CHEMICAL NOTES

ON ERRORS IN THE DETERMINATION OF THE DENSITIES OF MIXED VAPOURS.—In the *Compt. Rend.*, lxxxiii., Messrs. Troost and Hautefeuille record some experiments made by them to discover the error which occurs in determining the vapour-density of substances by the application of the law of Dalton on the tension of mixed gases, and Boyle and Gay-Lussac's laws, as applied to a mixture of the vapour examined, either with air or with some other vapour. They examined a mixture of carbon and silicium chlorides, using a modified form of Gay-Lussac's vapour-density apparatus. On increasing the amount of carbon chloride, the tension of the silicium chloride diminished. The vapour-density of silicium chloride alone varied only from 5·94 to 6·0, but in presence of carbon chloride was found to increase 6·27 to 8·2.

ON THE PROPERTIES OF RUTHENIUM.—In the same journal an account is given by Messrs. St. Claire-Deville and H. Debray, on the physical and chemical properties of the above metal. They find that the metal forms an oxide RuO_2, thus differing from osmium. By fusing the pure metal with potash and saltpetre, then saturating the ruthenate thus formed with chlorine, and distilling in a current of the gas at about 80° C., they obtain the tetra-oxide RuO_4 in yellow crystals, which, when reduced, yields the pure metal. The metal they obtained by purification from its alloy with zinc, was found to have a density of 12·261 at 0°. They also obtained a compound, $Ru_2K_2O_8$, in black crystals, on saturating the ruthenate of potash with chlorine. For the analysis of ruthenium ores, the process they employ is based on the foregoing remarks. After the fusion of the ore with saltpetre and potash, the whole mass is distilled with chlorine, the excess of gas, together with the RuO_4, being absorbed by solution of potash. The potash solution is then treated with alcohol which precipitates the ruthenium as oxide, and this is finally reduced to the metallic state with hydrogen.

ACONITIC ACID IN CANE JUICE AND RAW SUGAR.—In a late number of the *American Chemist* an account is given by Dr. Arno Behr of some experiments he has conducted on the above subject. For examining the properties of this acid he has found the so-called melado a proper material, this substance being merely cane juice boiled down to a concentration such as allows the sugar to crystallise out, the mother liquor being then drawn off and used for the production of the acid. The author has analysed an acid substance formed by decomposing its ammonia compound with sulphuric acid and extracting with ether, and assigns to it the composition $C_6H_6O_6$. He has also prepared silver, calcium, and ammonium salts of the acid body, the per centage composition of these salts agreeing closely with the theoretical composition of the silver, calcium, and ammonium aconitates. Although from the results of his analyses he has no doubt of the substance in question being aconitic acid, yet the melting point, 172-173° C., which he found was not in accordance with that generally given, viz., 140° C.° ; the author therefore prepared some pure acid which had a melting point of 168-169° C. The acid formed from aconitine fused at 165° C. It is difficult, however, to determine the melting point as the acid is decomposed in the process of melting. The author has found the melado to contain 0·149 per cent. of aconitic acid. The sweet waters from charcoal filters used in refining raw sugar contain it in an appreciable quantity, and some molasses sugars give a peculiarly opaque solution from which a sandy sediment is deposited, appearing under the microscope to consist of small rhombohedral crystals, and which, on analysis, proved to be calcium aconite. The author thinks aconitic acid to be a normal constituent of sugar, and that it is worthy of remark that the two plants yielding the most sugar—the beet-root and sugar-cane—also produce two acids standing so chemically near each other as citric and aconitic acids, and which contain in their molecules the same number of carbon atoms as fruit sugar.

MINERALS CONTAINING COLUMBIUM FROM NEW LOCALITIES IN THE UNITED STATES.—Mr. J. L. Smith, of Louisville, has examined several species of minerals containing columbium, and claims the restoration of this name for the metal instead of that of niobium, generally given to it in England and on the Continent. His reason for making this reclamation is that the name niobic acid was incorrectly given by H. Rose to one of the acids found by him in his researches on the columbite of Bodemais, and subsequently proved by him to be identical with the columbic acid originally discovered by Hatchett in 1801. The name niobic acid, however, given by Rose, has never been altered, and Mr. Smith thinks the original columbic acid should have been retained. In remarks on the chemical constitution of the minerals described by him, Mr. Smith thinks that the composition of the columbates, although appearing at first sight complex and irregular, becomes much simpler when due allowance is made for the intermixture of the different varieties with each other. Columbite, the best known of the minerals, can be well recognised as a simple columbate of iron and manganese ; microlite appears to be a columbate of lime ; pyrochlore, a columbate of the cerium oxides and lime, but whether or not a neutral columbate remains to be investigated. Hatchetolite he considers as a neutral columbate of uranium and lime, and samarskite a basic columbate of iron, uranium, and yttrium oxides. Yttrotantalite and euxenite are basic columbates of yttrium and uranium, the first being anhydrous when pure, the second containing water. Fergusonite is a hydrated basic columbate of yttria, and Rogersite, a columbate still more basic. In arranging a general view of these minerals Mr. Smith does not take into account the constituents which exist in small quantities only.

