

summit. Some day, perhaps, a liquid oxygen apparatus will be established at the 18,000 feet level and Everest thereby conquered in safety.

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¹ NATURE, 128, 1037, Dec. 19, 1931.

WITH most of what Mr. N. E. Odell says,¹ in commenting upon my paper "Oxygen and Everest", I am entirely in agreement. There are one or two points, however, on which I would like to reply.

Though Mr. Odell does not actually suggest it, it might possibly appear that I had cast doubt on the possibility of acclimatisation to 29,000 feet. There is, of course, no reason to doubt the possibility, on lines either theoretical or practical. There is, however, an element of doubt as to whether so high a degree of acclimatisation can be obtained in the time available, owing certainly to the slowness of the process and possibly to the onset of altitude deterioration.

I agree that "there is nothing to warrant Dr. Greene's supposition that their [Mallory and Irvine's] failure to return was due to a breakdown in the oxygen apparatus". I have never supposed such a thing. It has never even occurred to me. I did, however, suggest as a possibility that their *lateness* might be due to this cause. This is a very different matter, and it remains a possibility, but not a supposition.

Many climbers certainly believe that Everest should be climbed without "such artificial aids as may reduce a sport to a mere laboratory experiment". Others believe that such aids may raise a mere sport to the dignity of a laboratory experiment. But I do not follow the sentence with which Mr. Odell follows up this appeal to all that is best in British sport. No one wants to repeat the steel chamber experiment he has mentioned. Some even wonder why it was ever done. But we do want to know by direct experiment whether oxygen is of use to an acclimatised man: and we do want to know whether a man can acclimatise fast enough to climb Everest in the time available. Where, as Mr. Odell says, can these things be better studied than on Everest?

I made no mention of my ammonium chloride experiments because they are still in their infancy and any conclusions based upon them would be premature and unsound.

Through my carelessness, two misprints appeared in my article. In paragraph 4 'exponents' should read 'opponents,' and in the last paragraph 'mid' should read 'wind'.

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L-Discontinuities in X-Ray Absorption.

By definition, the absorption coefficient is the factor of proportionality of absorption in an infinitely thin layer. The atomic absorption coefficient, then, is the factor of proportionality for a very small number of atoms. This factor, therefore, can be said to be a measure of the probability of absorption for each photon passing the atom.

It is also obvious from Kossel's atomic model that if an electron has been removed from a certain level by an absorption process, this must be accompanied by an emission process corresponding to an electronic transition into the vacant position. Therefore the absorption processes of the highest excited level must be as frequent as the emission processes from this level. The coefficient of absorption therefore must be

a measure not only of the probability of absorption but also of the probability of emission.

We shall now consider the special case when the frequency of the absorbed radiation has reached the L_m - and L_n -absorption limits but not L_l . The excited levels are then L_{22} and L_{21} and, of course, lower levels. Now the unusually well-established rule of Burger and Dorgelo can be used. It is possible to arrange the lines, originating from those levels, in doublets or triplets in such a way that the ratio of intensity of the components is 1:2, according to the rule mentioned. For example, $\beta_1/(\alpha_1 + \alpha_2) = 1:2$, $\gamma_1/(\beta_2 + \beta_{15}) = 1:2$, $\eta/l = 1:2$. Generally 1:2 is the ratio of the numbers of quanta emitted from the two levels. Therefore the numbers of absorption processes must have the same proportions. We then conclude that when the frequency of the absorbed radiation exceeds the L_n -absorption limit, the probability of absorption will increase with 50 per cent of the probability of absorption in the L_{22} -level. If we take in account also the M -absorption, we can give the expression

$$dL_n = \frac{1.5a + m}{a + m},$$

where m is proportional to the absorption in the $M + N + \dots$ levels and a to the L_{22} -absorption. For elements with low atomic number, m will be negligible and therefore $dL_n = 1.50$. The only experimentally determined values available are: Ag(47) $dL_n = 1.47$; Pt(78) $dL_n = 1.37$; Au(79) $dL_n = 1.38$; Hg(80) $dL_n = 1.39$. They also confirm that $dL_n \rightarrow 1.50$ with decreasing atomic number.

E. Jönsson calculates the absorption using formulæ such as $dL_n = \frac{E L_n}{E L_m}$, where E represents the ν/R value

of the designated absorption limit. In the case of silver, for example, we get in this way $dL_n = 1.05$. Although the formula holds for the K and the total L discontinuity, in the case of dL_n it has no justification.

It is not possible to calculate in the same way as dL_n the other L -discontinuities. The lines of L_n , for example, cannot be arranged in groups with lines from the other L -levels, the components having a constant ratio of intensity. One would suppose that the experimentally found sum of the intensities of all the lines originating from a certain level would give a value of the probability of absorption in this level. The agreement is not good, however. In the case of silver we calculate $dL_l = 1.10$, but experimentally it is found to be $dL_l = 1.25$.

On the basis of the new quantum mechanics, Wentzel calculated the relative intensities of a number of lines in the L -series. In several cases his values are considerably higher than the observed data. Wentzel suggests that the failure may depend on 'non-radiating transitions' or inner absorption, that is, the photons emitted are partially reabsorbed in the lower levels before leaving the atoms. But such emitted quanta must also be included in the calculated rate of emission from different levels. If Wentzel's explanation of the difference between the calculated and observed values is quantitatively correct, we can best make the correction for the inner absorption by using his calculated values. This gives $dL_l = \frac{1.79a + m}{1.46a + m}$, giving 1.23 as the upper limit to which the dL -discontinuity tends with decreasing atomic number. In fact the observed values are Ag(47) $dL_l = 1.25$; Pt(78) $dL_l = 1.25$; Au(79) $dL_l = 1.25$; Hg(80) $dL_l = 1.18$. Perhaps this can be said to provide the experimental agreement to Wentzel's calculations not given by the directly observed intensities of the emitted lines.

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