

there were excavated the other day some vases of Egyptian manufacture, which will greatly interest archæologists. They are made of a particular kind of paste, composed of white clay and glass, and are extremely brittle. All round they have high relief representations of the animals worshipped by the ancient Egyptians.

A PHONOGRAPH of a new construction will be tried in the New Polyglot Institute of Paris, for the purpose of teaching pupils the art of pronouncing correctly the difficult words of foreign languages.

A SCHOOL for clockmakers has been organised in Paris, and was inaugurated yesterday by a meeting at the Conservatoire des Arts et Métiers.

THE new part of the *Transactions* of the Asiatic Society of Japan contains a paper by Dr. Edkins on the influence of Chinese dialects on the Japanese pronunciation of the Chinese part of the Japanese language.

WE have received part 3 of the *Transactions* of the Epping Forest Club, containing the address of the president, Mr. Meldola, proceedings, and list of members.

WE have to acknowledge the receipt of a postal order for 2s. 6d. from "Bullphumpus" for the John Duncan Fund.

THE additions to the Zoological Society's Gardens during the past week include an Indian Leopard (*Felis pardus*) from India, presented by the Duke of Buckingham and Chandos; an Entellus Monkey (*Semnopithecus entellus*) from India, a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, a Blue-fronted Amazon (*Chrysotis festiva*) from Brazil, deposited; four Indian Rat Snakes (*Ptyas mucosa*) from India, a Matamata Terrapin (*Chelys matamata*) from Upper Amazons, purchased; two Calandra Larks (*Melanocorypha calandra*), European, a Chinese Quail (*Coturnix chinensis*) from China, two Fire-tailed Finches (*Erythrura prasina*) from Java, received from Paris.

OUR ASTRONOMICAL COLUMN

THE SOLAR PARALLAX.—M. Faye has just communicated to the Academy of Sciences a paper on the actual state of our knowledge of the sun's parallax, of which we subjoin some particulars, without professing to regard his mean result as necessarily so definitive as he appears to view it himself.

M. Faye considers that there is no other scientific constant, the determination of which depends on an equal number of results completely independent of one another, and obtained by methods so totally different, and subdivides the various values assigned for the sun's mean parallax as follows:—

Geometrical methods,	8"85	by Mars (Cassini's method) ...	Newcomb.	
		8"79	by Venus, 1769 (Halley's method) ...	Powalky.
		8"81	by Venus, 1874 " "	Tupman.
		8"82	8"87 by Flora (Galle's method) ...	Galle.
	8"79	by Juno " "	Lindsay.	
Mechanical methods,	8"83	8"81 by the lunar inequality (Laplace's method) ...	—	
		8"85 by the monthly equation of the earth ...	Leverrier.	
		8"83 by the perturbations of Venus and Mars ...	Leverrier.	
Physical methods,	8"81	8"799 Velocity of light (Fizeau's method) ...	Cornu.	
		8"813 Velocity of light (Foucault's method) ...	Michelson.	

With regard to the first value by "mechanical methods," M. Faye mentions that he has obtained it by adopting for the coefficient of the inequality 125"2, the mean between the results of Sir George Airy from the Greenwich observations, and that of Prof. Newcomb, from the observations made at Washington, taking for the moon's mean parallax, 57' 2"7, and for her mass $\frac{1}{80.8}$. Leverrier found the value 8"95 from the said equation, which was reduced after correction by Mr. Stone for

two small errors to 8"85. The value from the perturbations of Venus and Mars assigned by Leverrier was 8"86, but one of the numbers requiring a small correction, it is reduced to 8"83. Michelson, after bringing to bear upon Foucault's method improvements which M. Faye says completely surmounted all difficulties, found for the velocity of light 299940 km., while Helmholtz altered Cornu's result to 299990 km. With Struve's constant of aberration the corresponding values for the solar parallax are 8"799 and 8"813, as above.

The general mean in which it may be considered that the errors of the individual results, obtained by so many methods, are to a great extent compensated is 8"82, and to this value M. Faye, for reasons given, attributes a probable error of $\pm 0"016$. The mean value by the physical methods is 8"806, and by astronomical methods 8"825. He then considers which of these values is the more reliable, and states that he does not hesitate in giving the preference to the physical result, and arrives at the conclusions:—

1. That the method of the physicists is superior to all others, and ought to be substituted.
2. That the value of solar parallax, 8"813 (by physical methods), is now determined to about $\frac{1}{100}$ of a second.
3. That the seven astronomical methods of procedure converge more and more towards that value, and tend to confirm it without equaling it in precision.

