

on each rod, the single ring (Fig. 1) being left in contact with the disc, and a very small amount of paraffin wax is melted round the rings. When the vessel is supported with the rods downwards, as in Fig. 2, the solid wax holds the indexes in position. The arrangement is then placed between the condenser and the focussing lens of the lantern, and boiling water is poured into the brass vessel. When that part of a metal rod, in the neighbourhood of the double ring of the index, reaches the

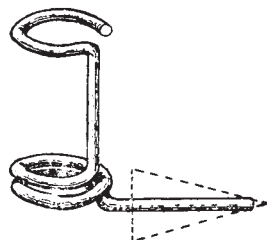


FIG. 1.—Enlarged view of index.

melting temperature of the wax, the index commences to slip downwards, carrying the wax with it, and when the temperatures of the rods have acquired steady values, the indexes will have descended to points on the various rods where the wax just solidifies, and which, therefore, possess equal temperatures. Hence, the conductivities of the various rods are proportional to the squares of the distances from the bottom of the brass vessel to the respective positions indicated by the several arrow-heads.

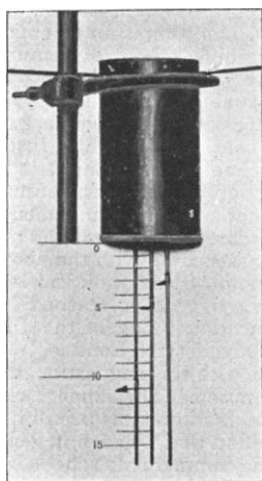


FIG. 2.—Lecture apparatus for demonstrating the relative thermal conductivities of metals. (The left-hand rod is of copper, the middle one of brass, and the right-hand one of soft steel.)

A scale of equal parts, or, better still, a scale of squares, may be drawn on the screen, when the relative conductivities may be directly read off.

In Fig. 2, rods of copper, brass and soft steel are shown with the indexes in the positions acquired at the end of an experiment. It will be seen that the relative conductivities work out to within three or four per cent. of the accepted values for the mean conductivities between 0° and 100° C.

Royal College of Science, July 8.

EDWIN EDSER.

The Electrical Resistance of the Blood.

It is no easy task to measure the electrical resistance of the blood of a living individual. The principal difficulty depends upon the fact that only very small quantities of blood can generally be obtained at a time. During the last five years many attempts have been made by me to obtain trustworthy and consistent results; various methods and forms of apparatus have been employed and subsequently rejected.

The best results were obtained by placing five cubic milli-

metres of freshly-drawn blood between two cup-shaped electrodes three millimetres in diameter, coated with spongy platinum, and fixed at 0.75 mm. apart.

The average resistance of normal blood at 60° F. measured by Kohlrausch's method in this apparatus is 550 ohms. A striking change may be observed in pernicious anæmia, the resistance in this disease being sometimes diminished to about one-half that of normal blood. The deduction is that the blood in pernicious anæmia contains an abnormal amount of salts, due to the destructive metabolism going on.

DAWSON TURNER.

School Laboratory Plans.

I HAVE long believed that by far the best arrangements of the benches in a laboratory for elementary chemical teaching is the last one suggested by Mr. Richardson, viz. "single benches, cross-ways, like the desks of an ordinary class room."

It must be remembered that qualitative analysis now occupies a secondary place in an elementary course, and a great number of reagents is not required for preparations and simple quantitative experiments. The superstructure of shelving may therefore be replaced by a single rack for the common reagents. This allows perfect supervision from the raised demonstration table in front of the benches, and the work of the class can at any moment be interrupted for explanation or revision of the work done, or for an experiment made by the master himself. It is surely a mistake to divide an elementary course of chemistry into two parts—*theoretical* and *practical*; the proposed arrangement allows of the practical work forming a part of the general course.

