was tested in regard to its porosity, and this was found to be considerable—a remarkable result, having in view the conditions under which it had been formed.

Another point of interest was that where the soft graphite had been driven into the Acheson graphite plug at the bottom of the apparatus it became extremely hard, so much so that a hard steel file made little or no impression upon it.

The main difference in treatment of this part of the graphite as compared with the remainder is that it was cooled much more quickly, thanks to the high heat conductivity of the Acheson graphite plug. The cause of hardening has hitherto not met with any satisfactory explanation.

No appreciable quantity of carbide of magnesia was formed in the experiments. The magnesia close to the graphite core contained traces of carbides, but as there were always traces of iron left from the drilling-out process, this may be plausibly accounted for by the formation of carbide of iron.

The graphite was finally systematically searched for microscopic diamonds by Staudenmaier's modification of Brodie's method of conversion of graphite into graphitic acid,[1] or else by Moissan's modification of the same method.[2] A convenient means of distinguishing diamond in fine powder from most or all of the substances which are not separated by a liquid of density 3·34 at 4° C. is to heat the powder in a silver spoon to a dull red heat in fused potassium hydroxide. Check experiments showed that diamond dust easily passing a sieve with 100 threads to the inch would withstand the action of molten caustic potash at a temperature at which the edges of the silver spoon began to melt for five or ten minutes. Crystals of alumina or of carborundum are entirely destroyed by this fusion, but the diamond particles seemed to have undergone no change. In fact, the individual fragments could be recognised under the microscope after passing through the ordeal.

I am led to consider that my experiments indicate that no wholesale transformation of amorphous carbon or graphite into diamond can be brought about by temperatures of the order of 2000° C. and pressures of more than 50 and less than 100 tons per square inch. There is some uncertainty, as already mentioned, in regard to the actual pressures operative during the trials. Prof. Tammann has, however, obligingly directed my attention to the fact that the equilibrium curve graphite-diamond may nevertheless have been crossed, but that no diamond was formed because time for crystallisation was not allowed under the conditions of the experiment. I confess my idea in making the trials was that the amorphous carbon or graphite might be forced to melt, and then that the conditions would require it to re-crystallise as diamond—not, of course, in the form of large clear crystals, but rather in the form of bort or black diamond.

The experiments described have only been rendered possible by the invention of high-speed steel, which keeps its hardness up to nearly, or quite, a red heat, and any further advance—mainly in the direction of the allowance of more time—must wait for improvements in that material. It may very well be, however, that the limits of temperature within which crystallisation in diamond form can take place are really very narrow at any pressure; and in this case it will be a matter of very great difficulty to make an apparatus in which the conditions could be kept constant for a sufficient length of time, and the difficulty would be greater the higher the temperature.

It is noteworthy from this point of view that in Moissan's artificial production of diamond very much lower pressures and temperatures were used than those just described. I have shown[3] that, using iron as a solvent, it is highly improbable that Moissan attained a pressure of more than 20 tons/sq. inch, and when silver was employed the pressure must have been much lower. A similar criticism places the effective temperature of formation of diamond in iron or silver spheroids at something of the order of 1500° C. Comparing the experiments of Moissan with those described above, it looks as if Roozeboom's opinion is at present the most probable, viz. that solvents are necessary in order to depress the crystallisation point of diamond to a temperature at which the transformation to graphite is slow enough for rapid cooling to interrupt it. In this case the next step would be to repeat the experiments I have described at the highest possible pressure in the presence of iron, though Mr. Parsons[1] has already made some trials in this direction with negative results. We have, however, many metals which have never been tried in this connection, and one or other of them may turn out to have the requisite properties.

[1] Ber., 1898, xxxi., 1485. [2] Electric Furnace, 49, translation.
[3] Journ. Chem. Soc., xciii., 1908, 1351.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The board of anthropological studies has elected Mr. A. R. Brown, fellow of Trinity College, to the Anthony Wilkin studentship in ethnology and archæology. The John Winbolt prize has been awarded to Mr. E. T. Busk, of King's College.

