interest. I have found that when the Röntgen rays pass through any substance, they make it for the time being a conductor of electricity, even although the substance is in its normal state a perfect insulator. Thus solid paraffin, paraffin oil, solid sulphur, ebonite, mica, air—all conduct electricity when the Röntgen rays pass through them. This explains the fact observed by Righi, Bergman, and myself, that an electrified plate in air loses its charge when exposed to these rays, whether it be electrified positively or negatively. The air is converted into a conductor by these rays, and the charge escapes through it. It is not necessary that a gas should surround the plate, as I have found that the leakage takes place whatever the medium surrounding the plate may be. That this leakage is due to the condition of the insulator, rather than to that of the plate, is shown by the fact that it occurs when the plane of the electrified discs is parallel to the rays, as well as when it is at right angles to them. The air through which these rays have passed retains traces of conductivity for some little time after the rays have ceased to pass through it; this can be shown by blowing the air, from a place where the rays are plentiful, against a charged disc placed where there are only a few rays; the rate of leak from this disc is much increased by the blast.

With the assistance of Mr. J. A. McClelland, of Trinity College, Cambridge, I have made a large number of measurements of the rate of leak from positively and negatively electrified discs surrounded by air, and have found that the rate of leak in the two cases is almost identical. We have also made a series of measurements of the rate of leak through air at different pressures; the rate of leak is greater at a high pressure than at a low one, and is over a wide range of pressures approximately proportional to the square root of the pressure. The rate of leak is also greater in air than in hydrogen, being at atmospheric pressure about twice as great in air as it is in hydrogen, while the leakage through carbonic acid gas is faster than that through air.

The leakage of electricity through non-conductors is, I think, due to a kind of electrolysis, the molecule of the non-conductor being split up, or nearly split up, by the Röntgen rays, which act the part played by the solvent in ordinary electrolytic solutions. If the air through which the rays are passing is ionised, the number of ions would, according to the well-known law of dissociation, be proportional to the square root of the pressure, provided the amount of ionisation is small. Thus the result we obtained for the rate of leak through air at different pressures, indicates that the rate of leak is proportional to the number of ions.

The view that the air is turned by these rays into an electrolyte, is supported by some experiments made in the Cavendish Laboratory, by Mr. Erskine Murray, on the contact difference of potential between metal plates in air. He finds that when the Röntgen rays are passing through the air in the neighbourhood of the plates, the plates (as far as their potential differences are concerned) behave as if they were connected by an electrolyte.

Mr. C. J. R. Wilson has investigated, in the Cavendish Laboratory, the effects produced by Röntgen rays on the condensation of clouds caused by the expansion of air, and has found that when the rays pass through the vessel in which the cloud is formed, the cloud is very much denser than when the rays are absent, showing that these rays increase the number of nuclei which act as centres of cloud condensation. The ions with their electrical charges would act as such nuclei, so that this, again, is in favour of the view that these rays turn the air into an electrolyte. These experiments seem to show that these rays exert a powerful disintegrating effect on the molecules of substances through which they pass, and suggest that their use may throw light on some questions of molecular structure. It would be interesting, for

example, to find the rate of leak through gases which are reputed to be monatomic, such as mercury vapour, argon, and helium. Again, if air and other gases can be made to act as electrolytes, we could use a mercury dropping arrangement, similar to that employed by Ostwald to measure the potential difference between metals and liquid electrolytes, to measure, by means of it, the potential difference between metals and various gases through which the Röntgen rays are passing.

By measuring the rate of leak from a disc charged to a fixed potential, we can compare the efficiency, as producers of Röntgen rays, of different tubes or of the same tube at different periods. The conclusion I have arrived at, by means of such measurements, is that bulbs generally improve for some time after they are sealed off from the pump, and attain a maximum efficiency, after which they begin to deteriorate.