In this county this arrangement has been successfully carried out. The grammar schools are, however, unwilling to risk the refusal of the Science and Art Department to recognise such a laboratory for earning grants, the old-fashioned benches with uncleanly teak tops and rarely used drawers and cupboards being usually insisted on.

T. S. DYMOND.

County Technical Laboratories, Chelmsford.

The Origin of the Doctrine of Compensation of Errors in the Infinitesimal Calculus.

I SHOULD be much obliged if you could help me by inserting a query on this point.

Lazare Carnot, at the end of his "Reflexions sur la Méta-physique du Calcul Infinitésimal," stated that "it is singular that in this indispensable condition of elimination the real character of Infinitesimal Quantities . . . should not hitherto have been discovered."

However, Lagrange (see "Œuvres," t. vii. p. 595) had explicitly stated this doctrine many years before. Very possibly Carnot did not see this note, but Lagrange again stated it in the preface of his "Théorie des Fonctions Analytiques," which Carnot had certainly seen, as he quoted some passages from it in the later editions, at least, of his "Reflexions."

If Carnot has any right to an independent discovery, he could hardly have quoted Lagrange in the first edition of his work. The first edition of both Carnot's and Lagrange's works was dated 1797.

I have been unable to find a first edition of "Carnot" here, so write to ask if any one can tell me whether there is any mention or quotation of Lagrange in it.

PHILIP E. B. JOURDAIN.

63 Chesterton Road, Cambridge, June 30.

Robert Browning and Meteorology.

ROBERT BROWNING's well-known description of Aurora Borealis, in "Easter Day" (c. xv. xvii), is so graphic that it must have been written from personal observation. Probably few persons can fully appreciate its accuracy; but on September 24, in that wonderful Aurora year 1870, just such a display took place, which I had the fortunate opportunity of watching nearly all night from the Welsh hills, when all the phenomena Browning describes, and many others, were abundantly visible. But I can find no account of any such display having been seen in these latitudes earlier in the century, and "Easter Day" dates from 1850.

The lunar rainbow in "Christmas Eve" (c. iv. and vi.), which "rose at the base with its seven proper colours chorded,"

blending at the summit "in a triumph of whitest white," with a second bow above it, and "a wondrous sequence" beyond that, is evidently the hybrid offspring of fancy and that inaccurate observation of phenomena which seems inevitable without scientific training, especially as, while evening service is going on in Zion Chapel, the moon's "full face" is shining in the West, and the bow appears in "the empty other half of the sky," "North and South and East." The effect of "the flying moon" trying to break out of its "ramparted cloud prison" is, however, very graphically described.

But I should like to know when and where the poet could have seen his Aurora.

B. W. S.

July 8.

A Plague of Frogs.

THIS afternoon, as I was walking into Lickey Village from King's Norton, I came across innumerable frogs. They lined the hedges and covered the road so thickly that I had to walk on tiptoe. I thus proceeded quite 400 yards, where the phenomenon ended as sharply defined as it had begun. Nowhere else along the road was a frog to be seen. I was particularly astonished, as I knew the nearest water to be the Little Reservoir—quite $\frac{1}{2}$ mile away. The frogs were about ten days old, very small. A cottage stood about 300 yards from the beginning of this swarm. Upon inquiry I ascertained that the frogs had thus congregated since noon on Monday, that they had literally besieged the house, jumping all over the ground-floor rooms, that the garden and its paths were full of them. The present occupants had lived there 4 $\frac{1}{2}$ years, but had never experienced anything like this. They have sometimes seen a few frogs cross the road in wet weather. They are now occupied with brushing them out of doors. Can any of your readers explain the cause of this extraordinary spectacle?

King's Norton, Birmingham, July 5. F. H. FORTEY.

THE UNIVERSITY OF LONDON.