A university lectureship in zoology, recently held by Prof. Gardiner, is now vacant. The general board of studies will shortly proceed to appoint a lecturer to hold office from January 1, 1910, until September 30, 1914. The annual stipend is 50*l*. Candidates are requested to send their applications, with testimonials if they think fit, to the Vice-Chancellor on or before Saturday, November 27.

The Vice-Chancellor gives notice, on behalf of the board of geographical studies, that the Rev. T. G. Bonney, F.R.S., has consented to deliver a lecture in Cambridge on Thursday, November 25, at 5 p.m., on "A Desert Phase in the Development of Britain." By permission of Prof. Hughes the lecture, which will be illustrated by lantern-slides, will be given in the large lecture-room of the Sedgwick Museum of Geology.

The professor of botany also gives notice that Dr. H. H. W. Pearson, of Gonville and Caius College (professor of botany in the South African College, Cape Town), has consented to deliver a lecture at the Botany School on Friday, November 19, at 5 p.m., on "A Botanical Journey in South-west Africa."

The general board of studies has approved Dr. C. S. Myers, of Gonville and Caius College, and A. E. Western, of Trinity College, for the degree of Doctor in Science.

LIVERPOOL.—Mr. W. S. Abell, instructor in naval architecture at the Royal Naval College, Greenwich, has been appointed to the chair of naval architecture endowed by Mr. Alexander Elder.

OXFORD.—Mr. Balfour will deliver the Romanes lecture in the Sheldonian Theatre on Wednesday, November 24. Lord Curzon of Kedleston, Chancellor of the University, will preside.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 11.—Sir Archibald Geikie, K.C.B., president, in the chair.—H. C. **Ross**: The vacuolation of the blood-platelets: an experimental proof of their cellular nature.—H. G. **Plimmer** and Captain W. B. **Fry**: Further results of the experimental treatment of trypanosomiasis, being a progress report to a committee of the Royal Society.—G. S. **West** and B. M. **Griffiths**: *Hillhousia mirabilis*, a giant sulphur bacterium.—Dr. H. B. **Fantham** and Miss Annie **Porter**: The modes of division of *Spirochaeta recurrentis* and *S. duttoni* as observed in the living organisms. The observations recorded were made on living Spirochætes. The examination of living material is imperative, as results based only on stained preparations are not always trustworthy. Both longitudinal and transverse division occur in Spirochætes, as seen in *S. recurrentis*, *S. duttoni*, *S. anodontae*, and *S. balbianii*. There is a periodicity in the direction of division exhibited by *S. recurrentis* and *S. duttoni*. At the onset of infection longitudinal division occurs. This is followed by transverse division of the