Some measurements of the absorption of Röntgen rays by various thicknesses of metal, have led me to the conclusion that the Röntgen rays are not all of the same kind. The experiments were made by measuring the change of the rate of leak from an electrified disc, produced by changing the number of sheets of tinfoil interposed between the disc and the phosphorescent tube. When a small number of sheets of tinfoil were interposed, the addition of another sheet of tinfoil produced a very considerable diminution in the rate of leak; when, however, the phosphorescent bulb was a very good one, a considerable leakage remained when the number of sheets of tinfoil was considerable, and this "residual leakage" diminished but slowly as the number of sheets of tinfoil was increased. This seems to indicate that while there are some rays which are rapidly absorbed by the tinfoil, there are others which can pass through it with comparative facility. It is only when using one or two of the most efficient bulbs that I have remarked this "residual leakage," but with these bulbs when in their most efficient state it was very marked.

J. J. THOMSON.

THE DEEPEST SOUNDING YET KNOWN.

IN NATURE (vol. iii. p. 550, October 3, 1895), I mentioned that H.M.S. *Penguin*, Commander A. F. Balfour, R.N., had found in the Pacific Ocean deeper water than any yet known in lat. 23°40' S., long. 175°10' W., but had failed to reach the bottom owing to breakage of the wire at 4900 fathoms.

Captain Balfour has been enabled to try again, and I have just received the announcement of his obtaining three satisfactory soundings of over 5000 fathoms.

The deepest trustworthy sounding heretofore known is 4655 fathoms near Japan, obtained by U.S. S. *Tuscarora* in 1874.

The deepest of the *Penguin's* casts is 5155 fathoms, or 500 fathoms (3000 feet) deeper; but it is especially remarkable that the three casts now obtained are not in the same hollow, but are separated by areas of considerably less water, the two extreme soundings being 450 miles apart.

The usual abysmal red clay was brought up by the sounding-tube on two occasions; on the third the wire broke.

Mr. V. Thorpe, surgeon of the *Penguin*, reports that a microscopic examination of the specimen from 5147 fms. shows that the remains of siliceous organisms are almost, if not entirely, absent. The mineral particles are in a minute state of disintegration, and consist of exceedingly fine flocculent matter, mixed with pumice and other glossy volcanic products, green crystals of augite and reddish crystals of pelagonite.

These deep hollows furnish fresh evidence to the observed fact that all the extreme depths in the ocean

are near land or shallow water, and apparently follow the trend of such upheaved parts of the earth's crust.

The positions of the soundings are:—

Lat. S.	Long. W.	Depth.	Fms.	Feet.	Nature of bottom.
23° 39'	175° 04'	5022	30,132	(Wire broke.)	
28° 44'	176° 04'	5147	30,882	Red clay.	
30° 28'	176° 39'	5155	30,930	Red clay.	

The attached chart shows their general position, the Kermadec Islands being 500 miles north-east of Auckland in New Zealand.

W. J. L. WHARTON.

THE DESTRUCTION OF TREES BY LIGHTNING.

IN an article¹ by Dr. Carl Müller, on the probable causes which induce lightning to strike certain kinds of trees and not others, the writer brings together some very interesting information, which has from time to time been gleaned from experiments and observations. In Germany, where the study of forestry is considerable, and where any experiments for procuring the welfare and preservation of trees are treated with great importance, the investigations on the point now under consideration have a very practical object, for great damage must be yearly done by the storms which occur there during the summer months. The work to which reference is here chiefly made is that of Dimitrie Jonescu,² and his observations are based on close observation in the field and experiments in the laboratory. The knowledge that we thus obtain contrasts strikingly with that previously attained, which was founded, for the most part, on conjecture and hearsay.

It has long been known that lightning seemed to have a special fascination for certain kinds of trees, and therefore preferred to

strike these rather than others. We have been informed, for instance, that the laurel was seldom if ever struck; while the oak, on the other hand, was the tree which, above all others, was signalled out for this purpose. We do not mean to say, however, that other trees are never damaged in this way, for all are to a more or less extent; but it seems that, in consequence of an unknown reason, preference is given to some more than to others.

A study of this question therefore, if it is to be

¹ *Himmel und Erde* for Jan. 1896.

² "Über die Ursachen der Blitzschläge in Bäume" in "Jahresheft des Vereins für Vaterland. Naturkunde in Württemberg," 1893, S. 32-62.