The data previous to 1841 are, I suppose, less reliable; but I may add these two cases of August rainfall under average:

Sun-spot max. 1830	...	Rainfall of August 1831, 2·14 in.
,, 1837	...	,, ,, 1838, 0·93 ,,

By way of showing that in other parts of the country there has been, in recent years at least, a similar variation, I add three similarly smoothed curves of August rainfall for Haverfordwest, Llandudno, and Boston (Lincoln) respectively (*c*, *d*, *e*). The data, however, do not extend back further than 1866.

The case of Greenwich may be presented as follows:—Take each maximum sun-spot year, and a year on either side, and tabulate the August rainfall in each of these. Indicate by the letters *d* (for dry) and *w* (for wet) whether this rainfall has been below or above the average. Then we have:—

Maximum.						
1847, 1848, 1849	...	1·95	4·25	0·45	...	*d w d*
1859, 1860, 1861	...	1·13	3·68	0·57	...	*d w d*
1869, 1870, 1871	...	1·21	2·02	0·86	...	*d d d*
1882, 1883, 1884	...	1·16	0·71	0·67	...	*d d d*

Here we find ten cases of a dry August out of twelve. Those twelve values give an average of 1·55 inches.

Now do the same with minimum sun-spot years:—

Minimum.						
1842, 1843, 1844	...	1·78	3·62	1·71	...	*d w d*
1855, 1856, 1857	...	1·40	2·42	2·50	...	*d w w*
1866, 1867, 1868	...	2·42	2·64	2·61	...	*w w w*
1877, 1878, 1879	...	2·90	5·38	5·19	...	*w w w*
1888, 1889, 1890	...	3·73	1·81	2·54	...	*w d w*

Here we find eleven cases of a wet August out of fifteen. Those fifteen cases give an average of 2·84 inches.

It would be interesting to know to what extent such relations subsist elsewhere, and perhaps some of your readers may be disposed to investigate the matter.

A. B. M.

Alteration in the Colours of Flowers by Cyanide Fumes.

IT is well known that the yellows of some insects are turned to red by the fumes from potassium cyanide; but I have not, after some inquiry, been able to obtain any literature describing the effects of such fumes upon the colours of flowers. The reactions I have observed are very curious, and while it seems improbable that they are hitherto wholly unknown, it may not be amiss to direct attention to them. A few lumps of the cyanide are placed in a corked tube, covered with a little cotton, and the flowers are placed on the cotton. It is probably necessary that the day should be hot, or the tube slightly warmed. The pink flowers of *Cleome integrifolia* and *Monarda fistulosa* turn to a brilliant green-blue, and finally become pale yellow. A purple-red *Verbena* becomes bright blue, then pale yellow. The purple flowers of *Solanum slœagnifolium* go green-blue and then yellow. The white petals of *Argemone platyceras* turn yellow—the natural colour of *A. mexicana.* The pale yellowish flowers of *Mentzelia nuda* turn a deeper yellow. Flowers of *Lupinus argenteus*, var., turn pale yellow. White elder (*Sambucus*) flowers turn yellow. The scarlet flowers of *Sphæralcea angustifolia* turn pale dull pink, resembling somewhat a natural variety of the same. Any of your readers will doubtless obtain similar results with the flowers growing in their vicinity.

T. D. A. COCKERELL.

Las Cruces, New Mexico, U.S.A., September 3.

ON THE CONSTITUENTS OF THE GAS IN CLEVEITE.

WE have investigated the spectrum of the gas discovered in the mineral cleveite by Ramsay, and have found it to be most regular. It consists of six series of lines, the intensity of the lines in each series decreasing with decreasing wave-lengths. Similar series of lines have been observed in many spectra. The first series was discovered by Dr. Huggins in the ultra-violet spectra of a number of stars. It proved to belong to hydrogen, and to be the continuation of the four strong hydrogen lines in the visible part of the spectrum. Johnstone Stoney had already shown that three of the wave-lengths of the visible hydrogen lines were most accurately proportional to the values 9/5, 4/3, 9/8, when Balmer discovered that these values were given by the formula

$$\frac{m^2}{m^2 - 4}$$

for $m = 3, 4, 6$, and that the other wave-lengths of the series were proportional to the values obtained by substituting for m the other entire numbers greater than three. The series has now been followed from $m = 3$ to $m = 20$, the lines growing weaker and weaker to the more refrangible side, and approaching each other closer and closer. The formula shows that they approach a definite limit for large values of m. This is seen more clearly when we consider wave-numbers instead of wave-lengths, which according to the formula would be proportional to

