Proceedings of the General meeting of the Pusa Agricultural Research Society held on 10th March 1950.

The first meeting of the Socity was held on the 10th March 1950 when Dr. K.S.Krishnan, Director, National Physical Laboratory gave a talk on the "Carbon Atom in Chemistry". Dr. B.P.Pal presided.

The speaker at the outset described the position of the carbon atom, in the Periodic Table, namely in the fourth column midway between the metallic elements on one side and the non-metallic elements on the other, and right at the head of this column, as unique, and he discussed many of the peculiar properties of the carbon atom both in the elementary state and in its numerons combinations with other atoms, in relation to this unique position in the Periodic Table occupied by the carbon atom. As is well known the four outer electrons in the free carbon atom are two of them of one kind, and the other two slightly different. But in combination with the neighbouring carbon atoms, these four electrons get hybridised either all the four becoming identical, as in doamond in which the four valency bonds are directed towards the corners of a regular tetrahedron, or three of them being identical as in graphite, in which the carbon atoms form a regular hexagonal net work, and the corresponding valency bonds are planar and are directed towards the corners of an equilateral triangle, and the fourth electron being more or less free to move over the whole of the net work, and these mobile electrons taking part in the extremely weak binding between adjacent layers of carbon atoms. The exceptional properties of diamond, namely its extreme hardness, its high refraction and its dielectric behaviour on one side, and the extremely flaky structure of graphite, its lubricating properties, its metallic behaviour in the plane of the flakes, and its large electrical resistivity perpendicular to the plane of the flakes (at least ten thousand times that along directions in the plane of the flake, and its abnormal diamagnetism for incidence of magnetic field perpendicular to the plane of th flakes, on the other side, all receive a very natural expla-

explanation in terms of the respective electronic structures in these two modifications of carbon. These very striking properties persist in the numerous compounds of carbon, the tetrahedral valency bonds in aliphatic combinations corresponding to those in diamond, and the plane hexagonal structure of benzene, and the condensed poly-benzene nuclear compounds corresponding to the graphite structure. Indeed a single graphite is the limiting case of a condensed poly-benzene nuclear hydro carbon, in which the ratio of the number of hydrogens to the carbons progressively decreases with the increase in size of the compound, until ultimately the number of hydrogens becomes relatively insignificant.

The speaker referred to the numerous models of the benzene ring proposed by Kekule, Dewar, Bayer, Armstrong, Ladenburg and others, all of which had some merits, but could not be reconciled with one another. The fundamental defect in all these models is in their attempting to locate the fourth valency bond of the carbon atom, which the lecturer pointed out, is by its very nature not localised. It is a sort of migratory electron which can wander more or less freely over the whole of the benzene ring, and when once this is realized all the major differences between the different models get resolved.

He then pointed out how the structure of the benzene ring can be simulated by the alternate atom in the ring being nitrogen and boron respectively instead of all of them being carbons: the nitrogen atom having one more electron than carbon, and the boron having one less, combining to give a structure essentially the same as that of the benzene ring. The separation of boron traces from graphite hence presents a very difficult problem.

The speaker then referred briefly to the use of radioactive carbons as tracers. He also drew attention to the occurrence in nature of the different isotopes of carbon. In addition to the well known major constituer

C^{12} and C^{13} which a little over 1% -- both of which are stable, there is a very rare component of atomic weight 14 which also is present in nature roughly about 1 part in some thousand millions. This is radioactive, disintegrates with emission of -particles, and has a half-life period of about 5,500 years. In all living organisms there is an exchange of the carbon atoms present in them, ~~but~~ with those in the atmosphere, and hence as long as it is alive, the relative abundance of the different isotopes of carbon, particularly the ratio of C^{14} to C^{12}, remains the same in as the rest of nature. But when the organism dies, this exchange is not kept up, and hence the C^{14} content decreases by radio-active disintegration. Hence a comparison of the C^{14} content of a piece of dead wood with the normal content in a piece of fresh wood, will enable us to fix the date when the exchange with nature stopped, and hence in dating the wood. This is one of most convenient methods of dating dead wood, but since the C^{14} content is already very small, and its half period is about 5,500 years, the dating is dependable only up to a few thousand years, and becomes less and less accurate as we proceed to more and more remote past.

A lively discussion followed in the course of which, at the suggestion of the President, the speaker gave a short account of the magnetic method of dating and its application to archaeology.

With a hearty vote of thanks to the learned speaker and the chair, the meeting terminated.