

"Mathematics" applied to Chemistry.

IN his notice of my book "Researches on the Affinities of the Elements" in NATURE, November 16, the reviewer impugns the legality of applying mathematical formulæ to my surfaces. I trust I may be allowed to answer briefly my critic's objections. His difficulty as to the non-continuous nature is imaginary, and arises from a mistaking of the object to be achieved—which is simply to obtain either a surface or a mathematical expression from which *can* be deduced the affinities any one element exhibits for any other. This can be done from the formulæ, and they do, therefore, characterise the chemical properties of an element which depend upon these affinities. Although there exist an infinite number of points on the surface which are occupied by no element, yet there exist only a *finite* number of points the x and y coordinates of which are *whole* numbers, and to *every* integer value given to x and y in my formulæ there corresponds a definite element; so that, so long as we keep within the domain of integer numbers (as we are forced to do by the nature of the construction) continuity is attained.

The complexity of the formulæ is more apparent than real, because the only values which x and y can have are integer numbers, and the constant and many terms disappear in practice.

GEOFFREY MARTIN.

Kiel, December 6.

It is true that the plan proposed by Mr. Martin is occasionally used on the convention that only the values of the equations to the curve which occur at the integer points are to be used; but the reviewer still maintains that the principle is a false one. A curve is intended to exhibit *continuous* change, according to some law, and he is unaware that any result of value has ever been obtained by the use of the plan, except, perhaps, that of appealing to the visual sense.

THE REVIEWER.

Heat a Mode of Motion in the Seventeenth Century.

THE following statement occurs in the "Medulla Medicinæ," by J. A. Van der Linden, Med. Prof., Franekeræ, 1642, p. 182:—

"Calor est minutissimarum materiæ partium motus in se reverberatus."

Van der Linden was a famous teacher, but the theory may not have originated with him. Are there other co-temporary anticipations of "Heat a mode of motion"?

W. R. GOWERS.

THE PULSE OF THE ATMOSPHERIC CIRCULATION.

SOME fifteen years ago an American eclipse expedition which included Prof. Cleveland Abbe visited St. Helena, and, on leaving represented to the Governor, Mr. R. L. Antrobus, now of the Colonial Office, the importance of establishing a meteorological observatory there. The representation was sent to the Colonial Office, and, the colonial finances being then in a depressed condition, the Colonial Office applied to the Meteorological Council for assistance.

It is needless to spend many words over the meteorological importance of such an enterprise. St. Helena emerges from the sea in the heart of the trade wind of the southern Atlantic. In no part of the globe, perhaps, is the trade wind current so persistent. The trade winds have long been recognised as primary factors of the atmospheric circulation. Speculation on their origin, which still forms the staple of the physical geography of the schools, carries us back to the writings of Halley and Hadley. The south-easterly current over St. Helena is the flow along the main artery of the never-failing atmospheric circulation, and at St. Helena if anywhere we may put our finger on the pulse of that endless and complex pro-

cess of transformation of solar energy of which the weather of our islands and elsewhere is an expression.

The council, itself not wealthy, had a Robinson anemograph, then lately returned from duty in Heligoland. This was lent to the colony, and with it was found a small annual sum by way of payment for its curator, Mr. Hands, of St. Matthew's Vicarage, who undertook as well the duties of observer for a normal station of the second order, with instruments furnished by the council.

The anemometer continued its run with some unavoidable interruptions, and the observations were taken until the middle of 1904. There are besides observations of rainfall at other stations in the island.

By 1904 that part of the spiral of the direction pencil which had to record south-easterly winds became so worn by constant use that a hollow was formed there and the record had become an unsatisfactory one. With the assistance of the engineer officers stationed at St. Helena the matter was inquired into, and, as a result, the instrument was ordered home for repairs. At the same time an attempt was made in the observatory branch of the Meteorological Office to put together the results of the long run and to collate them with the other observations. I will not anticipate the publication of the results which, I hope, will follow in due course, but to one interesting side of them, too speculative for an official report and too suggestive to be altogether ignored, I would like to direct attention, because it shows a possibility (perhaps more) that with more searching we may find a working connection between the *pulsations* of the trade wind in the southern hemisphere and the general type of weather in so distant a part of the globe as our own islands.

While the trade winds may be regarded as the most obvious representative of the dynamical effect of solar energy, rainfall must be allowed to be also very closely connected with the process of distribution of that energy. The convection of heat by evaporation from warm water surfaces and condensation in cooler regions represents a process tending towards equalisation of thermal distribution on a gigantic scale. The main directions of transference are from south to north on the one hand, and generally eastward from sea to land on the other. The white snow coverings of the polar regions and the persistent rivers of great continents are permanent records of nature's endeavour to distribute more nearly equally over the globe the supply of solar heat. From a general point of view rainfall or snowfall in the temperate and arctic zones may be regarded as an index, perhaps a spasmodic one, of the general circulation from the tropical regions towards the poles, and to that extent as the counterpart or correlative of the kinetic energy of the trade winds which represent the flow towards the equatorial region. The transformation of energy in rainfall is on a vastly greater scale than that displayed by the trade winds. Supposing that the trade wind at St. Helena is a mile high, the energy represented by the year's flow in a slice of the current a mile in width would be about equal to that represented by a year's rainfall on a single square mile in the neighbourhood of London. Of these two indices of the general process of distribution of solar energy, the one is the steadiest, the other the most fluctuating of all meteorological phenomena, and any indication of an underlying relation between them, which is, in a way, a necessity of the general process of circulation, would be of great meteorological interest and might be of immense economic importance.

So far as I have carried it, the study is perhaps