X-ray Evidence for the Existence of Different Modifications of Fatty Acids.

IN continuation of the work on the high order X-ray reflections of fatty acids done in this laboratory (J. A. Prins and D. Coster, NATURE, July 17, 1926), I tried to get the high orders with stearic acid. In determining the long spacing of a crystal of stearic acid obtained by slow crystallisation from acetone, I found the remarkable fact that the crystal showed a long spacing of 43·95 A.U., whereas a thin layer obtained by melting the acid on a glass strip gave a spacing of 39·75 A.U. Crystals obtained from alcohol and petrol also showed the larger spacing. A film obtained by evaporating an alcoholic solution on a glass strip gave the smaller spacing, but an acetonic film gave the two spacings, the relative intensities of which were altered by slight changes in the way of forming the film. Apparently these facts point at the existence of different modifications of stearic acid.[1]

As, on the other hand, Garner, Randall and Ryder (*Jour. Chem. Soc.*, 125, 881, 1924; 127, 720, 1925), from a determination of the heat of crystallisation and molecular volume, concluded that undecoic acid exists in two enantiotropic modifications, it seemed worth while to test this point by an X-ray investigation. According to Garner (*loc. cit.*) the transition takes place between 12·5° C. and 17° C. I determined, therefore, the long spacing of a layer of undecoic acid obtained by melting on a glass strip, first at 20° C. and a second time at 12·5° C. the apparatus not being changed between the two exposures (the lower temperature was obtained simply by opening the windows). At the higher temperature a spacing of 25·4 A.U. was found, which spacing has already been measured by Müller and Shearer (*Jour. Chem. Soc.*, 123, 3156, 1923). At the lower temperature, however, these lines had practically disappeared and another set of lines of strong intensity occurred on the plate, these lines belonging to a spacing of 30·1 A.U. When the temperature was raised again to 20° C. and a photograph was taken after some hours, the lines due to the longer spacing, though not wholly disappeared, were much fainter, whereas the intensity of the lines belonging to the smaller spacing had much increased

These facts give a strong support to the view suggested by Garner and his collaborators.

After these results were obtained the beautiful work of Piper, Malkin and Austin (*Jour. Chem. Soc.*, Sept. 1926) on the different modifications of the even fatty acids came to my notice. As is stated by these authors, the different spacings of stearic acid seem to be independent of the temperature, and only to depend on the manner the reflecting layer is obtained.

The higher orders are now being investigated in order to get some information about the molecular structure of the different modifications.

I am much indebted to the kindness of Prof. P. E. Verkade of Rotterdam, who put a quantity of very pure undecoic acid at my disposal.

G. M. DE BOER.

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A Rock of Unknown Origin from Glacial Gravel at Ipswich.

A LITTLE time ago I found, in the sub-Chalky Boulder Clay glacial gravel, exposed in the brickfield of Messrs. A. Bolton and Co., Ltd., to the north of Ipswich, an erratic of unusual and arresting appearance. The gravel in which the specimen was embedded is that which, in my opinion, was laid down in the interval of time between the deposition of the Kimmeridgian Chalky Boulder Clay and that of the Upper Chalky Boulder Clay of East Anglia. As I had never before seen a rock in the Ipswich area of the type discovered, I submitted it to Prof. P. G. H. Boswell, of the University of Liverpool, and to Dr. Herbert H. Thomas, of the Geological Survey, for investigation. Both these experts, though giving me valuable information upon the nature of the erratic, were unable to inform me as to its probable source of origin, and Dr. Thomas, suggesting that this source might be in some area of old rocks, such as Scandinavia, advised me to submit the specimen to Prof. Victor Goldschmidt, of Oslo. This I have now done, and with Prof. Goldschmidt's permission, I give below the result of his examination of the rock.