[1] *Loc. cit*

Spirochætes when the infection is at its height. As the infection draws to an end, and there is a diminution in numbers of the parasites, there is a reappearance of longitudinal division. Naturally there are times when both forms of division occur together. The observations relating to periodicity were made on peripheral blood of the host. The actual processes of division, and the movements of the parasites meanwhile, are set forth in detail in the paper.—G. A. **Buckmaster** and J. A. **Gardner**: The supposed presence of carbon monoxide in normal blood, and in the blood of animals anæsthetised with chloroform. In a paper published in 1898, Desgrez and Nicloux stated that the normal blood of Paris dogs contains about 1·6 c.c. of carbon monoxide per litre, and that when the animals are anæsthetised by chloroform the amount increases to 2·5 to 6 c.c., according to the duration of anæsthesia. Their method of estimating carbon monoxide consisted in passing the blood gases over iodine pentoxide at 150° C., and determining the iodine liberated by the method of Rabourdin. The authors have carefully re-investigated the question, making use of Haldane's method of estimating carbon monoxide by means of diluted blood, after having previously ascertained that far smaller quantities of this gas than those found by the French observers in normal blood gases could be readily detected. They find that *neither normal cats' blood nor the blood of cats anaesthetised by chloroform contains any detectable trace of carbon monoxide.* They also find that most of the chloroform in the blood comes off with the gases when extracted at 40° C. In order to arrive at an explanation of Nicloux's results, the authors (1) repeated his experiments with variations, investigated (2) the effect of heat on iodine pentoxide, (3) the effect of chloroform vapour on iodine pentoxide, and (4) the effect of chloroform vapour on alkalis. The latter experiments show that chloroform vapour is readily decomposed by passing over solid potash, and also by the reagents used in gas analysis, with the production of carbon monoxide. It is concluded from the experiments (1) that chloroform is not decomposed in the blood with formation of carbon monoxide; (2) the iodine liberated in the experiments of Nicloux was due, to some extent, to the direct decomposition of the iodine pentoxide by the chloroform vapour in his blood gases, but mainly to the carbon monoxide produced by *the action of this chloroform on the solid potash over which he passed the blood gases* in order to free them from carbon dioxide.—G. W. **Ellis** and J. A. **Gardner**: The origin and destiny of cholesterol in the animal organisms. Part vi., the excretion of cholesterol by the cat. In this paper the results of a number of estimations of the cholesterol content of the fæces of cats fed on a variety of diets—animal and vegetable—of known cholesterol content, are described. It was found that cats behave similarly to dogs when fed on meat diets, but the tendency for the change of cholesterol into coprosterol appears to be greater in the case of cats. The change is, however, never complete unless the diet contains a considerable amount of fat. In all these experiments the total cholesterol and coprosterol excreted was considerably less than that taken in with the food. Without considering the cholesterol poured into the gut with the bile, the percentage deficit was 50–60, an average loss of about 0·08 gram per day. In the case of vegetable diets free from cholesterol or phytosterol, the weights of food necessary to keep the animals in condition were larger, and the amounts of fæces very much larger, than in the case of meat diets. Small amounts of cholesterol were excreted, averaging about 0·03 gram per day, but no change into coprosterol took place. In the case of artificial diets to which measured quantities of cholesterol or phytosterol were added, no excess of cholesterol above that administered was recovered from the fæces. The bearing of these results on hypotheses advanced in former papers of the series is discussed.—Prof. W. A. **Osborne**: The elasticity of rubber balloons and hollow viscera (with a note by W. Sutherland).

MANCHESTER.

Literary and Philosophical Society, October 19.—Mr. Francis Jones, president, in the chair.—L. E. **Adams**: Some notes on the breeding habits of the common mole. An account was given of observations on the length of time the young of the mole spend in the nest, and their rate of growth. Special breeding nests, sometimes as large as, but generally simpler than, the winter fortresses, from which they are further distinguished by the absence of a "bolt-run," are made by the female for the accommodation of the young. These are usually born about the middle of May, though they have been observed as early as April 24, the latest date on which they were found in the nest being June 25. The author thinks that, considering their subterranean existence, climatic changes have little influence on their pairing early or late. Fresh observations confirm the statement made in a former paper that only one litter is produced annually by each pair. In any given season all the litters were born within a period of three weeks, and, as the young remain four weeks in the nest, there could not have been time to rear two litters. In order to ascertain the rate of growth of the young, the author took one, for measurement and reference, from each of several litters, and, after replacing the nest as carefully as possible, repeated the operation at intervals of a few days. The tabulated results showed that head and body measured at birth 40 mm., and at the end of the third week 117 or 118 mm., at which limit they evidently remained for some weeks before growth recommenced. The young begin to leave the nest at the end of the fourth week, and the process is a gradual one, requiring for its accomplishment six or seven days.

PARIS.