M. Faye adds that he has no idea of attempting to diminish the importance of the observation of the approaching transit of Venus: but as Leverrier pointed out, "il faut que les efforts des astronomes aient pour but d'obtenir une précision toute nouvelle dans leur prochaines expéditions." Without neglecting the contacts, he considers it will be desirable to employ to a greater extent than was done in 1874 "les procédés si puissants de la photographie," to which, be it observed, M. Faye from his own experiences drew attention a quarter of a century back. He thinks it will be very surprising if that admirable method of procedure, which has already succeeded so well in measuring delicate stellar groups, should fail for the transit of Venus, or under circumstances more favourable for its application. The value 8"813 for the sun's parallax, which appears to him definitive, is in accordance with that adopted by Laplace in the *Mécanique céleste*, 27.2 centesimal seconds or 8"812.

SWIFT'S COMET, 1880 e.—Mr. Winslow Upton of the Naval Observatory at Washington, sends us elements of this comet, which, as he remarks, afford a further confirmation of the 5½-years' period already assumed. He employed two observations made with the meridian circle of the Washington Observatory on October 25 and November 23, and one with the 26-inch equatorial on December 22. The elements are as follow:—

Epoch 1880, October 25.5 M.T. at Washington.

Mean anomaly ...	357 48 49.3	} M. Eq. 1880.0
Perihelion from node ...	106 18 13.8	
Ascending node ...	296 41 55.4	
Inclination ...	5 31 3.5	
Angle of eccentricity ...	42 31 39.7	
Log. semi-axis major ...	0.518438	

The corresponding period is 2189 days, or a little less than six years. The middle place is represented within the small errors of - 1"2 in longitude and - 0"6 in latitude.

PHYSICAL NOTES

MR. T. C. MENDENHALL of Japan has measured with a so-called "invariable pendulum" the acceleration of gravity at the top of the extinct volcano Fujiyama, which plays so prominent a part in the mythology and in the art of Japan. The value found for the summit of the mountain was $g = 9.7886$, whereas at Tokio the value was found to be 9.7984. The average barometric pressure at the summit was 19.5 inches, the mountain itself being an almost perfectly symmetrical cone of vertical angle 138°, and of a height of 2.35 miles. It rises alone out of a plain of considerable extent, and appears to be composed of a uniform rock of porous nature. Tradition states that the mountain was thrown up in a single night in the year B.C. 286. The density of the rock in the lump was 1.75, but when reduced to powder the density was 2.5; competent geologists conclude the mean density of the mountain mass to be 2.12. Assuming the mountain to be a cone of semi-vertical angle of 69°, and density 2.12, Mr. Mendenhall calculated its attraction upon a particle

placed at the vertex, and comparing it with his result, deduced for the mean density of the earth the value $D = 5.77$. If however the accepted density of the earth as determined by Bailly at 5.67 be adopted, it follows that the mean density of Fujiyama is only 2.08.

A CAPITAL summary of the recent thermochemical investigations of Julius Thomsen appears in the current number of the *Am. Journ. Sci.* from the pen of Prof. Josiah P. Cooke (of Cambridge, Mass.). The peculiar significance of these researches in their bearing upon the problems of molecular structure in general and upon the supposed ring-structure of the benzene molecule in particular, is pointed out in a clear and emphatic manner.

M. ROSENSTIEHL has freshly determined the tints corresponding to the three primary colour-sensations, on the principle of rotating disks originally devised by Clerk-Maxwell. Constructing a disk with seventy-two sectors of gradating tints of as nearly equal saturation as could be judged of by the eye, he found that a sensation of red more powerful than any single red tint could be compounded from blue, violet, red, orange, and orange-yellow, with a maximum intensity in the orange. Similarly a sensation of green more powerful than the brightest green tint, could be compounded out of a set of tints having a greenish-yellow for their maximum point, and the sensation of blue culminated in a tint named "third blue" by M. Rosenstiehl. Hence M. Rosenstiehl proposes to accept as the primary-sensation tints of the Young-Helmholtz theory the orange, the yellow-green, and the ("third") blue tints, in which the three sensations of red, green, and blue find their respective maxima; further arguments on this point are promised shortly by M. Rosenstiehl.

ACCORDING to Wiedemann Swedish filter-paper, pyroxylysed by steeping in mixed strong nitric and sulphuric acids, forms an excellent source for electricity by friction. Prof. Guthrie's films of collodion and gutta-percha, in five or six alternate layers, realise the same end, namely that of utilising for the generation of electricity the most powerfully *negative* electric known pyroxylin.

