

resistance, which is 0.7 of its value at room temperature at about 2.1° abs., has vanished $\frac{1}{10}$ lower. The level, from which the resistance falls steeply, lies about three hundred and fifty times higher than for the 'classical' superconductor mercury, and about a thousand times higher than for the 'classical' superconductor tin.

Of course, it may be that superconductivity is a much more general property than has been supposed until now. At 1.5° abs., however, neither gold nor bismuth is a superconductor.

W. J. DE HAAS.

University of Leyden,
Dec. 28.

The Arc Spectrum of Chlorine.

L. A. TURNER (*Phy. Rev.*, vol. 27, p. 397; 1926) discovered the fundamental or resonance lines of chlorine due to the transition $4M_2(M_2 \leftarrow N_1)$. De Bruin (*Amsterdam Proc.*, vol. 30, p. 20; 1927) found a number of lines in the visible with the constant frequency difference of 530, and Laporte in a note to NATURE (vol. 121, p. 1021; 1928) announced the discovery by Asagoe of a set of lines between $\lambda 4700$ and $\lambda 4200$, which he ascribed to the transition $4M_2(N_1 \leftarrow N_2)$.

In a paper to the *Indian Journal of Physics* (vol. 3, p. 67; 1928), it has been shown that if a group of successive elements (for example, Al, Si, P, . . . , K) be taken, the wave-numbers of the lines of the elements due to the transition $N_1 \leftarrow N_2$, increase linearly with the atomic number. This enables us to predict that the lines of chlorine arising from the above transition will lie in the infra-red, the strongest line having the wave-length $\lambda 8400$. The lines of chlorine which Laporte mentions cannot, therefore, be due to the transition $4M_2(N_1 \leftarrow N_2)$, but may be due to the transition $4M_2(N_1 \leftarrow O_2)$, forming the higher Rydberg sequence of the infra-red lines. Using a special kind of chlorine tube, I have been able to photograph these infra-red lines on a neocyanine plate. The lines lie exactly where they were expected. The quartet combinations, namely, ${}^4(PD)$ and ${}^4(PS)$, have been obtained, the ${}^4P_{321}$ -differences being 530 and 340. The ${}^4(P\bar{P})$ -lines lie beyond $\lambda 8700$ and have not yet been obtained. With this data the ionisation potential of chlorine is estimated at about 13 volts.

It is interesting to note here that most of these infra-red lines seem to be identical with some of the unidentified lines in the solar spectrum as given in the "Revision of Rowland's Preliminary Table of Solar Spectrum Wave-lengths" by the staff of the Mount Wilson Solar Observatory. Infra-red lines of sulphur have been traced in the sun by Meissner (*Phys. Zeit.*, vol. 15, p. 668; 1914), but the corresponding argon lines are clearly absent. Chlorine lines seem to be present. It may not be impossible that, like the helium lines, these infra-red lines of elements from silicon to argon may come out strongly in the spectrum of the solar chromosphere.

K. MAJUMDAR.

Department of Physics,
University of Allahabad, India,
Nov. 25.

Salmon Disease.

I AM particularly interested in the reference to the work of Dr. F. H. A. Clayton and Miss Isobel J. F. Williamson on salmon disease which appeared in NATURE on Dec. 29, 1928.

As Dr. Clayton refers in his concluding remarks to the possibility of the existence of 'carriers' spreading

salmon disease, the following note on the occurrence of this disease among coarse fish may be of interest to readers of NATURE.

In 1914 and 1915 this disease was very prevalent locally among gold fish both in private aquaria and in the laboratory stock. It also assumed epidemic intensity among roach in a private ornamental pond. The occurrence of this disease among coarse fish so well removed from any stream or contact with salmon was of considerable interest. An investigation was made and the results reported to the Board in 1915; from this report the following conclusions are quoted:

(1) That coarse fish are subject to a bacterial disease which resembles in many respects that occurring among salmon.

(2) That this disease, or a disease producing similar pathogenic conditions, occurs fairly commonly among coarse fish both in aquaria and in relatively open situations where salmon and similar fish do not occur.

(3) The great similarity between the diseases found attacking coarse fish and salmon, and also between the organisms isolated, suggests that it is one disease fairly frequent among coarse fish generally, and that occasionally it attains a marked virulence among salmon and is then known as the 'salmon disease.'

Since this investigation was made the disease has not been so prevalent and the laboratory stock has been relatively free, but roach taken from a local lake in May last were infected with this disease. It would appear, therefore, that the disease is endemic among coarse fish, where it may attain epidemic virulence as in the 1914-1915 outbreak, and that coarse fish may readily provide the necessary 'carriers.'

J. W. HAIGH JOHNSON.

Biological Laboratory,
West Riding of Yorkshire Rivers Board,
71 Northgate, Wakefield.

The Average Life Period of an Atom.

I QUITE agree with Dr. Jeffreys (NATURE, Jan. 19, p. 87) that a reader of my original letter would not have gathered much about Dr. Jeffreys' views on earth history from my remarks about the average life period of an atom. The whole point of my letter was that as the earth at present appears to be approximately in thermal equilibrium, the life period of a terrestrial atom must be very large compared with that of the universe. Dr. Jeffreys' contention that 13 per cent approximately of the present heat loss must, of necessity, be attributed to primeval heat, leaving only 87 per cent to be explained by all atomic disintegration processes, known or unknown, only strengthens this proposition.

Personally, I am not prepared to accept Dr. Jeffreys' view that the equation of heat conduction in a solid material is sufficient to determine the whole past and future history of the earth's crust. At certain epochs in that history it is possible that we may be confronted with the problem of a liquid substratum overlain by its own solid. In considering the probable history of such a case, it would appear not to be sufficient to consider the heat flow due to conduction in the upper solid alone. The transference of heat in the liquid layer by convection and the physical properties of the liquid must also be taken into account.

Readers interested in this problem might consult two papers by Dr. Joly and Dr. Jeffreys in the *Philosophical Magazine* for January 1928, and one by Dr. H. H. Poole and myself in the same periodical for March 1928.

J. H. J. POOLE.

Trinity College, Dublin.