COEFFICIENT OF CAPILLARITY FOR CERTAIN LIQUIDS.—M. Gueront, in the *Comptes Rendus* (lxxxiii. 1291) describes experiments in which he finds that in any series of organic compounds the coefficient of capillarity decreases as the amount of carbon in the substance increases. He has examined three series of bodies, the fatty acids, the acid ethers of ethylic alcohol, and the ethers formed by the union of acetic acid with the different fatty alcohols. In the series of fatty acids those members above propionic acid agree with the above statement, but the two lowest members, acetic and propionic acids, are exceptions ; this he thinks probably due to impurities ; the two series of ethers, however, agree perfectly with the law. From his observations it becomes evident that the coefficient of capillarity of the ethers is higher than that of the alcohols or the acids from which they are formed, showing that the introduction of an organic radical into the alcohol molecule renders the body more fluid. On comparing the two series of ethers it was found that the isomeric ethers have nearly the same coefficient, but the acids isomeric with them are much lower. Thus valeric acid, which is isomeric with ethyl propionate and propyl acetate, has a coefficient only about one quarter that of these latter. The reason suggested for this difference is that in the two isomeric ethers atoms are grouped in a similar way, while in the isomeric acids the grouping is different.

METEOROLOGICAL NOTES

SUN-SPOT PERIODS AND AURORAS FROM 1773 to 1827.—We have received a communication from Mr. Buchan inclosing the following table, showing the number of auroras observed by Mr. James Hoy at, or in the vicinity of, Edinburgh, each year from 1773 to 1781, and at Gordon Castle, Banffshire, from 1781 to 1827 :—

Year.	Sun-spots.	Auroras.	Year.	Sun-spots.	Auroras.
1773	40	5	1801	39	2
1774	48	5	1802	58	2
1775	28	1	1803	65	6
1776	35	3	1804	75	5
1777	63	0	1805	50	2
1778	95	6	1806	25	2
1779	90	11	1807	15	1
1780	73	6	1808	7	1
1781	68	2	1809	3	1
1782	33	3	1810	0	0
1783	22	2	1811	1	0
1784	5	0	1812	5	0
1785	21	0	1813	14	0
1786	89	10	1814	20	1
1787	105	12	1815	35	1
1788	108	9	1816	45	1
1789	111	22	1817	44	3
1790	84	4	1818	34	1
1791	53	6	1819	22	5
1792	47	1	1820	9	3
1793	40	2	1821	4	1
1794	34	1	1822	3	0
1795	22	1	1123	1	1
1796	15	3	1824	7	2
1797	8	1	1825	17	0
1798	4	0	1826	29	0
1799	10	1	1827	40	1
1800	18	0			

This table is of peculiar value with regard to the many questions at present under discussion in connection with sun-spots.

SUN-SPOTS AND THE PREDICTION OF THE WEATHER OF THE COMING SEASON AT MAURITIUS.—In the *Monthly Notices*, new series, No. 1, of the Meteorological Society of Mauritius (December 21, 1876), Mr. Meldrum gives a clear and interesting summary of his researches into the relations of sun-spots to several atmospheric phenomena. A valuable table appears on p. 14 setting forth the number of cyclones which have occurred in the Indian Ocean between the equator and 34° lat. S. each year from 1856 to 1875, the total distances traversed by these cyclones, the sums of their radii and areas, their duration in days, the sums of their total areas, and their relative areas. The well-known thoroughness with which the Meteorological Society of Mauritius has worked at the storms of the Indian Ocean ensures that the subject has been exhaustively treated. The period embraces two complete, or all but complete, sun-spot periods, the former beginning with 1856 and ending 1867, and the latter extending from 1867 to about the present time. The broad result is that the number of cyclones, the length and duration of their courses, and the extent of the earth's surface covered by them all reach the maximum in each sun-spot period during the years of maximum maculation, and fall to the minimum during the years of minimum maculation. The peculiar value of these results lies in the fact that the portion of the earth's surface over which this investigation extends is, from its geographical position and what may be termed its meteorological homogeneity, singularly well fitted to bring out prominently any connection that may exist between the condition of the sun's surface and atmospheric phenomena. A drought commenced in Mauritius early in November, 1876, and when the paper was read on December 21, Mr. Meldrum ventured to express publicly his opinion that probably the drought would not break up till towards the end of January, and that it might last till the middle of February, adding that up to these dates the rainfall of the island would probably not exceed 50 per cent. of the mean fall. This opinion was an inference grounded on past observations, which show that former droughts have lasted from about three to three and a half months, and that these droughts have occurred in the years of minimum sun-spots, or at all events in years when the spots were far below the average, such as 1842, 1843, 1855, 1856, 1864, 1866, and 1867, and that now we are near the minimum epoch of sun-spots. It was further stated that the probability of rains being brought earlier by a cyclone was but slight, seeing that the season for cyclones is not till February or March, and that no cyclone whatever visited Mauritius during 1853–56 and 1864–67, the years of minimum sun-spots. From the immense practical importance of this application of the connection between sun-spots and weather to the prediction of the character of the weather of the coming season, we shall look forward with the liveliest interest to a detailed statement of the weather which actually occurred in that part of the Indian Ocean from November to March last.