DURING a hailstorm in Geneva on January 19 Prof. Colladon observed the hailstones as they fell to repel each other mutually and to bound about after lying quiet for a moment or two on the ground exactly after the fashion of the pith balls in Newton's well-known experiment of the *electric hail*. The observation would appear to have a bearing on Volta's somewhat neglected theory of the formation of hail.

COMMANDER O. J. SHERMAN has taken some observations of deep-sea temperatures during the summer of 1880 on the Arctic steamer *Gulnare*, when becalmed at about lat. 61° N., long. 56° W., at a point where a branch of the warm Gulf Stream current is represented on the maps as being overlapped by an Arctic current whose direction is to the eastward coast of Greenland. The temperatures at the surface being in two observations respectively $41^{\circ}9$ (F.) and $45^{\circ}0$, those at the depth of sixty fathoms were found to be $39^{\circ}0$ and $40^{\circ}0$ respectively. At 150 fathoms a temperature of $38^{\circ}2$ was observed, but at lower depths the temperature was again higher, reaching $40^{\circ}8$ at 300 fathoms.

M. PAUL SÉGUÉY, whose experience as a constructor of vacuum-tubes is very great, gives the following results of observation upon the effect of cold upon the discharge through exhausted tubes. A tube cooled (naturally by being placed in a cold room) exhibits increased resistance, sometimes double its usual resistance, and may even require to be warmed at the fire or over a spirit-lamp to bring it to its usual working condition. But then the tube does not at once recover itself, but only gradually as the passage of the spark liberates heat and warms the glass and the electrodes. This experiment is best shown with a long thin tube and with a feeble induction-coil. With Crookes's high-vacua tubes the effects of heat are more pronounced, and can be readily observed by arranging a discharger in a branch circuit, the spark leaping between the poles of the discharger when the air-resistance is less than that of the tube. A cooled Crookes's tube does not transmit a spark equivalent to a 3-centimetre spark in air; but when warmed, the "radiant" effects appear to give place in turn to ordinary stratified discharges as the temperature rises. The inverse order of phenomena should take place on cooling, but does not if care has not been taken in the construction of the tube to expel residual occluded gases from the aluminium electrodes by heating them

during the exhaustion. The effects of extreme artificial cold upon vacuum-tubes was not tried by M. Séguéy. In conclusion M. Séguéy asserts the existence of a curious phenomenon, namely, that in a tube used frequently and for a long time, the vacuum may grow more perfect, so as at last to be almost absolute. M. Séguéy attributes this effect to the gradual occlusion by the electrodes of the residual gases.

IT has been proved by Herren Strouhal and Barus (*Wied. Ann.*, No. 13, 1880), from experiments in which steel wire was treated so as to show all degrees of hardness between the glass-hard and annealed states, that the thermo-electric and galvanic properties of steel vary with the degree of hardness in a very sensitive manner. Their researches throw some useful light on the nature of the annealing process and on the magnetic behaviour of steel in relation to its hardness and other properties.

HERR HOLTZ has been able (*Wied. Ann.*, i. 1881) to measure the modulus of elasticity of rods of carbon used for the electric light (Carré's, of Paris) by the acoustical method; the rod being held in the middle with two fingers, and stroked lengthwise with two other fingers on which colophonium has been rubbed. The modulus increases with the density, which is, as a rule, greater in the thinner rods. The tone of thin rods alters a good deal, on repeated rubbing, through heat being generated. On an average the modulus is equal to that of lead. As to the proved increase of electric conductivity of carbon rods with rise of temperature, Siemens has tried to account for it by supposing allotropic modification (as is probably the case with selenium); Herr Holtz, however, shows that pyrolusite, a metallic oxide, behaves similarly, but such an explanation would not here apply. Nor does pyrolusite conduct as an electrolyte; there is no polarisation. For carbon Herr Holtz adheres to his hypothesis (of closer pressure of molecules caused by heat, improving the conduction), in default of a better.

A CENTIGRADE photometer devised by S. Coglievina is described in the *Rivista Sci. Ind.* for January 31. He seeks to remedy the imperfections of ordinary methods by substituting for a single source of light, defined by the substance of the combustible or its hourly consumption, a flame of variable size, which can be reduced to a particular degree of illuminating force. He means to apply the same principle to the electric and other light sources.

AN interesting phenomenon of polarisation of light was observed by Herr Sörrensen in the recent cold weather (*Naturf.*, No. 9). Some of the ice on a window-pane had melted, the water forming a small pool at the bottom. In this pool various bright and beautiful colours appeared; on looking closer they were seen to be only in the grotesque images of frost flowers on the lower part of the window, reflected in the water. The reflecting water surface was here the analyser, while the thin ice crystals, varying according to position and thickness in the ice flowers, played the part of polychromatic gypsum and mica plates. To find the polariser Herr Sörrensen took a Nicol prism, and observed that the daylight itself was strongly polarised; and this he accounts for by the presence of a light mist of ice particles reflecting the sunlight. The temperature outside was about -12° .