AS we went to press last week, an adjourned meeting of the Senate of the University of London was being held to discuss the report of the special committee appointed to consider the offer of the Government to house the University in the Imperial Institute. The history of the negotiations that have taken place may be read in the abridged report published in last week's NATURE; and the facts contained in that statement formed the basis of the discussion in the Senate. In the end the offer of the Government was accepted, the following resolution, proposed by Sir Edward Fry and seconded by Mr. Bryce, being carried by a large majority:

"That the Senate accepts the proposal of Her Majesty's Government as far as it provides in the buildings of the Imperial Institute accommodation for the work hitherto done by the University; and authorises the Committee consisting of the Chancellor, the Vice-Chancellor, and Sir J. G. Fitch to settle the formal terms of agreement with the Government, and the Senate reserves the right of the University to hereafter request the Government to make further provision for such further needs as may arise in the future."

By this resolution the question of the future headquarters of the University is practically settled. The schemes of organisation of the constituent Colleges of the University and future possible teaching centres are now matters of the highest importance, for by them the future work and influence of the University will be determined. An ideal University should encourage the advancement of every branch of knowledge which assists human progress, and it can only do this by admitting into its constitution all subjects with which men of "light and leading" are concerned. It can hardly be held that the University of London has satisfied these conditions in the past, but under the new constitution we may confidently hope that a wider view will be taken of its functions and responsibilities. We have no longer to deal merely with a body authorised to confer degrees by examination, but with a

living organisation taking part in the actual work of instruction. The teachers in this great University will feel that the interests of the University are their own interests, and that their work is not to have for its end the preparation of candidates for degrees, but to encourage students to work for the dignity and influence of their *alma mater*.

There are several directions in which the work of the University ought to be developed. Law and medicine should, of course, have their Faculties, as they have in the Universities of Paris, Bologna and elsewhere; and we may surely look to those institutions which have for centuries kept the lamp burning in the absence of a University for the needed help. Higher commercial education can be provided for by the establishment of a School of Economics and Political Science organised at the Imperial Institute itself. The exceptional facilities offered by the Institute for the work of a school of this character were referred to in an article in NATURE of April 20 in the following words:

"The well-arranged collections of Indian and Colonial products, which form a most important part of the equipment of the Imperial Institute, would be found of especial value in illustrating the teaching of that branch of commercial education known as *Waarenkunde*. Nowhere else in London do similar facilities exist for instruction in the technology of commercial products. Within the building, too, has been provided a chemical laboratory, which is now largely used for the examination and analysis of foreign products; and much of the scientific investigation therein carried on, under the able direction of Prof. Dunstan, is an essential feature in the programme of a high school of commerce. Indeed, a large part of the work which entered into the original scheme of the promoters of the Imperial Institute might, it would seem, consistently, and with great advantage to the public, be continued in that Institute under the auspices of a school of economics, industry and commerce, in connection with the reconstituted University of London. Whether such an arrangement can be effected is a matter for careful consideration; but there is no doubt that the association with the new University of a school of 'economics and political science,' under a separate Faculty, suggests a reasonable basis of union between the educational side of the Imperial Institute and the future University of London."

In connection with this suggestion, another point well deserves consideration. The support which the Colonies have given to the Institute has been in some cases withdrawn on the ground that no advantage was derived from it. But with a commercial school at the Institute colonial students could come over to pursue their studies in the midst of collections illustrating the products of their homes, and the training they would receive with such an environment would ultimately be used for the benefit of the Colonies, so that an adequate return would be made for whatever support was given. In fact, it seems that the use of the collections for the purposes of instruction in connection with the new University would satisfactorily settle the question of the service of the Institute to the Colonies, as well as give colonial students an opportunity of obtaining a degree under the very best conditions.

If the example is once set by using the Institute collections to illustrate courses of instruction on colonial products and industries, it is to be hoped that the other special collections which abound in London illustrating many other branches of culture may also be utilised for University purposes. With its new resources and facilities for advanced teaching, the University is given the opportunity of widely increasing its sphere of influence; and friends of education and national progress look to it to make the best use of the opportunities which the new headquarters will afford.