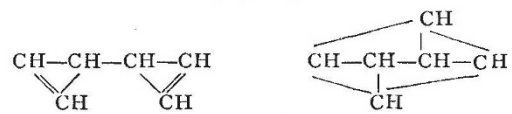
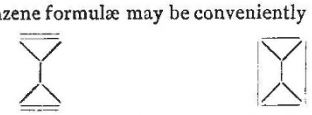
6500 atmospheres he finds that sulphur combines with magnesium, zinc, iron, cadmium, bismuth, lead, copper, silver, tin, and antimony. Sulphur and phosphorus do not combine when compressed together (*Berichte*, xvi. 999).

BENZENE is perhaps the most important body in the whole range of chemistry, not on account of any intrinsic interest in the substance itself, but because of the immense number of its derivatives. The constitution of these derivatives must depend upon the structure of the benzene molecule itself, and this problem is therefore one of the most interesting that presents itself to the chemist. Any idea that can throw light upon this subject is worthy of attention, and the more so as long as the least doubt exists as to whether benzene can yield more than three di, tri, or tetra derivatives, or more than one mono or penta derivative, the substituting groups being the same. Again, it is possible that benzene may exist in two or more isomeric modifications (disregarding dipropargyl), and the difference found by V. Meyer (*Ber.* xv. 2893) between two samples of benzene, both presumably pure, would seem to point in this direction. The mere fact, therefore, that one formula is good and useful is no condemnation of any other formula that may be proposed. M. Mendeléeff has suggested that benzene may be regarded as a normal butane, in which six hydrogen atoms are replaced by two triad groups, CH. If we allow that benzene is best represented as containing six CH groups, and there seems as yet no reason for departing from this supposition, then this replacement may take place in two ways, as shown by the following formulæ :—



These two benzene formulæ may be conveniently written thus :—



and these expressions show at a glance the difference between them. The second is identical with Ladenburg's prism formula, the advantages of which do not need recounting. The first, so far as double and single linkings are concerned, is intermediate between the prism formula and Kekulé's. It lends itself in a particularly ready way to the expression of more complex formulæ, as of naphthaline, &c., but does not show the hexad nature of the benzene molecule. Moreover, it shows possible two mono or penta derivatives, and five each di, tri, and tetra derivatives, a capability that is not yet needed ; and a formula should be a concise expression of facts, and should as far as possible show the limits of those facts. Thus, however valuable the suggestion of M. Mendeléeff may be as showing a possible method of synthesising benzene, it does not appear to be practically useful as indicating its constitution, though the future chemistry of benzene may require such a formula as the one referred to above.

PROF. MENDELÉEFF, to avoid the superheating which takes place during ordinary fractional distillation with a dephlegmator tube, has devised a modified method for the oils from Baku petroleums boiling between 15° and 150°, which consists in passing the vapours from the distilling flask by means of the dephlegmator, or delivery tube, to the bottom of a second similar flask, and from this to a third, and so on ; the heated vapours from the one providing the necessary heat for the distillation of the next, &c. In this manner a great number of fractions at intervals of two degrees were obtained. By comparing boiling points and specific gravities of products the author concludes that Baku oils contain similar hydrocarbons to American petroleum, and in addition a hydrocarbon boiling at 55° and same specific gravity as hexan with the properties of an unsaturated compound. The great bulk of the Caspian petroleums appears to consist, in addition to derivatives of marsh gas, of C_nH_{2n} hydrocarbons, and also some members of the C_nH_n or acetylene series.

SOME interesting results have been obtained by Spring (*Ber. Ber.*) by washing precipitated sulphide of copper for several weeks until all traces of salts were removed. It was then found that the sulphide dissolved to a black liquid, with slight green fluorescence, in water. The solution might be boiled and evaporated without change ; slight traces of salts caused precipitation. The author has also obtained sulphide of tin and oxides of antimony and manganese in a condition perfectly soluble in water. Sulphide of tin on evaporation of its solution in vacuo forms a transparent red glass.

GEOGRAPHICAL NOTES

ON June 6 Baron Nordenskjöld's Greenland expedition arrived at Reykjavik in the steamer *Sophia*. The *Sophia* lay at Reykjavik for a few days, and in the meantime Baron Nordenskjöld and the geologists of the party examined the coal deposits which occur in Bergarfiord. Dr. Arpi, a Swedish philologist, who has resided some time in Iceland and acquired a thorough knowledge of the language, accompanied the expedition thither, and will, along with two other men of science, remain in Iceland after the *Sophia* has left.

