Neutrons and Protons in Atomic Nuclei

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HEISENBERG has discussed the hypothesis that the nucleus of an atom is composed of neutrons and protons only, the neutron being regarded as a fundamental entity and *not* as a combination of an electron and a proton. On this view, the nucleus is formed of n neutrons and p protons, and p is also the number of planetary electrons required to form an electrically neutral atom. Thus p, the charge number, is identical with Moseley's atomic number, Z, which determines the position of the element in the periodic table. The mass number, A, is the sum of n and p. For example, the nucleus of an ordinary hydrogen atom consists of a single proton, while that of the hydrogen isotope of mass 2 consists of one proton and one neutron. The helium nucleus or α-particle, which may form a constituent of heavier nuclei, is composed of two protons and two neutrons.

Importance is attached to the value of the *ratio* of n to p, which is supposed to determine disruption of a radioactive nucleus. The question as to whether these numbers are odd or even is also of moment. For light elements, n is very nearly equal to p, never differing from it by more than one or two units. E. C. Pollard[1] concludes that the height of the potential barrier of a light nucleus is proportional to the atomic number, and claims that this is in agreement with Heisenberg's suggestions.

The accompanying table gives the values of p and n and the mass number A for hydrogen and the elements in the two short periods at the beginning of the periodic table. The more abundant isotopes are printed in heavy type. A study of the table brings out several interesting points with regard to their distribution. In the first period, helium with its single isotope is followed by three elements, Li, Be, B, for which the more abundant isotope has $n=p+1$. Then come three elements, C, N, O, for which the condition for abundance is that $n=p$. The period ends with fluorine, F, having only one known isotope. In the second period there is another type of symmetry, and there is a well defined alternation in the position of the more abundant isotope as we pass from group 0 to group VII. The figures in the table are also of interest in connexion with the artificial disintegration of the atomic nucleus.

There is no difficulty in extending the table so as to include other periods, but the results tend to become more complicated as the atomic number increases.

HYPOTHETICAL NUCLEAR STRUCTURE OF LIGHT ELEMENTS

showing the number of protons (p) and neutrons (n).

H $1p$ $A=1$ **0n** $A=2$ $1p$ $1n$

0	I	II	III	IV	V	VI	VII
He $2p$ **4 2n**	**Li** $3p$ 6 $3n$ **7 4n**	**Be** $4p$ 8 $4n$ **9 5n**	**B** $5p$ 10 $5n$ **11 6n**	**C** $6p$ **12 6n** 13 $7n$	**N** $7p$ **14 7n** 15 $8n$	**O** $8p$ **16 8n** 17 $9n$ 18 $10n$	**F** $9p$ **19 10n**
Ne $10p$ **20 10n** 21 $11n$ 22 $12n$ 23 $13n$	**Na** $11p$ **23 12n**	**Mg** $12p$ **24 12n** 25 $13n$ 26 $14n$	**Al** $13p$ **27 14n**	**Si** $14p$ **28 14n** 29 $15n$ 30 $16n$	**P** $15p$ **31 16n**	**S** $16p$ **32 16n** 33 $17n$ 34 $18n$	**Cl** $17p$ **35 18n** 37 $20n$ 39 $22n$

[1] NATURE, **131**, 97, 398; 1933.

Forestry Practice

SIR FRANCIS D. ACLAND, a forestry commissioner, has undertaken a most timely piece of work in publishing a small brochure on "Forestry Practice—A Summary of Methods of Establishing Forest Nurseries and Plantations with Advice on other Forestry Questions for Owners and Agents" (Forestry Commission, Bulletin No. 74, H.M. Stationery Office, 1933). This little book, replete with practical advice, should prove of the greatest value to proprietors of land who are engaged in planting, and should give encouragement to, and provide knowledge for, those who hesitate to improve their properties by this form of monetary outlay.

After referring to the results given in the "Census of Woodlands", published by the Commission in 1928, it is pointed out that the existing reserves of mature coniferous timber in Great Britain are equivalent to less than a six months' consumption. The younger crops, though well distributed through the various age-classes, are on the same small scale. Oak planting in particular has gone out of fashion and future supplies of home-grown oak are endangered. The total area of woodlands tends to diminish and the productiveness of the area under coppice and coppice-with-standards will probably be reduced. There is thus plenty of room for improvement, and those who plant for the future should not be deterred by present unfavourable prices. As regards the decrease in area of existing coppice-with-standards woods, when the standards consist chiefly of oak, there is unfortunately little doubt that they are in some counties disappearing at an alarming rate under the ruthless operations of the timber lumberer.

The author's advice to the landowner is strongly supported by the opinion expressed by Lord Clinton, when chairman of the Forestry Commission. Speaking at an annual meeting of the Scottish Arboricultural Society, he said: "I am not at all confident that the State can properly undertake the full duties of afforestation" (NATURE, 122, 231, August 18, 1928).

It is impossible here to discuss the treatment of