Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 622.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

New Data on Isotopes

ISOTOPIC WEIGHTS BY THE DOUBLET METHOD

CONTINUING work with my new mass-spectrograph[1], I have made measurements of several more doublets. That of N, CH_2 was easy to obtain with a mixture of nitrogen and methane, and gave very consistent results. The vapour of pure heavy water did not, at first, give as strong a line at 20, OD_2, as was hoped, but as 19, ODH, was good, CF_4 was introduced and the doublet F, ODH measured. Later the intensity of OD_2 was improved and enabled a comparison with ^{20}Ne to be made. The latter line was then coupled with doubly charged ^{40}A, giving a very close doublet. By the use of BF_3 with a suitable quantity of neon, the fairly wide doublet ^{10}B, $^{20}Ne^{++}$ was photographed. The spectra also showed the expected doublet at 29 due to ^{29}Si and ^{10}BF. This gave the first accurate measurement of the mass of the former. The following are the results :

Doublet	Number of doublets measured	Difference in packing fraction	Difference of mass
N, CH_2	17	$8{\cdot}8_9 \pm 0{\cdot}05$	0·01245
F, HDO	10	$9{\cdot}6_4 \pm 0{\cdot}15$	0·01833
Ne, D_2O	14	$15{\cdot}4_1 \pm 0{\cdot}2$	0·03083
A^{++}, Ne	11	$5{\cdot}4_4 \pm 0{\cdot}15$	0·01088
Ne^{++}, ^{10}B	14	$16{\cdot}8_3 \pm 0{\cdot}15$	0·01684
^{29}Si, ^{10}BF	7	$11{\cdot}8 \pm 0{\cdot}2$	0·0342

On a plate obtained when ethane was present in the discharge, two spectra gave good measurable doublets at 27. It is quite certain that the heavier member is due to C_2H_3, and highly probable that the lighter is ^{27}Al derived from the cathode. If this is so, it provides the first measurement of the mass of this simple element. What was assumed to be the doublet ^{28}Si, CO was also measured, but the conditions were not favourable to accuracy. The following are the packing fractions and isotopic weights deduced. Those of ^{27}Al and ^{28}Si are only provisional.

Symbol	Packing fraction	Isotopic weight
^{10}B	16·1	10·0161 ± 0·0003
^{14}N	5·28	14·0073 ± 0·0005
^{19}F	2·36	19·0045 ± 0·0006
^{20}Ne	− 0·70	19·9986 ± 0·0006
{ ^{27}Al	− 3·3	26·9909 }
{ ^{28}Si	− 5·0	27·9860 }
^{29}Si	− 4·7	28·9864 ± 0·0008
^{40}A	− 6·15	39·9754 ± 0·0014

SOME DOUBTFUL ISOTOPES

Owing to the rapid advance in research on disintegration and the theory of nuclear structure, the existence or non-existence of rare isotopes has acquired an entirely unexpected importance and calls for a short review of the present situation.

The possible presence of lines due to compounds, particularly hydrides, has been a bugbear of mass-spectrum analysis from the start. When S 33, 34 and Ne 21 were found to be true isotopes, caution was somewhat relaxed, with regrettable results in the case of Zn and Ge. So long as ample resolution and intensity are both available, negative results are absolutely conclusive, and the spectra obtained by Bainbridge for these elements showed that many of the lines recorded by me were really hydrides. I corrected the values of abundance for this result in my book[2], and it is of interest to note that the correction brought the atomic weight of Ge into good accord with the chemical value recently confirmed by Honigschmid[3].

From the work of Dempster[4] and Bainbridge and Jordan[5] it is clear that similar corrections must be made for Cd 115, Sn 121 and Pb 209, though in the last case I find it difficult to explain line 224 on my spectra, which seemed to confirm the presence of $^{209}PbCH_3$. The following are the revised figures for percentage abundance, all the rarer isotopes of lead being regarded as doubtful.

Cd mass numbers	106	108	110	111	112	113	114	116		
Abundance	1·5	1·0	15·6	15·2	22·0	14·7	24·0	6·0		
Sn mass numbers	112	114	115	116	117	118	119	120	122	124
Abundance	1·1	0·8	0·4	15·5	9·1	22·5	9·8	28·5	5·5	6·8
Pb mass numbers	204	206	207	208						
Abundance	1·5	28·3	20·1	50·1						

The parabola analysis of Ni and Fe by de Gier and Zeeman[6] is, except for Ni 61, in excellent agreement with my own. Their results for Fe 58 and Ni 64, present on my plates, but of doubtful origin, makes it highly probable that these are true isotopes. The evidence as to Ni 61, where unfortunately the resolving power of the parabola apparatus is pushed to its limit, I regard as conflicting. The line 61 on my plates cannot possibly be due to a hydride of Ni and if, as is suggested, it is C_5H, there is the further difficulty in explaining my confirmatory line 89 $^{61}NiCO$. The matter will best be settled by the production with an instrument of ample resolving power, such as Dempster's, of a spectrum so strong that components considerably weaker than Ni 64 could be detected.

With regard to the remarkable mass-spectrum obtained by Dempster[4] with a mixture of rare earths, it appears to me probable that the lines 148, 150 are due to isotopes of Nd not recorded by the feebler beams I was able to get with anode rays. If this is so, the discrepancy between the physical and chemical atomic weight of that element may disappear.

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[1] NATURE, **137**, 357 (February 29, 1936).
[2] "Mass-spectra and Isotopes". (Arnold, London, 1933).
[3] *Z. anorg. Chem.*, **225**, 81 (1935).
[4] *Proc. Amer. Phil. Soc.*, **75**, 735 (1935).
[5] St. Louis meeting, Amer. Phys. Soc., *Phys. Rev.*, **49**, 416 (1936).
[6] *Proc. K. Akad. Wet. Amsterdam*, **38**, 810, 959 (1935).