February 25, 1858.

WILLIAM R. GROVE, Esq., Vice-President, in the Chair.

Charles Piazzi Smyth, Esq., was admitted into the Society.

The following communications were read:—

I. "Remarks on the interior Melting of Ice." By Professor William Thomson, F.R.S. In a Letter to Professor Stokes, Sec. R.S. Received January 23, 1858.

In the Number of the 'Proceedings' just published, which I received yesterday, I see some very interesting experiments described in a communication by Dr. Tyndall, "On some Physical Properties of Ice." I write to you to point out that they afford direct ocular evidence of my brother's theory of the plasticity of ice, published in the 'Proceedings' of the 7th of May last; and to add, on my own part, a physical explanation of the blue veins in glaciers, and of the lamellar structure which Dr. Tyndall has shown to be induced in ice by pressure, as described in the sixth section of his paper.

Thus, my brother, in his paper of last May, says, "If we commence with the consideration of a mass of ice perfectly free from porosity, and free from liquid particles diffused through its substance, and if we suppose it to be kept in an atmosphere at or above 0° Cent., then, as soon as pressure is applied to it, pores occupied by liquid water must instantly be formed in the compressed parts, in accordance with the fundamental principle of the explanation I have propounded—the lowering, namely, of the freezing-point or melting-point, by pressure, and the fact that ice cannot exist at 0° Cent. under a pressure exceeding that of the atmosphere." Dr. Tyndall finds that when a cylinder of ice is placed between two slabs of box-wood, and subjected to gradually increasing pressure, a dim cloudy appearance is observed, which he finds is due to the melting of small portions of the ice in the interior of the mass. The permeation into portions of the ice for a time clear "by the water squeezed against it from such parts as may be directly subjected to the pressure," theoretically demonstrated by my brother, is beautifully illustrated by

Dr. Tyndall's statement, that "the hazy surfaces produced by the compression of the mass were observed to be in a state of intense commotion, which followed closely upon the edge of the surface as it advanced through the solid. It is finally shown that these surfaces are due to the liquefaction of the ice in planes perpendicular to the pressure."

There can be no doubt but that the "oscillations" in the melting-point of ice, and the distinction between strong and weak pieces in this respect, described by Dr. Tyndall in the second section of his paper, are consequences of the varying pressures which different portions of a mass of ice must experience when portions within it become liquefied.

The elevation of the melting temperature which my brother's theory shows must be produced by diminishing the pressure of ice below the atmospheric pressure, and to which I alluded as a subject for experimental illustration, in the article describing my experimental demonstration of the lowering effect of pressure (Proceedings, Roy. Soc. Edinb. Feb. 1850), demonstrates that a vesicle of water cannot form in the interior of a solid of ice except at a temperature higher than 0° Cent. This is a conclusion which Dr. Tyndall expresses as a result of mechanical considerations: thus, "Regarding heat as a mode of motion," "liberty of liquidity is attained by the molecules at the surface of a mass of ice before the molecules at the centre of the mass can attain this liberty."

The physical theory shows that a removal of the atmospheric pressure would raise the melting-point of ice by $\frac{3}{400}$ths of a degree Centigrade. Hence it is certain that the interior of a solid of ice, heated by the condensation of solar rays by a lens, will rise to at least that excess of temperature above the superficial parts. It appears very nearly certain that cohesion will prevent the evolution of a bubble of vapour of water in a vesicle of water forming by this process in the interior of a mass of ice, until a high "negative pressure" has been reached, that is to say, until cohesion has been called largely into operation, especially if the water and ice contain little or no air by absorption (just as water freed from air may be raised considerably above its boiling-point under any non-evanescent hydrostatic pressure). Hence it appears nearly certain that the interior of a block of ice originally clear, and made to possess vesicles of water by

the concentration of radiant heat, as in the beautiful experiments described by Dr. Tyndall in the commencement of his paper, will rise very considerably in temperature, while the vesicles enlarge under the continued influence of the heat received by radiation through the cooler enveloping ice and through the fluid medium (air and a watery film, or water) touching it all round, which is necessarily at 0° Cent. where it touches the solid.

I find I have not time to execute my intention of sending you to-day a physical explanation of the blue veins of glaciers which occurred to me last May, but I hope to be able to send it in a short time.

WILLIAM THOMSON.

Jan. 21, 1858.

II. "On the Practical Use of the Aneroid Barometer as an Orometer." By Captain W. S. MOORSOM, Member of the Institution of Civil Engineers. Communicated by P. W. BARLOW, Esq. Received January 28, 1858.

A Government Commission to Ceylon in the beginning of 1857, led the author, as Chief Engineer in charge of the Expedition, to provide (among other instruments) some aneroids, as a means of saving time in ascertaining the levels of the mountain passes of that Island. The aneroids offered by makers did not appear sufficiently graduated to admit of minute observation, and at the author's suggestion Messrs. Elliott furnished a more complete vernier, which, however, was shown to be susceptible of material improvement.

With these comparatively imperfect instruments, it was shown that an elevation of 950 feet may be taken to correspond with the fall through the first inch of the aneroid; that about 970 feet more corresponds with the fall through the second inch, and about 1000 feet corresponds with the fall through the third inch. These altitudes having been checked by levels taken with the ordinary surveyor's spirit-level, it was shown that this experience corresponds with the Tables published by M. Bellville, within 1 per cent.

The thermometer, which is usually attached to the aneroid, is not a necessary adjunct, but is frequently useful, and always interesting. The compensations introduced to provide against variations of tempe-