It is hardly necessary to make any detailed review of the history of the atomic theory. Berzelius made it a starting-point for researches which, on the whole, have been unsurpassed in their practical importance, and engrafted upon it his celebrated electrical doctrine. Davy and Faraday refused to admit it; Laurent and Gerhardt accepted it doubtfully, or in a much modified form. Henry declared that it did not rest on an inductive basis. There can be no doubt, however, that the atomic theory has been accepted by the majority of chemists, as may be seen on even a cursory inspection of the current literature of their science. Our present intention is to give such a summary of the atomic question as may be serviceable to those who take an interest in the discussion at the Chemical Society on Thursday last.

The modern supporters of the atomic theory agree with Dalton in the fundamental suppositions we have given above; but assert that they have a much stronger case. The phenomena of gaseous combination and specific heat have indeed changed the numerical aspect of the theory, but not its substance. The simplicity of all the results we have accumulated with respect to combining proportions is itself a great argument for the existence of atoms. They all, for example, have the same capacity for heat; they all, when in the gaseous state, have a volume which is an even multiple of that of one part by weight of hydrogen. But bodies in the free or uncombined state—such, in fact, as we *see* them—more commonly consist of many clusters of atoms (*molecules*) than of simple atoms. These molecules are determined by the fact that when in the gaseous state they all have the same volume. Again, select a series of chemical equations, in which water is formed, and eliminate between them so as to obtain the smallest proportion of water, taking part in the transformations they represent. It will be found that the number is 18; which necessarily involves the supposition that the oxygen (16) in water (18) is an indivisible quantity. To put this last point another way: hydrochloric acid, if treated with soda, no matter in what amount, only forms one compound (common salt). Now we know that the action in this case consists in the exchange of hydrogen for sodium. But if hydrogen were infinitely divisible, we ought to be able to effect an inexhaustible number of such exchanges, and produce an interminable variety of compounds of hydrogen, sodium, and chlorine; hydrochloric acid being the limit on the one side, and common salt (sodic chloride) terminating the other. No such phenomenon occurs; and, since matter must be infinitely or finitely divisible, and has been thus proved not to be the former, it must be the latter. Atoms, therefore, really exist; and chemical combination is inconsistent with any other supposition. Those who hold the contrary opinion are bound to produce an alternative theory, which shall explain the facts in some better way.

Now let us hear the plaintiff in reply.

The atomic theory has undoubtedly been of great service to science, since the laws of definite and multiple proportions would probably not have received the attention they deserve, but for being stated in terms of that theory. Yet we must discriminate between these laws, which are the simple expression of experimental facts, and the assumption of atoms, which preceded them historically, and therefore has no necessary connection with them. For it was the Greek atomic theory which Dalton revived. Nor has any substance yet been produced by the atomists, which we cannot find means to divide. If, moreover, we have no alternative but to admit the infinite divisibility of matter, even that is consistent with the simple ratios in which bodies combine; for two or more infinites may have a finite ratio. Therefore, the observed simplicity, if used as an argument, cuts both ways. Possibly we are mistaken in connecting the ideas of matter and division at all; at any rate, the connection has never been justified by the opposite side. Again, admitting the argument based on the formation of common salt, the atomic theory does not tell us why only one third of the hydrogen in tartaric acid can be exchanged for sodium; why, indeed, only a fraction of the hydrogen in most organic substances can be so exchanged. Yet, the explanation of the one fact, when discovered, will evidently include that of the other. On the whole, it appears that the atomic theory demands from us a belief in the existence of a limit to division. No such limit has been exhibited to our senses; and the facts themselves do not raise the idea of a limit, which Dalton really borrowed from philosophy. The apparent simplicity of chemical union we do not profess to explain, but to be waiting for any experimental interpretation that may arise. The atomists, in bringing forward their theory, are bound to establish it, and with them lies the *onus probandi*.

The above are a few broad outlines of the existing aspect of the atomic controversy, and may somewhat assist in forming an estimate of it. The general theoretical tone of the discussion last Thursday must have surprised most who were present. Our own position is necessarily an impartial one; but it will probably be agreed that between the contending parties there is a gulf, deeper and wider than at first appears, and perhaps unprovided with a bridge.

LECTURES TO LADIES.

WHAT is the meaning of the present stir about the "Higher Education of Women"? We have before us announcements of courses of lectures intended to be given during the coming winter to the ladies of Edinburgh, London, Glasgow, Manchester, and Bradford; and we believe that similar courses are to be delivered in several other towns. The organisations under whose auspices these lectures are to be delivered, seem all of them to have come into existence at nearly the same time. Edinburgh and Professor Masson, so far as we know, have the credit of having taken the lead in the movement; but this was only two winters ago, and none of the towns we have named were more than one year behind.