$$1 - \frac{4}{m} 2.$$

Many series of lines similar to the hydrogen series were discovered by Liveing and Dewar. They have called them harmonic series, and have compared them to the series of over-tones of a vibrating body. They have been further studied by Rydberg and by Kayser and Runge. We cannot here enter into any detailed account. We only want to explain so much as to make the conclusions understood which we have drawn from the spectrum of the gas in cleveite. The wave-lengths λ of the lines belonging to the same series are always approximately connected by a formula somewhat similar to Balmer's

$$1/\lambda = A - B/m^2 - C/m^4.$$

A determines the end of the series towards which the lines approach for high values of m, but does not influence the difference of wave-numbers of any two lines. B has nearly the same value for all the series observed, and C may be said to determine the spread of the series, corresponding intervals between the wave-numbers being larger for larger values of C. As B is approximately known, two wave-lengths of a series suffice to determine the constants A and C, and thus to calculate approximately the wave-lengths of the other lines. It was by this means that we succeeded in disentangling the spectrum of the gas in cleveite, and showing its regularity.

In the spectrum of many elements two series have been observed for which A has the same value, so that they both approach to the same limit. In all these cases the series for which C has the smaller value, that is to say which has the smaller spread, is the stronger of the two. In the spectrum of the gas in cleveite we have two instances of the same occurrence. One of the two pairs of series, the one to which the strong yellow double line belongs, consists throughout of double lines whose wave-numbers seem to have the same difference, while the lines of the other pair of series appear to be all single. Lithium is an instance of a pair of series of single lines approaching to the same limit. But there are also many instances of two series of double lines of equal difference of wave-numbers ending at the same place as sodium, potassium, aluminium, &c. There are also cases where the members of each series consist of triplets of the same difference of wave-numbers as in the spectrum of magnesium, calcium, strontium, zinc, cadmium, mercury. But there is no instance of an element whose spectrum contains two pairs of series ending at the same place. This suggested to us the idea that the two pairs of series belonged to different elements. One of the two pairs being by far the stronger, we assume that the stronger one of the two remaining series belongs to the same element as the stronger pair. We thus get two spectra consisting of three series each, two series ending at the same place, and the third leaping over the first two in large bounds and ending in the more refrangible part of the spectrum. This third series we suppose to be analogous to the so-called principal series in the spectra of the alkalis, which show the same features. It is not impossible, one may even say not unlikely, that there are principal series in the spectra of the other elements. But so far they have not been shown to exist.

Each of our two spectra now shows a close analogy to the spectra of the alkalis.

We therefore believe the gas in cleveite to consist of two, and not more than two, constituents. We propose to call only one of the constituents helium, the one to which the bright yellow double line belongs, whose spectrum altogether is the stronger one, while the other constituent ought to receive a new name.

We have confirmed this rather hypothetical conclusion by the following experiment. The connection leading from our supply of cleveite gas to the vacuum tube contained a side branch parting from it and joining it again. There were stopcocks on either side of the side branch, and a third one in the side branch. In the main tube between the ends of the side branch a plug of asbestos was tightly inserted. To prepare the vacuum tube only the tap leading to the supply was closed, the whole space up to this tap being carefully evacuated. Now the side branch was closed, and the tap leading to the supply was opened. Then we observed that the light of the electric discharge in the vacuum tube was at first greenish, and after a while grew yellow. By cutting off the current of gas after a sufficiently short time, we succeeded in making a vacuum tube which remained greenish. On examining it in a small spectroscope with which we could overlook the whole spectrum, we found that the intensities of the lines had changed. The yellow line was scarcely as bright as the green line 5016, and the red line 7065 had apparently decreased relatively to 7282 and 6678, although it was still stronger than 7282. The two lines that had decreased in intensity belong to the second set of series, while the others are members of the first set. The other visual lines of the second set could not very well be examined because they are more in the violet part.

This observation confirms our spectroscopic result. The gas in cleveite may be taken to be a mixture of two gases of different density, of which the lighter one is more rapidly transmitted through the plug of asbestos. There is, however, the objection to be raised, that in the green tube the pressure is less, and that the difference of intensities is due to the pressure being different. This must be further inquired into.

We were not satisfied with the visual observation of the change of intensities in our green tube, but thought it desirable to test the conclusion by the bolometric measurement of the two lines that we have discovered in the ultra-red part of the spectrum. If we were right, the ultra-red line of smaller wave-length, which belongs to the second set of series, ought to have decreased in intensity relatively to the other ultra-red line. This we found to be so indeed. In the yellow tubes the intensity of the smaller wave-length was to that of the other on an average as 3 to 1, while in the green tubes it was as 1·8 to 1. This confirmation we consider the more valuable as it does not depend on any estimation which may be biassed by the personal opinion of the observer, but is based on an objective numerical determination.