WITH reference to the physical conditions of heavenly bodies Herr Lohse (*Wied. Ann.* 1) has experimentally studied the phenomena of glow on various metallic electrodes (magnesium, zinc, iron, cadmium, copper, &c.) in a hydrogen atmosphere of varying pressure. Quantitative data as to the relation of vapour formation to the density of the gas are furnished; and it is proved, *inter alia*, that with progressive rarefaction of hydrogen the luminous power of metallic vapours in the more refrangible parts of the spectrum increases (a sign of exalted temperature).

M. PELLAT gives, in the *Journal de Physique* (February), results of an inquiry into the apparent difference of potential of two metals in contact. This difference he finds to depend essentially on the nature of their superficial layer, and to vary (sometimes considerably) with chemical or simply physical changes of the surface. When an inert gas surrounding the metals is rarefied, the apparent difference of potential increases, and it recovers its former value on the pressure being restored. Further, the said difference has the same value as the electromotive force of a battery element formed by alcohol and the same metals (not yet altered).

DR. PULJY has made the following experiment to prove his suggestion that radiant matter consists of electrode particles

pulled off by the action of electricity. The cathode of a vacuum-tube was covered with chalk. It exhibits phosphorescence of orange-yellow colour, while in a short time the tube-wall becomes covered by a very delicate layer of chalk, without losing its clearness and transparency, and phosphoresces like chalk. Puluj believes that the yellow-coloured phosphorescence observed on metallic cathodes is caused by the phosphorescence of the oxides covering the metal.

GEOGRAPHICAL NOTES

AT its annual meeting the Russian Geographical Society elected as vice-president M. Semenov, and Baron Osten-Secken as his "aid." The great Constantine medals were awarded to M. Moushketoff, for his geological researches in Central Asia, and to M. Yanson, for his remarkable work on "Comparative Statistics of Russia," the two first volumes of which have already appeared; the Lütke gold medal was awarded to Baron Kaulbars for his papers on the Lowlands of the Amu-daria; the two great gold medals instituted last year for ethnographical and statistical researches were awarded to Dr. Pyasetzky for his work, "Travels to China during the Years 1875-77," and to M. Roussoff for his statistical description of the Nyejin district. Small gold medals were awarded to M. Nordkvist, who took part in Nordenskjöld's expedition; to M. Potanin for his travels in Mongolia; to M. Tyaghin, for meteorological observations on Novaya Zemlya, and to M. Mainoff for anthropological explorations among the Mordovians. Silver medals were awarded to Mme. Treskina and to MM. Andrianoff, Unterberger, Polonsky, Orloff, Skassi, Karatin, Zinovieff, Krasovsky, and Mikhalenko.

WE learn from the last number of the *Izvestia* of the Russian Geographical Society that the Society sends this spring M. Polyakoff with an assistant for the exploration of Sakhalin Island. M. Polyakoff will start from Odessa, on board of a Russian ship, and proceed to Sakhalin, where he will stay during a year; thence he will go to the Manchurian shore of the Pacific for further explorations.

THE explorer Begaert has arrived at Lisbon. He was sent by the King of the Belgians to make scientific researches on the route of Mr. Stanley at Vivi and other parts of Zaire.

WE are glad to learn that the U.S. Congress have decided to appropriate 175,000 dollars to send out an expedition in a whaling vessel in search of the missing steamer *Jeannette*, which was sent out in 1879 by Mr. Gordon-Bennett to carry on Arctic exploration by way of Behring Strait. The initiative in this matter is due to Chief-Justice Daly, President of the American Geographical Society.

IN addition to two papers descriptive of the visits of Mr. Leigh Smith to Franz-Josef Land and Mr. Delmar Morgan to Kuldja, the new number of the Geographical Society's *Proceedings* gives Mr. F. C. Selous' notes on some of his many journeys in South Central Africa, those dealt with here being to the north of the Zambesi between the 27th and 29th meridians, and in the neighbourhood of the River Chobe which empties into the great river above the Victoria Falls. We gave last week the text of the interesting note on Col. Prejevalsky, in addition to which we may refer to the record of some altitudes recently determined in Matabele Land, and a note of Dr. Otto Finsch's explorations in Polynesia. The maps this month are of the South Coast of Franz-Josef Land and the Central Zambesi region.