What is the cause of this sudden and wide-spread demand on the part of our countrywomen for access to a different and, presumably, a higher kind of intellectual culture than has hitherto been within their reach? Or rather, first of all, is the apparent demand a real one? Is it such as to indicate that a real step has been taken, or is likely soon to be taken, towards an improved method and a higher standard of female education in England? Or is it more reasonable to suppose that the interest now manifested in the subject will disappear in the same proportion as the novelty of it? For our own part,—after making what seems full allowance for the influence which the love

of novelty, and the liking to do as other people are doing, have no doubt exerted in gaining for these "Ladies' Lectures" greater popularity, and a larger share of public attention than they would otherwise have obtained,—we believe that their rapid spread, and the success which has so far attended them, are mainly due to a serious effort on the part of the women of this country to improve their intellectual condition, coupled with the conviction of the inefficiency of the facilities for mental culture that have been hitherto open to them.

An explanation of the appearance just now of such efforts and convictions must be sought for among those facts of our present social condition which are making the Woman's Question in all its aspects one of the foremost problems of the time. It is obvious enough what some of these facts are, but we should have little confidence in an attempt to enumerate them all, and to estimate exactly their relative importance. But without undertaking to explain fully the movement under discussion, we think there are evident signs that it is a natural and spontaneous outcome of existing social and intellectual conditions, and not the result of artificial stimulus. If this view is correct, it is obvious that the importance of the movement must be judged of rather by what it indicates than by what it is,—by future results that may be hoped for, rather than by successes already achieved. Looked at in this way, it claims the serious attention and support of every one who desires the intellectual advance of the community, in order that the present opportunity may be turned to advantage, and that efficient plans of future action may be founded on the experiments now being tried with more or less of what must necessarily be temporary enthusiasm.

We venture to assume that in this, as in most other cases, the first condition of permanent success is that the object aimed at should be one in which it is worth while to succeed. If both lecturers and students are in earnest in trying to make these lectures really educational and serious, they cannot fail of producing valuable results. But this will require a good deal of determination on both sides. The most obvious, and perhaps the most serious, danger besetting the teachers, is the temptation—arising from an unconscious want of respect for their audience—to make their lectures *interesting*, instead of trying to impart the greatest possible amount of solid instruction. We confess that one or two very attractive-looking programmes that we have seen have suggested the thought, that possibly the lectures they announced might be equally well described as essays, such as constitute the more thoughtful kind of magazine articles; and that, if this were the case, it was not obvious what greater advantage would arise from their author reading them aloud to an assemblage of ladies than would result if the same ladies could be induced to read them to themselves at home.

But, though we have no reason to believe that such a criticism would be really applicable to any of the actual courses, it is none the less desirable that all concerned should be on their guard against the tendency for it to become so. Thorough teaching, and not entertainment, of however high a kind, is what we trust that every lecturer will strive to give, and every student to obtain. And, after all, the spirit and quality of these lectures will depend as much on the students as on the teachers. No doubt a thoroughly earnest teacher may do a good deal towards producing earnest pupils; but, in the long run, the kind of instruction given will be that for which there is a demand. Ladies who intend to join any of the classes now forming will not expect to get any benefit from them, unless they give up for them all other engagements, at least so far as to be able to attend with regularity. If they only go to the lectures when in want of other occupation, they had better not go at all. Moreover, we have not much faith in the educational value,—at any rate for residents in London,—of courses in which only one lecture is given in a week. There are few persons who can keep up any vivid interest in a subject which occupies their thoughts for only one hour a week; and we imagine that ladies, who are unwilling to spare the time for two lectures a week on a subject which they wish to study, will scarcely be found among the number.

In conclusion, we may remind our readers of two sets of lectures to ladies which begin this week in London: one of them at the South Kensington Museum, and the other, by Professors of University College, partly at St. George's Hall, Langham Place, and partly at University College. We heartily wish success to them all, and urge all our readers to do what they can to promote it.

GEOLOGY AND AGRICULTURE

WHEN man penetrated into Western Europe and Britain, he found the country clothed with dense forests interspersed with fresh-water lakes, peat-mosses, and bogs, relieved by few open glades, heaths, or moors. The native rocks could only be seen here and there, in crags and escarpments, sea-cliffs, river-banks, or mountain-heights; whilst herds of wild cattle, deer, and lesser game occupied the country, and afforded food to numerous beasts of prey.

In such a country, at first thinly populated, man could subsist by the chase alone, and a long period elapsed ere he added, first the horned sheep, and then the *Bos longifrons*, to his earliest domesticated animal, the dog, and thus entered on the pastoral stage of his existence.

The shepherd's life, however, although a great step in advance of that of the hunter, necessitates wandering from one point to another in search of fresh pasturage or water. The early shepherd was a nomad, while agriculture proper necessarily dates from the period of fixed residence; for, even admitting that early man might clear for himself—if not with his axe of stone, at least by the aid of fire—a tract of land suited for the growth of cereals, yet he would hardly toil for even such scanty return as he could gather from his little patch of corn, unless he had some kind of fixed habitation, and a recognised right of occupation.

In Britain the art of agriculture, and indeed of all the arts of civilisation, really commenced with the Roman occupation, but the Saxons and Danes who followed, though doubtless good soldiers, sailors, and fishermen, were scarcely less barbarous than the early Britons, and no advance was made in agricultural pursuits until after the introduction of Christianity, the members of the religious establishments, once so numerous, and into whose hands most of the landed property passed, having done much to improve the cultivation of land.