METEOROLOGY IN SOUTH AUSTRALIA.—The publication of the meteorological observations made in this colony, which required to be discontinued in 1870 owing to the heavy pressure of official duties devolving on Mr. Charles Todd in connection with the construction and organisation of the Overland Telegraph, was resumed in an extended form in January, 1876, and we have now before us the first nine monthly issues, which bring the publication down to the end of September last. The reports detail, with some care, the conditions under which the observations are taken, the three or six daily observations made, and full *résumés* of the monthly results. An extremely valuable part of the reports is the monthly table of the rainfall at upwards of eighty stations, as observed by the officers of the postal and telegraph departments, and a number of volunteer observers who have co-operated with Mr. Todd in observing the rainfall for many years. The stations are arranged in geographical order from north to south, commencing with Port Darwin on the north coast, and along with the monthly amounts there are also given the averages of the month at all those places at which at least seven years' observations have been made. Among the many points of interest offered by these tables are the torrential rains of the north coast in the first three months of the year, frequently rising to from ten to sixteen inches in the month, their rapid diminution on advancing inland to Barrow's Creek or Alice Springs, and the great diminution in April, and the rainless, or all but rainless character of the northern region from June to September, when the prevailing winds of Australia become decidedly continental, or blow from the interior seawards. Since it would be impossible to over-estimate the importance of barometrical and thermometrical observations from this extended network of stations in South Australia, we very earnestly hope that the Colony will soon take steps to obtain these observations and publish them in the interest of meteorology.

RAINFALL OBSERVATIONS IN THE EAST OF FRANCE FROM 1763 TO 1870.—In the *Bulletin Hebdomadaire* of the Scientific Association of France, of the 10th instant, Prof. Raulin gives an interesting historical account of all the rainfall observations made during these 108 years anywhere in that section of France which is marked off by lines joining Givet on the Meuse, Lauterbourg on the Rhine, Belley near the Rhon, and Decize on the Loire, and which thus comprehends seven well-marked regions, viz., the plain of Alsace, the chain of the Vosges, the plateaux of Lorraine and Bourgogne, the plains of Champagne and Bresse, and finally the chain of the Jura mountains. During the past three years Prof. Raulin has been engaged collecting all available materials for a monograph on the rainfall of this part of Europe, which, judging from his great monographs of the rainfall of other sections of France and of the rainfall of Algeria, will doubtless take its place as a permanent contribution of very high value to meteorological science.

IOWA WEATHER REPORT.—We observe from a circular issued by Prof. Gustavus Henrichs to the volunteer observers of Iowa (U.S.), that his report of the observations made at the meteorological stations of that State during 1876 is to be published as an Appendix to the *Report of the Iowa State Agricultural Society*, and that as the monthly reports are published in fully twenty of the newspapers, the *Weather Review* will be discontinued. The *Weather Report* about to be published will embrace an account of the meteorological system now in full operation over the State, and discussions of the rainfall, storms, and other phenomena, the normals which have been ascertained for different localities, and the detailed observations made at the Central Weather Station.

OUR ASTRONOMICAL COLUMN

THE SATURNIAN SATELLITE, HYPERION.—Prof. Asaph Hall, in *Astron. Nach.*, No. 2,137, publishes an ephemeris of this faint object about the approaching opposition of Saturn, with the view to facilitate observations, especially near the conjunctions. He remarks that although the satellite was discovered (by Bond and Lassell) nearly thirty years since, the difficulty of observing it has been so great that no satisfactory determination of its orbit has been practicable; most of the observations being made near the elongations, the position of the plane of the orbit is not accurately deducible therefrom, though it probably does not coincide with the plane of the ring, but appears to lie between those of Titan and Japetus. With the view to assist observation in the present year Prof. A. Hall has calculated elements from his observations in 1875, which may be stated as follows:—Perisaturnium passage, 1875, August 24·0036 mean time at Washington; distance of perisaturnium from the node 40° 0′, eccentricity 0·125, semi-axis major 214″·22, period of revolution 21·3113 mean solar days. For the reason stated above it is supposed for this approximate orbit that its plane coincides with that of the ring, the node of which on the earth's equator is assumed to be in 126° 9′·1, and its inclination thereto 7° 3′·8. From these data auxiliary quantities and an ephemeris for Washington midnight, August 1–September 15, are added, and it is suggested that with the aid of the former comprising the interval June 1–December 28 a more accurate calculation may be made by Mr. Marth's formulæ.