WE observe that M. Henri Duveyrier's interesting observations on the question of the sources of the Niger appear in the last (December) number of the French Geographical Society's *Bulletin*, but we regret to find that they are published without a map.

IN last week's issue of *Les Missions Catholiques* Mgr. Lavigerie, Archbishop of Algiers, commences an account of the missions of Equatorial Africa, with the direction of which he has been charged. There is also a letter from Père Antonin de Reschio in Brazil, in which will be found some notes on curious traditions among the Indians.

MARQUIS ANTINORI and the other members of the Italian expedition to Shoa are expected shortly at Zeila. It is also stated that Signor Libman, an Italian traveller, has gone to Assab in order to make an attempt to open commercial relations with the interior and to survey some of the little-known regions in the neighbourhood. Signor Giuletti, who accompanied the Italian

official representative to Assab in January, is charged by the Italian Geographical Society to undertake a journey through the country of the Danakil and Adel tribes, and to study the best means for opening a trade-route between Assab and Abyssinia. His mission has considerable geographical importance, as the region to be traversed is unknown, and he will have an opportunity of solving the problem of the River Gualima, which probably he found to empty into some lake in the interior, as the Hanash does, if indeed it be not part of the latter river-system.

CAPT. NEVES FERREIRA, Governor of Benguela, and other Portuguese officers, have placed their services at the disposal of the Lisbon Geographical Society for a scientific expedition across Africa, to start from the West Coast.

THE *Sydney Morning Herald* of January 17 publishes a telegram from their Queensland correspondent as follows, dated January 14:—"Skuthorpe arrived two days ago from his exploring trip out west. He reports having travelled 200 miles inside the South Australian boundary, and in the Herbert River discovered relics of Leichhardt, consisting of his diary and Classen's diary; also a telescope with presentation engraving, compasses, and other things. These, he alleges, are in two packs which he has brought with him. The diary of Classen is to the effect that he left Leichhardt at the Saltwater Creek while he searched for water, and that on his returning he found the party dead, and then joined the blacks, with whom he lived until three years ago. Skuthorpe will not allow any one to inspect the alleged relics, and here it is considered doubtful whether they are genuine."

INTELLIGENCE has been received at the Foreign Office from Her Majesty's Consul at Mozambique, which confirms the report of the deaths of Capt. Phipson-Wybrants and Messrs. Carr and Mears, of the Wybrants' expedition. Mr. Mayes is stated to be at Umzeilas, and Mr. Owen to have left with the remainder for Inhambane, whither Her Majesty's ship *Ruby* will proceed forthwith.

ON THE VISCOSITY OF GASES AT HIGH EXHAUSTIONS¹

II.

INFLUENCE of Aqueous Vapour on the Viscosity of Air.—In the foregoing experiments many discrepancies were traced to the presence of moisture in the gas. The influence of aqueous vapour does not appear to be great when present in moderate amount in gas of normal density, but at high exhaustions it introduces errors which interfere with the uniformity of the results. A series of experiments were accordingly undertaken to trace the special action of aqueous vapour when mixed with air.

Up to a pressure of about 350 millims. the presence of aqueous vapour has little or no influence on the viscosity of air. The two curves are in fact superimposed. At this point, however, divergence commences, and the curve rapidly bends over, the viscosity falling from 0.0903 to 0.0500 between 50 and 7 millims. pressure. Here it joins the hydrogen curve, and between 7 millims. and 1 millim. they appear to be identical.

These results are partly to be explained by the peculiar action of water vapour in the apparatus. At the normal pressure the amount of aqueous vapour present in the air, supposing it to be saturated, is only about thirteen parts in a million, and the identity of the log dec. with that of dry air shows that this small quantity of water has no appreciable action on the viscosity. When the pump is set to work the air is gradually removed, whilst the aqueous vapour is kept supplied from the reservoir of liquid. As the exhaustion approaches the tension of aqueous vapour, evaporation goes on at a greater rate, and the vapour displaces the air with increasing rapidity; until, after the pressure of 12.7 millims. is passed, the aqueous vapour acts as a gas, and, being constantly supplied from the reservoir of water (as long as it lasts), washes out all the air from the apparatus, the log dec. rapidly sinking to that of pure water gas.

This explanation requires that the viscosity of pure aqueous vapour should be the same as that of hydrogen, at all events between 7 millims. and 1 millim. pressure. The facts can, however, be explained in another way. During the action of the Sprengel pump sufficient electricity is sometimes generated to render the fall tubes luminous in the dark. It is conceivable

¹ Abstract of a paper read before the Royal Society, February 17, 1881. by William Crookes, F.R.S. Continued from p. 423.