Academy of Sciences, November 8.—M. Bouchard in the chair.—G. **Bigourdan**: A means of removing astronomical clocks from the influence of the variations of atmospheric pressure. The apparatus described and figured maintains the pressure round the clock constant, this pressure being fixed so that it is always higher than any possible atmospheric pressure.—L. **Maquenne** and M. **Demoussy**: The influence of the ultra-violet rays on the growth of green plants. The ultra-violet rays were produced by means of a Heraeus quartz mercury lamp. It was found that the ultra-violet rays determine the death of plant cells in a relatively short space of time, comparable with that required for the sterilisation of a contaminated liquid. The action is especially on the surface.—A. **Calmette** and L. **Massol**: The precipitation of the tuberculins by the serum of animals immunised against tuberculosis. In a preceding note a description has been given of a method of immunising cattle against tuberculosis by the injection of bovine bacilli cultivated on glycerinated ox bile. This method furnishes a serum of extraordinary agglutinating power. In the present note the precipitation of tuberculin from physiological saline solutions by this serum is described, and the properties of the precipitated tuberculin discussed.—M. **Giacobini**: Observations of Halley's comet, made at the Paris Observatory with the 38-cm. equatorial. Details of the observations on November 5, 6, and 7 are given. The comet is at the extreme limit of visibility; a small nucleus of the fourteenth magnitude can be distinguished, surrounded by a nebulosity of about 5″ to 6″.—Arthur R. **Hinks**: The mass of the moon deduced from photographic observations of the planet Eros, made in the years 1900 and 1901.—Eugène **Fabry**: The modulus of a Taylor's series.—E. **Vessiot**: The groups of rationality of systems of ordinary differential equations.—Demetrius **Gravé**: An identity in the theory of binary quadratic forms.—H. **Pellat**: A compound pendulum of very simple construction giving immediately the length of the synchronous pendulum. A new method of determining *g*. A description of a bifilar pendulum the bob of which contains a cavity. Two determinations of the time of oscillation are made, in one of which the mass is altered by the addition of mercury to the cavity. A simple calculation gives the length of the equivalent simple pendulum.—L. **Bloch**: The phosphorescence and oxidation of arsenic. The phosphorescence of arsenic is always accompanied by the production of the oxide. No ozone is produced, and there are no phenomena of ionisation. Both the oxides of arsenic are produced, and this is the case during both phosphorescence and during combustion with flame.—C. **Féry** and C. **Chéneveau**: The total and monochromatic radiation of incandescent lamps. A study of the relation between

temperature of the filament and watts consumed by the carbon and tungsten incandescent lamps.—Georges **Claude**: The frigorific recuperation of volatile liquids lost in various industries. In many industries, especially in the manufacture of artificial silk, smokeless powder and celluloid, considerable quantities of alcohol and ether are lost owing to the enormous dilution with air. A practical system is described in which the air containing these volatile vapours is compressed and gradually cooled by expansion to a temperature of −100° C., a special device being necessary for the preliminary separation of the water. The method is shown to be capable of effecting large economies in practice.—E. **Rengade**: The theoretical form of the cooling curves of binary mixtures.—Marcel **Delépine**: The metallic iridio-sulphates.—A. **Guyot**: New general methods for the synthesis of aromatic aldehydes. The method is based on the condensation of a phenol, hydrocarbon, or amine with the αβ-diketonic esters of the type X—CO—CO—CO_2R.—Charles **Mauguin**: The acid properties of the halogen amides: the Hofmann migration. The sodium derivative of bromacetamide, $CH_3CO.NaBr$, has been isolated and its decompositions studied.—N. **Danaila**: The oxidation of the dimethylanilinisatins.—H. **Masson**: The composition of essence of cloves. To the principal constituents already known of essence of cloves it is necessary to add methyl salicylate and two aldehydes, α-methylfurfural and a dimethylfurfural.—P. A. **Dangeard**: The photographic properties of *Chlorella vulgaris*.—M. **Biot**: Concerning *Trypanosoma lewisi*.—M. **Glover**: The examination of the respiration and the graphical analysis of speech in special schools. The radioscopic examination of the thorax has been found of great value in examining the mode of breathing.—Paul **Hallez**: The biological cycle of a form nearly related to Otoplana.—P. **Hachet-Souplet**: The psychology of the Artiozoa.—Mlle. L. **Chevroton** and F. **Vlès**: The kinematics of the segmentation of the egg and the chronophotography of the development of the sea-urchin. An application of the method of Marey to the study of the embryonic development of an animal. A series of photographs is taken at equal intervals of time, and the long film, containing 7000 to 8000 images, examined in the kinematograph.—M. **Sarthou**: The presence in milk of an anæroxydase and a catalase.—M. **Billon-Daguerre**: A mode of integral sterilisation of liquids by radiations of very short wave-length. Geissler tubes, made of quartz, containing rarefied gases, give out rays of short wave-length which are twenty-five times more powerful in producing sterilisation than ordinary ultra-violet rays. Such tubes are more economical than mercury vapour lamps, requiring a primary current of 2 amperes at 4 to 6 volts.—E. **Gley**: The action of toxic serums and their antitoxins on the nervous system. Contribution to the study of the mechanism of immunity.—E. **Gley** and V. **Pachon**: The action of toxic serums on the isolated heart of animals immunised against these serums.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 18.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture: The Statistical and Thermodynamical Relations of Radiant Energy: Sir J. Larmor, Sec.R.S.

