The accurate values have been calculated as described by Jaeger and Hulme[1] (*loc. cit.*) using Dirac wave functions. The numerical work is tedious, and only the most important electronic transitions have been taken into account in calculating the absorption cross-section per atom (σ), which should be correct to within 5 per cent. Screening has been neglected, which is quite justifiable for low energies. It will be seen that σ approaches the value given by the Born approximation quite rapidly, the difference varying as Z^4. The three values calculated lie on the curve

$$\sigma \times 10^{24} = 0{\cdot}95(Z/137)^2 + 2{\cdot}54(Z/137)^4,$$

the first term giving the Born approximation. An empirical formula of this type could probably be used to fit results at higher energies. The increase in $\overline{E}_+ - \overline{E}_-$ is roughly linear, as we should expect (see Bethe and Heitler, *loc. cit.*, p. 108).

We may summarise by saying that the Born approximation always gives results which are too low, but the error decreases rapidly with decreasing atomic number and increasing energy of the γ-ray.

J. C. JAEGER.

University of Tasmania,
Hobart.

[1] Jaeger and Hulme, *Proc. Roy. Soc.*, A, **153**, 443 (1936).
[2] *Proc. Roy. Soc.*, A, **146**, 83 (1934).

The *D* Region of the Ionosphere

DURING the last ten years, investigations based upon the mathematical theories of Eccles and Larmor have given considerable information regarding the reflecting layers of the atmosphere. The most interesting discovery was that of Prof. E. V. Appleton, who showed that there is an upper reflecting region in addition to the Kennelly-Heaviside layer.

From experiments which we have conducted during the last year, we are led to believe that there is a third region at a height of 5–50 km. which strongly reflects radio waves. Such a layer has been postulated before as an absorption layer in the ozone region, but its reflecting powers have not been emphasised.

Our apparatus consists of a sending station which gives out sixty pulses per second, each pulse lasting ten microseconds. The signal is received upon a rotatable loop or a standard antenna located two hundred metres from the sending station. After passing through a special receiver having a wide band pass and short lag characteristics, the signal is observed visually upon a cathode ray oscilloscope. The rapid sweep of the oscilloscope separates the reflected and the ground rays.

From the many observations which have been made, the following important conclusions may be drawn :

(1) The lower part of the *D* region is well within the normal winds of the troposphere. It occasionally rises to a height of 50 km. in low-pressure areas and drops to 5 km. in high-pressure areas. It is the rise and fall of this region which causes the change in signal strength of nearby broadcasting stations such as *KDKA* (150 km. north of Morgantown).

(2) Generally there are reflections from two parts of the region at virtual heights of 5–30 km. and 40–55 km. During periods of low barometer these two reflections may combine.

(3) At times the region is very erratic. The polarisation and intensity change with great rapidity. This is especially true near the hours of sunrise and sunset.

(4) The *E* and *F* layers (Kennelly-Heaviside and Appleton layers) are shielded by the lower region. When the intensity of the *D* reflections increases, that of the two other layers decreases.

(5) The two waves employed were 1,614 kc. and 3,492·5 kc. The penetration and variations are greater on the higher frequency.

(6) Periodic fading has been observed on stations within 150 km. due to the change in the interference pattern when the *D* region is either rising or falling.

Messrs. N. I. Hall and L. R. Hill collaborated with us in making these measurements.

R. C. COLWELL.
A. W. FRIEND.

Department of Physics,
West Virginia University,
Morgantown.

Origin of the Term 'Solute'

IN 1894, at the instigation of Sir Henry A. Miers, my teacher in crystallography at the Central Technical College, London, I prepared a translation and enlargement of Fock's "Einleitung in die chemische Krystallographie" which was published by the Clarendon Press under the title of "An Introduction to Chemical Crystallography" in 1895.

The late Prof. N. Story-Maskelyne, who then held the chair of mineralogy in the University of Oxford, kindly wrote a preface, dated Nov. 18, 1894, to this little work. In this preface occurs the phrase "what for lack of a much-needed term I may call the *solute* (namely the substance or substances dissolved)". The word solute is italicised in the original.

Crystallographers have always been facile inventors of new words, and to Story-Maskelyne, a master of the art, must be ascribed the parentage of the term referred to in NATURE of April 25 (p. 698).

W. J. POPE.

The Chemical Laboratory,
Cambridge.

THE "Introduction to Chemical Crystallography", to which Sir William Pope refers, was reviewed in NATURE of August 1, 1895 (52, 315), and in the notice the word 'solute' occurs italicised as here shown : "the conditions of equilibrium in a solution containing various *solutes* (to employ a convenient word suggested by Prof. Maskelyne in his preface as a term for the substances dissolved)". Though the preface was dated November 18, 1894, the book containing it was not published until 1895. Before this date, Prof. F. G. Donnan had proposed the use of the word 'solute' in a letter from Leipzig published in NATURE of December 27, 1894. The letter is so short that we reproduce it in full. "Corresponding to the words 'solvent' and solution, some word is very badly wanted to express 'the dissolved substance'. The analogous word is evidently 'solute', and it is as short and euphonious as the others. May I inquire why it is not in general use ? Surely someone must have proposed it."

To Prof. Donnan, therefore, appears to belong the credit of first publication of the suggested use of the word 'solute' in the sense in which it has since been employed.

[ED. NATURE.