Taking the solar parallax at 8″·86 Prof. A. Hall's elements would give for the mean distance of Hyperion from the centre of Saturn 914,000 miles, distance in perisaturnium 800,000, in aposaturnium 1,028,000 miles.

The first computation of the orbit of this satellite was by the late Prof. G. P. Bond, of Cambridge, U.S., from his distances observed between 1848, September 19, and January 12 following; his period of revolution is 21·18 days, mean distance 214″, eccentricity 0·115; the elements will be found in the *Proceedings* of the American Academy of Arts and Sciences.

THE TRIPLE-STAR 7 CAMELOPARDI.—The third component of this triple star was detected by Baron Dembowski on September 28, 1864, having been overlooked by Struve at Dorpat, who measured A and B in 1831, his mean result being 1831·57, pos. 238·32°, dist. 25·647″. The Galarate epoch for the new companion is (A C) 1865·33 pos. 308°·83, dist. 1″·245. Baron Dembowski says the object was one of great difficulty for his refractor principally on account of the sombre hue of the star C, which did not appear always of the same intensity; referring to his observations at the epoch 1865·25, he remarks, "Elle avait alors une couleur de cendre mouillée; je n'ai jamais vue d'étoile aussi sombre.' His magnitudes of C in 1864-5 vary from 7·0 to 9·0, while in the middle of November, 1865, he could not perceive the least trace of the star. Mr. Crossley measured A B at the end of December, 1873, but has no reference to the third star. The object will be worth watching on the score of variability and the unusual duskiness noted by the Galarate observer.

THE CAPE ASTRONOMICAL RESULTS FOR 1874.—Mr. Stone has just circulated his volume of observations made at the Royal Observatory, Cape of Good Hope, in 1874, being the thirteenth separate publication which has emanated from this important and active astronomical establishment since the year 1871, when Mr. Stone undertook its direction. We believe there is not a refinement in observing or computing which is not introduced into the Cape work, and the results have consequently a very high value, comparable with the best work of the kind published by the great European and American observatories, where attention is given to stellar astronomy. The volume for 1874 contains the mean positions of 1,246 stars, including all Lacaille's stars of the *Cœlum Australe Stelliferum*, which now fall between 155° and 165° of north polar distance, and some additional ones in the same zone. Lacaille's stars between N.P.D. 145° and 155° were similarly observed in the course of the year 1875, and those between N.P.D. 135° and 145° in 1876, the reductions to mean places for the former zone having been completed at the beginning of the present year. A complete determination of the accurate places of all Lacaille's stars, founded on the Cape observations, is therefore in a very forward state.

As an appendix to this volume of Cape Observations, Mr. Stone presents tables intended to facilitate the computation of star-constants, which appear likely to prove of very great service to the practical astronomer. By a slight modification of Bessel's form for star-corrections he has been able to tabulate the quantities in a very convenient and compendious manner, so that the whole computation occupies but a short time. Mr. Stone hopes that the use of these tables may render it unnecessary to give star-constants for every star contained in future catalogues, the labour of forming which, and of insuring their accuracy is very great. It is probable, as he observes, that the use of star-constants in various catalogues has been in many cases extended beyond the time when they could be introduced with a due regard to the precision required in modern stellar astronomy, which will be obviated by the use of the tables in question. It is understood that Mr. Stone liberally offers to supply a copy of these tables to anyone who would find them of real service, and who will make application for them. A few remarks on the *modus operandi* with the tables are reserved for a future column.

THE BRITISH ASSOCIATION AT PLYMOUTH

FEW towns in the United Kingdom have so much to interest alike the scientific and the general visitor as Plymouth; and the meeting there of the members of the British Association in August next should prove alike pleasant and profitable. For the general visitor it will perhaps be enough that the Plymouth Hoe is one of the finest promenades in England, and that the landscapes of the neighbourhood are at once most varied and most attractive. The man of science will be able to enjoy all this and a good deal more. The zoologist may if he pleases revel in dredging expeditions in and off the Sound, which are sure to yield an ample reward. For the mechanician there are three of the most no able works of modern engineering skill to inspect—the Eddystone Lighthouse, the Plymouth Breakwater, and the Royal Albert Bridge, while the Government dockyards and factories at Devonport and Keyham, and the war vessels which stud the Hamoaze, will have a general as well as a special interest. One of the most enjoyable excursions of the Exeter meeting was that to the Three Towns, on which occasion the Government establishments were visited and gunnery and torpedo practice, with all the latest electrical