"I have got your specimen, and I have examined it. If the boulder has its place of origin in Norway, it must be a sandstone from one of the pre-Cambrian formations. The rock is a breccia, consisting of fragments of a sandstone rock in a matrix. The sandstone of the fragments is without any doubt a sedimentary rock, containing well-rounded grains of quartz. The matrix is rather fine-grained; the matrix contains perhaps even pyroclastic material, but that could not be ascertained. The clastic grains of the matrix are angular. One may say that none of the Eocambrian, Cambrian, or other Palæozoic sandstones of Norway has any resemblance to your specimen. Among the pre-Cambrian formations there might be several possibilities for placing the boulder. It is most likely that it may be derived from the pre-Cambrian Telemark formation, which, among other rocks also includes quartzitic sandstones, breccias, and also pyroclastics. The general character of the rock, its degree of re-crystallisation, makes it possible, but of course not certain, that it is derived from the districts around the mountain Gausta in Telemarken. My friend, Prof. J. Schetelig, to whom I showed your boulder, also agrees with me. But neither of us has ever seen exactly the same rock *in situ*. We shall look for it in Telemarken. I shall send the boulder back to your address by mail to-morrow. The thin section I shall keep here, to have a possibility to identify the boulder, if I succeed in finding the breccia *in situ*."

I would wish to thank Profs. Boswell and Goldschmidt, and Dr. Thomas, for the help they have given me in this matter. The rock, which I have deposited in the Ipswich Museum, where it can be examined, is of a definite pinkish colour.

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Thermal Agitation of Electricity in Conductors.

ORDINARY electric conductors are sources of spontaneous fluctuations of voltage which can be measured with sufficiently sensitive instruments. This property of conductors appears to be the result of thermal agitation of the electric charges in the material of the conductor.

The effect has been observed and measured for various conductors, in the form of resistance units, by means of a vacuum tube amplifier terminated in a thermocouple. It manifests itself as a part of the phenomenon which is commonly called 'tube noise.' The part of the effect originating in the resistance gives rise to a mean square voltage fluctuation V^2 which is proportional to the value R of that resistance. The ratio V^2/R is independent of the nature or shape

[1] Both lattice-constants have already been measured by Müller (*Jour. Chem. Soc.*, **123**, 2043, 1923; NATURE, **116**, 45, 1925), but he seems not to have paid much attention to the discrepancy between these two results.

of the conductor, being the same for resistances of metal wire, graphite, thin metallic films, films of drawing ink, and strong or weak electrolytes. It does, however, depend on temperature and is proportional to the absolute temperature of the resistance. This dependence on temperature demonstrates that the component of the noise which is proportional to R comes from the conductor and not from the vacuum tube.

A similar phenomenon appears to have been observed and correctly interpreted in connexion with a *current sensitive* instrument, the string galvanometer (W. Einthoven, W. F. Einthoven, W. van der Horst, and H. Hirschfeld, *Physica*, 5, 358-360, No. 11/12, 1925). What is being measured in these cases is the effect upon the measuring device of continual shock excitation resulting from the random interchange of thermal energy and energy of electric potential or current in the conductor. Since the effect is the same for different conductors, it is evidently not dependent on the specific mechanism of conduction.

The amount and character of the observed noise depend upon the frequency-characteristic of the amplifier, as would be expected from experience with the small-shot effect. The apparent input power originating in the resistance is of the order 10^{-18} watt at room temperature. The corresponding output power is proportional to the area under the graph of *power amplification—frequency*, at least in the range of audio frequencies. The magnitude of the 'initial noise,' when the quietest tubes are used without input resistance, is about the same as that produced by a resistance of 5000 ohms at room temperature in the input circuit. For the technique of amplification, therefore, the effect means that the limit to the smallness of voltage which can be usefully amplified is often set, not by the vacuum tube, but by the very matter of which electrical circuits are built.

J. B. JOHNSON.

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Oxygen = 17. Oϕ.