Another confirmation may be gathered from the spectrum of the sun's limb and that of several stars. Let us confine our attention to the six strongest lines in the visible part of the spectrum:

7066, 6678, 5876, 5016, 4922, 4472.

The first, third, and sixth belong to the second set of series; the second, fourth and fifth to the first set. These six lines have all been observed in the spectrum of the sun's limb, as Norman Lockyer and Deslandres have pointed out. Now, according to their appearance in the spectrum of the sun's limb, they may be classed in two groups, one group being always present, the other group being sometimes present. C. A. Young long ago called attention to the difference in the frequency of appearance of the chromospheric lines. He has given them frequency numbers, roughly estimating the percentage of frequency with which the lines were seen during the six weeks of observation at Sherman in the summer of 1872. According to Young, 7066, 5876, 4472 have the frequency number 100, while 6678, 5016, 4922 have the numbers 25, 30, 30, showing that one of the two constituents was always present, while the other was only seen about once in every four cases.

The lines of both constituents have been observed in the spectra of a considerable number of stars β, δ, ϵ, ζ, γ Orionis, α Virginis, β Persei, β Tauri, η Ursæ majoris, β Lyræ. In the spectrum of β Lyræ, thirteen lines have been identified with certainty. But the most interesting case in point is the spectrum of Nova Aurigæ, that wonderful star whose sudden appearance was announced to astronomers in 1892 by an anonymous postcard. In the spectrum of Nova Aurigæ the two lines 5016 and 4922 were very strong, while 4472 was weak and 5876 has only been seen by Dr. Huggins, we believe only on one occasion, and appears to have been very weak. Now 5016 and 4922 belong to the lighter constituent, and are together with 6678 the strongest lines in the visible part of the spectrum; while 5876 and 4472 are the strongest lines of the other constituent in the visible part of the spectrum. In Nova Aurigæ, therefore, the lighter constituent gave a much brighter spectrum than helium proper. But there may here be raised an objection, which indeed we do not know how to refute. Why has the line 6678 not been observed? It is a pity that the red part of the spectrum cannot be more easily photographed. Nova Aurigæ has now become very weak, and besides the spectrum is quite altered, so that we shall never know whether the red line 6678 was really absent or has only escaped notice.

From the fact that the second set of series is on the whole situated more to the refrangible part of the spectrum, one may, independently of the diffusion experiment, conclude that the element corresponding to the second set is the heavier of the two. In the spectra of chemically related elements like Li, Na, K, Rb, Cs, or Mg, Ca, Sr, or Zn, Cd, Hg, the series shift to the less refrangible side with increasing atomic weight. But it appears that in the spectra of elements following each other in the order of their atomic weights in a row of the periodic system like

Na, Mg, Al;
K, Ca;
Cu, Zn;
Rb, Sr;
Ag, Cd, In;

the series shift the opposite way, so that the spectrum of the element of greater atomic weight is as a whole situated further to the more refrangible side. Now in our case the density of the gas has been determined by Langlet (published by Cleve) and by Ramsay to be about double the density of hydrogen. Assuming the atomic weights of the two constituents to be between that of lithium and that of hydrogen, they would both belong to the same row of the periodic system, and therefore the more refrangible set of series would correspond to the greater atomic weight.

For convenience of reference all the observed lines are given in the following table, the wave-lengths being abridged to tenth-metres.

Lighter Constituent.

Principal series.	First subordinate series.	Second subordinate series.
20400	6678	7282
5016	4922	5048
3965	4388	4438
3614	4144	4169
3448	4009	4024
3355	3927	3936
3297	3872	3878
3258	3834	3838
3231	3806	3808
3213	3785	

Heavier Constituent (Helium proper).

	Double lines.	Double lines.
11220	5876	7066
3889	4472	4713
3188	4026	4121
2945	3820	3868
2829	3705	3733
2764	3634	3652
2723	3587	3599
2696	3555	3563
2677	3531	3537
	3513	3517
	3499	3503
	3488	3491
	3479	3482
	3472	
	3466	
	3461	

C. RUNGE AND F. PASCHEN.

NOTES.

THE third International Congress of Zoologists (an account of the proceedings at which will appear in a subsequent issue of NATURE) has just been held at Leyden, and appears to have been a great success. No fewer than twenty nationalities were represented, and the arrangements for the comfort of the members were all that could be wished. It was decided to hold the next meeting (in 1898) in England, and Sir William H. Flower was elected President. During the meeting it was announced that the Senate of the University of Utrecht had conferred degrees upon Sir William H. Flower, M. Milne-Edwards, of Paris, and Prof. Weismann, of Freiburg.

