliged to Mr. Newth for pointing out this stupid slip.

I thought Joshua was more concerned with demolishing towns than with raising buildings; but my Hebrew history is a little rusty.

M. M. PATTISON MUIR.

Cambridge, Nov. 21.

Singing Water-Pipes.

AT Oxford, Prof. Osborne Reynolds showed an interesting case of sound in water. There is another familiar effect, of which he has probably given the reason, but it does not seem to be commonly known.

A little while back there was a clear steady note carried through my house by the water-pipes, a note of the middle octave of the quality of an organ diapason pipe. When the source was found, it was easy to change the note through the octave. The music arose as often as the scullery tap was turned on, and lasted so long as the water was running. The tap was worn, and the flow of water kept up a rapid tapping of the loose part, just as in Trevelyan's Rocker.

The singing is sometimes heard after a tap is turned off. This happens because the ball-tap of a cistern has thus been left running.

W. B. CROFT.

Winchester College, November 26.

An Aurora on November 23.

STEPPING out of doors to-night, November 23, at 7.30, I was surprised to see the whole northern sky filled with luminous mist, so clear that our shadows were dimly observed on the shining surface of the wet highway. There were few tremulous motions, but the light clouds advanced southwards in great patches. For a while the planet Jupiter shone to the east of the luminous haze. Then the mist passed over Jupiter, who shone, however, with nearly its wonted splendour until a great detached belt hung between Jupiter and Pleiades, over to the south-west horizon.

The Milky Way became obscured as the haze passed right over our heads. By eight o'clock the detached luminous belt, which was not uniform, but in patches, had reached the planet Mars. Neither was the light in the north uniform, but here and there were clear spaces. By 8.10 the aurora was much dimmer. By 8.30 there was no luminosity except in the north, between the Great Bear and the horizon.

J. SHAW.

Tynron, Dumfriesshire.

A Snake "Playing 'Possum."

A PUFFING adder, *Heterodon platyrhinus*, caught by the writer in May 1894, exhibited a most curious instance of feigned death which may be worthy of record.

The snake when discovered at first tried to escape, but on being captured it turned on itself with mouth wide open, head thrown back sharply, and tongue limp and protruding. The mouth remained open thus to its fullest extent, while the head and upper part of the body threshed violently from side to side for a few times, and then his snakeship rolled over on his back, and after a few convulsive movements became apparently lifeless. The body was then quite limp, and remained in whatever position it was placed, providing the snake was on his back, but when turned over in the proper position, he immediately rolled back by an almost imperceptible muscular contraction. When struck lightly, pinched or held up by the tail, there was very slight resistance. He continued in this state for about half an hour, when no attention having been paid to him, he resumed his normal position. A little teasing caused a repetition of this performance a number of times afterwards, and it did not vary in any essential particular. It would be interesting to know whether this is a ruse common to individuals of this species, and if so whether it is confined to them alone.

L. C. JONES.

The Soaking of Seeds.

IN reply to Mr. Alfred W. Bennett's inquiry as to the soaking of seeds in milk before sowing, it may interest him to learn that in book iii. section v. of his "Deipnosophists," Theophrastus is quoted by Athenæus as saying that "cucumbers contain a more agreeable and wholesome juice if the seed be steeped in milk or mead before it is sown," and that "plants come up quicker if they are steeped in water or milk before they are put in the ground."

P. C. GLUBB.

Pendean, Liskeard, November 13.