Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 931.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Isotopic Weight of ^{12}C

IN my last letter[1] I directed attention to the uncertainty in the value of this constant, which is particularly unfortunate as it is the most important sub-standard in the determination of isotopic weights by the mass-spectrograph. Since then I have been to great pains to make further measurements of it by as many independent methods as possible. The following is a summary of all my results in the order in which they were obtained.

(*a*) The doublet O—CH_4 was measured using a cylindrical discharge tube and varying the position of the doublet on the spectrum to minimize the effect of any local disturbances in the fields of the instrument. The results were used in fixing the fundamental isotopic weights[2].

(*b*) These measurements were repeated using a large spherical discharge tube[1].

The objections to the use of the O—CH_4 doublet to determine the isotopic weight of carbon are: (1) It is so wide (more than 22 units of packing fraction) that the effect of uncertainty in the absolute value of the dispersion coefficient may be serious. (2) The value obtained is dependent to the extent of about one third on the isotopic weight of ^1H. (3) The fact that one line is atomic and the other molecular may possibly cause asymmetry.

(*c*) The analogous doublet CO—C_2H_4 was measured. This is not so easy or accurate, but eliminates objection (3).

(*d*) The fortunate occurrence on one plate of a particularly well-matched doublet ^{40}A—C_3H_4 gave a useful check, for the values of the isotopic weight of ^{40}A show no serious discrepancy.

(*e*) The mass of ^{12}C was compared directly with that of ^{16}O by means of the close ratios $O^{++} : C \sim C : OH_2$ by artificial doublets made by applying electric fields in the ratio $3 \sim 2$. This is the method by which the packing fraction of ^{12}C was originally measured[3]. It reduces errors due to (1) and (2) each to about a third, but unfortunately the technical difficulty of controlling the intensity of the OH_2 line makes it somewhat unreliable.

(*f*) The ratio $O^{++} : C$ was now measured against $A^{+++} : A^{++}$. These artificial doublets were easier to produce, and gave very consistent results. The particles concerned are all atomic, the results are independent of hydrogen and of any reasonable error in the absolute dispersion coefficient as the ultimate difference is only 3 units of packing fraction.

(*g*) By long running with dry gases containing argon, the OH_2 line had been reduced to such an extent that three well-matched natural doublets $^{36}A^{++}$—OH_2 were obtained. In each of these the very faint intermediate line due to ^{18}O was clearly visible, enabling a provisional value for it to be found as given below. ^{36}A had already been paired with C_3, so that the packing fraction of C could be calculated from that of OH_2.

(*h*) As a further check, the ratios $^4He : C^{++} \sim A^{+++} : A^{++}$ were compared, there being no serious disagreement in the isotopic weight of He.

The accompanying table gives the mean values of the packing fraction of ^{12}C deduced from these experiments in estimated order of their reliability. My figures for the isotopic weights of hydrogen, helium and argon have been used in the calculations, and the appropriate small corrections for the mass of the electron have been applied in the case of artificial doublets.

	Method	Number of independent observations	Packing fraction of ^{12}C deduced
(*a*)	O—CH_4	14	2·96
(*b*)	O—CH_4	13	2·97
(*c*)	CO—C_2H_4	18	2·91
(*f*)	$O^{++} : C \sim A^{+++} : A^{++}$	15	2·91
(*g*)	$^{36}A^{++}$—OH_2, ^{36}A—C_3	3,6	2·99
(*e*)	$O^{++} : C \sim C : OH_2$	18	3·11
(*h*)	$He : C^{++} \sim A^{+++} : A^{++}$	5	3·00
(*d*)	^{40}A—C_3H_4	1	3·0

These results justify the value 2·96 which I have been using, and enable its probable error to be reduced. The following are the values deduced:

Symbol	Packing fraction	Isotopic weight
^{12}C	2·96	12·00355 ± 0·00015
^{18}O	3·2	18·0057 ± 0·0002
^{36}A	−6·10	35·9780 ± 0·0010

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[1] NATURE, **138**, 1094 (December 26, 1936).
[2] NATURE, **137**, 357 (February 29, 1936).
[3] *Proc. Roy. Soc.*, A, **115**. 499 (1927).

Temperature Equilibrium of C-Neutrons

THE slow neutrons leaving a block of paraffin wax, containing a source of fast neutrons, mostly possess thermal energies. The existence of such thermal neutrons has been established by the discovery[1] that the temperature T of the paraffin has an influence on the activities induced in various elements. Since the neutrons penetrating a screen of cadmium do not show this effect[2], cadmium may be used to discriminate between the slowest neutrons (C-neutrons[3]) and the faster ones.

The dependence on temperature of the absorption of C-neutrons has been studied by a number of investigators[4]. If the C-neutrons are in thermal