TELEGRAMS from St. John's, dated September 22, announced the return, in the steamer *Kite*, of the Peary Expedition. The result of the expedition was a most disappointing one, as Lieut. Peary and his companions were unable to extend their journeyings beyond Independence Bay, which point was the furthest north reached by Lieut. Peary in his expedition of 1892. The main cause of failure was the loss of all the stores of provisions, save one, which had been got together and deposited along the intended line of march last year, all having been buried by perhaps the heaviest snowfall known, which obliterated all traces of them. The sufferings endured by the explorers, on the verge of starvation as they were for the greater part of the time, can hardly be estimated, and when, on July 31, the *Kite* arrived, they were utterly broken down and ill, but they subsequently recovered under careful treatment. The expedition, according to a later telegram, will not be entirely barren of scientific results, as Lieut. Peary is reported to have mapped Whale Sound, and completed his studies of the Eskimo Highlanders. He has also brought back another year's meteorological record. The relief expedition, too, is credited with obtaining the largest collection of Arctic fauna and flora ever acquired, and Prof. Salisbury, of Chicago University, did good geological work.

A COMMUNICATION was made to the press on Friday last by Reuter's Agency with reference to the movements of the Jackson-Harmsworth Polar Expedition. It was admitted that the intelligence received had been made in a somewhat meagre and disjointed form; but from it could be gleaned that on September 7 of last year the expedition arrived safely on the coast of Franz Josef Land and in the locality of Cape Flora. On September 10 the ice closed round the *Windward*, and she was frozen in for the winter. On February 23 the sun returned, and on March 10 Mr. Jackson started on his northern journey, with a quantity of stores, and made his first depôt. Various journeys to and fro with provisions, &c., were made, and depôts formed, the most northern of which was about 100 miles from the camp. The *Windward* has, it is expected, now set sail for home, bearing letters and journals of the early part of the expedition.

THE expedition to Alaska of the United States Geological Survey, for the purpose of examining into the coal and gold mines of the territory, has returned safely to San Francisco after a successful and very interesting season, during which, incidentally, many of the glaciers and volcanos were studied. Messrs. Becker and Dall will return to Washington by October 1, to submit their report upon the mineral resources to the Director of the Survey, which will be printed as soon as the necessary analyses, &c., can be made.

WE have to record the death, at Berlin, at the age of seventy-six, of Prof. Bardeleben, the eminent surgeon and author of "Lehrbuch der Chirurgie und Operationslehre."

THE death is announced, from Bendigo, Victoria, of Dr. Paul Howard MacGillivray, well known as a medical man and for his researches on Polyzoa.

AT the meeting of the Entomological Society of London, to be held on Wednesday, October 2, the following papers will be read:—"Contributions towards the History of Maruina, a New Genus of Diptera" (*Psychodidæ*), by Dr. Fritz Müller; "Remarks on the Homologies and Differences between the First Stages of Pericoma and those of Maruina," by Baron Osten Sacken.

THE annual meeting of the Federated Institution of Mining Engineers has just taken place at Hanley, and papers were read on "The Use of Steel Girders in Mines," "Economic Minerals of the Province of Ontario," and "Gold Mining in Nova Scotia." The Institution seems to be in a flourishing condition, the membership having risen from 1189 in 1889–90, to 2199 at the present time. The prizes for papers on "The Prevention of Accidents in Mines" have been awarded as follows: (1) Mr. A. Kirkup (2) Mr. W. N. Drew; Messrs. E. A. Allport and A. Noble were bracketed for the third place.

THE Royal Society of New South Wales offers its medal and the sum of £25 for the best communications (provided such be deemed of sufficient merit) on original research in the following subjects:—"The Origin of Multiple Hydatids in Man"; "The Occurrence of Precious Stones in New South Wales, with a description of the Deposits in which they are found"; "The Effect of the Australian Climate on the Physical Development of the Australian-born Population"; "The Physiological Action of the Poison of any Australian Snake, Spider, or Tick"; "The Chemistry of the Australian Gums and Resins"; "The Embryology and Development of the Echidna or Platypus"; "The Chemical Composition of the Products from the so-called Kerosene Shale of New South Wales"; "The Mode of Occurrence, Chemical Composition and Origin of Artesian Water in New South Wales." The competition is open to all, and is not subject to any restriction, save that the communication to be successful must be either wholly or in part the result of the competitor's own original observation or research. The suc-