I KNOW that I am very ignorant, but old and unrepentant as I am I still live to learn from young people and watch their doings with delight, tho' maybe they are sometimes a little 'previous.' The argument behind Messrs. Harkins and Shadduck's letter (NATURE, December 18, p. 875) is doubtless irreproachable and unanswerable. Probably, therefore, I am more than stupid in being surprised at "the atom (presumably oxygen of mass 17) which is synthesised." Suppose, however, that a poor errant molecule of fair hydrone were the stricken 'atom,' it might well be 'electrolysed' and give OH = 17 + H = 1. Who will say me hay and make it clear that this cannot be? Uesanian orders are sometimes tall and the propinquity of the Wheat Pit may well have influenced the Chicago laboratory, just as Cambridge, being an apanage of Newmarket, is given over to racing competitions and so demoralises the whole of our educational system.

I know full well, that it is wrong for a poor worm of a chemist to turn and put a common or garden interpretation upon the work of august and fashionable physicists: that they should be regarded as kings who can do no wrong. I have, however, preserved from my youth the memory of a king who wore no clothes and myself still work a little in the garden with not too much regard for weather. NATURE, too, disturbs my belief in things. In it, Dr. Jeans—who, being senior secretary of the Royal Society, a mathematician and a man who sees stars, must know everything—has recently assured us that the elements short of uranium are infinitely stable, even at the super-satanic temperature of 12,500,000 million degrees. If so, is a mere missile of mass 4 with a range of 6 cm. likely to knock spots off them? Cannot we rather picture the nitrogen molecule, in itself a hard nut to crack, as contemptuously asking, whenever hit by an α-particle: 'Who are you shoving of?' and moving on its way, naked and unashamed, uncaressed by the particle—this latter, attended as it is from its birth by the faithful electron, as then wickedly compassing the prostitution of fair hydrone?

My faith in the immaculate judgment of the 'Physicals' would be greater if they would curb their imagination by learning just a little chemistry and would seek to tell me what happens when I rub my stylo upon my coat sleeve: a fundamental question to which I can get no answer. The α-particle may be doing as the moving stylo does. When I read the heroics in NATURE of December 18, I am only too conscious of the greatness of the 'Electronicals': still, men with the unlimited speculative power they possess might sometimes deign to deal with matters which affect ordinary mortals and with the common objects of the laboratory floor.

HENRY E. ARMSTRONG.

Temperature Coefficient of γ-Ray Absorption.

RECENT improvements in design and technique for a gold-leaf electrometer, details of which will be published shortly, have made it possible to apply the instrument with success to the problem of a possible temperature coefficient of γ-ray absorption. Preliminary measurements with lead as absorber, over a temperature range of about 250° C., indicate that when due allowance has been made for the expansion of the lead, there occurs an increase in the absorption coefficient of approximately 0·2 per cent. per hundred degrees rise of temperature. That the effect is dependent on temperature, or indeed on any incidental at all, is somewhat of a surprise; and considerable interest is added by the recent account by H. S. Read (*Phys. Rev.*, 27, p. 373, 1926) of an effect of temperature on X-ray absorption, in which he records, for lead and the five other metals examined, a temperature increase in the coefficient of the same magnitude as here reported. Further investigation is contemplated.

L. BASTINGS.

The University, Durham,
Dec. 3.

The Supposed Law of Flame Speeds.

WITH reference to Prof. Bone's letter in NATURE of Dec. 11, p. 837, it is evident that the speed generalisation advanced by Prof. R. V. Wheeler and Dr. W. Payman must break down when one of the combustible gases in a complex mixture interferes with the burning of another. This has been shown to occur for carbon monoxide–hydrogen–air mixtures by Dr. Payman (*J.C.S.*, 115, 1454, 1919). In this case the speed of burning of carbon monoxide is much increased in the presence of hydrogen. The reverse effect occurs when mixtures of carbon disulphide not too far removed from the limit are mixed with certain other combustibles (*J.C.S.*, 121, 2561, 1922). By mixing suitable carbon disulphide–air and (say) ether–air mixtures having the same speed of flame, mixtures can be obtained which refuse to propagate flame.

A. G. WHITE.

45 Caledonia Road,
Saltcoats, Dec. 20.