WE learn from *Science* that a party for the relief of the observers under Lieut. Greely at Lady Franklin Bay was to leave St. John's, Newfoundland, on one of the steam sealing-vessels belonging to that port, about June 15, probably accompanied by a naval vessel as tender. It will be commanded by Lieut. E. A. Garlington, U.S.A., and composed of twelve men, of whom ten are stated to be old sailors and accustomed to the use of boats. Twenty dogs, native drivers, and a supply of fur clothing, have been secured at Godhavn, Greenland. The party at Lady Franklin Bay will be reached and withdrawn if the state of the ice permits. If not, the relief party is to be landed on Littleton Island, and while part of them are engaged in preparing winter quarters, Lieut. Garlington will endeavour to open communication by sledges with Greely's people. In the failure of the first attempt, another will be made in the spring of 1884. It is to be hoped, if Greely is not reached, that an attempt will be made to leave at Cape Hawkes or Cape Sabine, if not the relief party as a whole, which would be best, at least a boat by which the open water to be anticipated between those points and Littleton Island next year (1884) may be passed by a retreating party, which might well find their own boat unseaworthy after dragging it over many miles of hummocky ice, if, indeed, they did not find themselves obliged to abandon it. Further, the schooner *Leo* is on the point of sailing for Point Barrow to withdraw the signal-service observing party under Lieut. Ray, in compliance with the act passed by the last Congress. To utilise the opportunity, Mr. Marr, of the U.S. Coast-Survey, will accompany the vessel with the design of making absolute magnetic determinations, of fixing the astronomical position of the station, and of making pendulum observations.

IN a communication from the Russian Geographical Society we are informed that Col. Prejevalsky is about to start on his fourth journey to Central Asia, accompanied by two officers and seventeen men. The Emperor has granted to the Society 43,000 roubles for the purpose of Col. Prejevalsky's journey. The Society is also sending out a new expedition under M. Potanin, who is now completing the publication of the two last volumes on his journey of 1879–80. He will start in July for South-East Mongolia and the adjacent parts of China ; he will be accompanied by a naturalist and M. Skassi, the companion of Severtzov in his exploration of the Pamir. The funds are being supplied partly by the Society and partly by M. Sookachef, a Siberian merchant.

IN the same communication we are informed that the average temperature of January and February at the Russian Polar station at Sagastyr, on the mouth of the Lena, was about − 50° C. Thanks to the Governor-General of Eastern Siberia there has been organised a special postal service between Jakutsk and Sagastyr once a month. The observing party will most probably remain at the station up to the end of October, *i.e.* until the river is frozen.

THE last number of the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* (Bd. 18, Heft 2) contains a paper by Herr van Langegg, entitled "Nara eine alte Kaiserstadt," describing the town of Nara, not far from Kioto, in Japan, at one time the capital of the country, and still much renowned for its temples The celebrated colossal statue of Buddha there is fully described. The following figures give some notion of its dimensions :—Its weight is 500,000 kilog. ; 3,000,000 kilog. of wood were con-

sumed in making the bronze, which consists of 250 kilog. of gold, 8413·5 of tin, 977 of mercury, and 493 of copper. The present image only dates from 1801.

WE have received a German pamphlet by Herr Max Buch, on "Finland and its Nationality Question," being a reprint of papers which have appeared in recent issues of the *Ausland*. In the limited space of seventy-four pages the author gives a short but correct description of Finland, of the prehistoric Finns, according to Ahlquist's researches, of the history of the country, and of the present state of the "national question." He summarises the excellent researches by Retzius on the race-characters of the Finns—as far as can be done in a few pages—and dwells upon the recent efforts of Finnish writers towards the development of the Finnish language and literature as a reaction against the former supremacy of the Swedish language and influence. We notice the interesting fact that although only 7·5 per cent. of the Finns can now read and write, and 70 per cent. read, primary instruction has taken during the last few years a great extension. The number of State schools being too limited, they are supplemented by private instruction. Thus, of the 342,836 children from seven to sixteen years old of the Lutheran Finnish population, only 6983 had not received primary instruction in 1877 (1801 of them on account of disease). But only 26,900 went to the State schools, whilst 116,201 children received primary instruction in private ambulatory schools, and 177,925 at home.