LINNEAN SOCIETY, at 8.—A New Tipulid Subfamily: W. Wesché.—Freshwater Rhizopods from the English Lake District: J. W. Brown.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Development of Heavy Gravitation Stamps: W. A. Caldecott.—Experiments in Reverberatory Practice at Cananea, Mexico: L. D. Ricketts.

FRIDAY, NOVEMBER 19.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—An Internal-combustion Pump and other Applications of a New Principle: Herbert A. Humphrey.

MONDAY, NOVEMBER 22.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Naturalist's Travels on the Congo-Zambezi Watershed: S. A. Neave.

TUESDAY, NOVEMBER 23.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further discussion*: The Single-phase Electrification of the Heysham, Morecambe and Lancaster Branch of the Midland Railway: J. Dalziel and J. Sayers.—The Equipment and Working-results of the Mersey Railway under Steam and under Electric Traction: J. Shaw.—The Effect of Electrical Operation on the Permanent-way Maintenance of Railways, as Illustrated on the Tynemouth Branches of the North-Eastern Railway: Dr. C. A. Harrison.

ZOOLOGICAL SOCIETY, at 8.30.

WEDNESDAY, NOVEMBER 24.

ROYAL SOCIETY OF ARTS, at 8.—Photo-Telegraphy: T. Thorne Baker.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, NOVEMBER 25.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Change in Hue of Spectrum Colours by Dilution with White Light: Sir William de W. Abney, K.C.B., F.R.S.—On the Nature of the Hydrogen Flocculi and their Structure at Different Levels in the Solar Atmosphere: Prof. G. E. Hale, For.Mem.R.S. and F. Ellerman.—The Boiling Point of Sulphur corrected by Reference to New Observations on the Absolute Expansion of Mercury: Prof. H. L. Callendar, F.R.S., and H. Moss.—(1) On the Refraction and Dispersion of Neon; (2) On the Refraction and Dispersion of Air, Oxygen, Hydrogen, and Nitrogen; (3) On the Refraction and Dispersion of Sulphur Dioxide and Hydrogen Sulphide, and their Relation to those of their Constituents: C. Cuthbertson and M. Cuthbertson.—On Flapping Flight: Prof. M. F. Fitzgerald.—The Crystalline Structure of Iron at High Temperatures: W. Rosenhain and J. C. W. Humfrey.—The Relation of Thallium to the Alkali Metals: a Study of Thallium-zinc Sulphate and Selenate: Dr. A. E. H. Tutton, F.R.S.—And other papers.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Present Aspects of Electric Lighting: H. W. Handcock and A. H. Dykes.

FRIDAY, NOVEMBER 26.

PHYSICAL SOCIETY, at 5.—The Effective Resistance and Inductance of a Helical Coil: Dr. J. W. Nicholson.—Ductile Materials under Combined Stress: W. A. Scoble.—The Recoil of Radium C from Radium B: Dr. W. Makower and Dr. Sidney Russ.—The Sun's Motion with Respect to the Æther: Dr. C. V. Burton.

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