THE last number of the *Izvestia* of the Russian Geographical Society contains several interesting papers. M. Veselago gives a sketch of the life and work of the late Count Lütke. Prof. Fr. Schmidt discusses again the claim of Wrangel to the discovery of the land situated north of the Cape Yakan. He tries to prove, against Nordenskjöld, that Wrangel was right in denying the existence of a land which Andréeff said he saw from the fifth island of the Medvyejiy Archipelago; but he did not deny the existence of a land situated north of Cape Yakan. Prof. Schmidt admits, however, that even with regard to this land, Wrangel wrote "in different parts of his report with a varying degree of certainty as to the probability of its existence." M. Karzin, an official of the Verkhoyansk district, having been struck with the terrible fate of De Long, publishes a most valuable list of all settlements and places where human beings can be met with at different seasons on the coast of North-Eastern Siberia. M. Andréeff publishes a brief account of his hydrographical researches in the White Sea and on the Murman coast during the last three years. The flora of the coast becomes very poor north of Archangel. At the Svyatoy Noss lighthouse it consists only of lichens, mosses, and creeping brushes of *Betula nana*. It improves, however, west of Kildin and especially west of the Ribachiy peninsula, offering excellent forests and meadows at the new colony at Pechenga. The yearly average temperature, which is but − 0°·6 Celsius at Archangel, and −2°·4 at the Svyatoy Noss lighthouse, reaches −1°·1 at Kola, and +1°·4 at Vardö. This increase of temperature is due, as is known, to the warm current which flows along the coast. Thus, at Svyatoy Noss, during the hottest days, the temperature of water does not exceed 6°·9; and during the autumn it reaches but 1°·9. To the west of 30° 6′ it suddenly becomes double that. In the spring the warm streamlets reach 4°·3, whilst the cold ones, flowing close by, reach but 1°·9; and during the summer the warm streamlets reach 12°·5, whilst the cold ones, close by, reach 6°·9 to 7°·5. It appears thus that one isolated measurement of temperature of water is of little value, the warm current being not so compact along the Murman coast as elsewhere. Under 33° 6′ E. long. it leaves the coast and flows towards the north-north-east. The positions taken by the warm current at the Murman coast vary with the seasons, and depend upon the prevailing winds. From April to August it touches the coast, but later on it is driven north by the southern winds; in October it already flows off Vardö. Its position varies also for different years, depending upon the prevailing winds. The richness of the fishing depends entirely upon the position taken by the warm current. In 1881, the Norwegians, owing to the current flowing in their waters, had the richest prey, whilst in 1882, the richest prey for a twenty years' series was given by the warm current to the Russian fishers. The same number of the *Izvestia* contains the first sheets of M. Polakoff's reports on his researches in Sakhalin, and M. Mezhoff's bibliographical index of the Russian geographical literature for the year 1880.

M. THOUAR, the French traveller, has written a letter from Chili, in which he says that several members of the exploring party under Dr. Jules Crevaux, who was massacred with most of his followers in the early part of last year by Indians while making explorations along the Bolivian part of the Pilcomayo, are believed to be still alive, but prisoners in the hands of the Indians.

THE CAUSE OF EVIDENT MAGNETISM IN IRON, STEEL, AND OTHER MAGNETIC METALS[1]

Neutrality

THE apparatus needed for researches upon evident external polarity requires no very great skill or thought, but simply an apparatus to measure correctly the force of the evident repulsion or attraction; in the case of neutrality, however, the external polarity disappears, and we consequently require special apparatus, together with the utmost care and reflection in its use.

From numerous researches previously made by means of the induction balance, the results of which I have already published, I felt convinced that in investigating the cause of magnetism and neutrality I should have in it the aid of the most powerful instrument of research ever brought to bear upon the molecular construction of iron, as indeed of all metals. It neglects all forces which do not produce a change in the molecular structure, and enables us to penetrate at once to the interior of a magnet or piece of iron, observing only its peculiar structure and the change which takes place during magnetisation or apparent neutrality.

The induction balance is affected by three distinct arrangements of molecular structure in iron and steel, by means of which we have apparent external neutrality.

Fig. 1 shows several polar directions of the molecules as indicated by the arrows. Poisson assumed, as a necessity of his theory, that a molecule is spherical, but Dr. Joule's experimental proof of the elongation of iron by 1/720,000th of its length when magnetised, proves at least that its form is not spherical; and as I am unable at present to demonstrate my own views as to its exact form, I have simply indicated its polar direction by arrows —the dotted oval lines merely indicating its limits of free elastic rotation.

In Fig. 1, at A, we have neutrality by the mutual attraction of each pair of molecules, being the shortest path in which they could satisfy their mutual attractions. At B we have the case of superposed magnetism of equal external value, rendering the wire or rod apparently neutral, although a lower series of molecules are rotated in the opposite direction to the upper series, giving to the rod opposite and equal polarities. At C we have the molecules arranged in a circular chain around the axis of a wire or rod through which an electric current has passed. At D we have the evident polarity induced by the earth's directive influence when a soft iron rod is held in the magnetic meridian. At E we have a longitudinal neutrality produced in the same rod when placed magnetic west, the polarity in the latter case being transversal.

In all these cases we have a perfectly symmetrical arrangement, and I have not yet found a single case in well-annealed soft iron in which I could detect a heterogeneous arrangement, as supposed by Ampère, De la Rive, Weber, Wiedermann, and Maxwell.

We can only study neutrality with perfectly soft Swedish iron. Hard iron and steel retain previous magnetisations, and an apparent external neutrality would in most cases be the superposition of one magnetism upon another of equal external force in the opposite direction, as shown in B, Fig. 1. Perfectly soft iron we can easily free, by vibrations, from the slightest trace of previous magnetism, and study the neutrality produced under varying conditions.

If we take a flat bar of soft iron, of 30 or more centimetres in length, and hold it vertically (giving while thus held a few torsions, vibrations, or, better still, a few slight blows with a wooden mallet, in order to allow its molecules to rotate with perfect freedom), we find its lower end to be of strong north polarity, and its upper end south. On reversing the rod and repeating the vibrations, we find that its lower end has pre-

[1] Paper read before the Society of Telegraph Engineers and of Electricians, on May 24, 1883, by Prof. D. E. Hughes, F.R.S., Vice-President

Continued from p. 162.