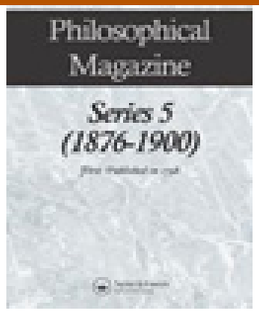

Philosophical Magazine Series 5

ISSN: 1941-5982 (Print) 1941-5990 (Online) Journal homepage: http://www.tandfonline.com/loi/tphm16

Cosmical determination of Joule's equivalent

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To cite this article: Pliny Earle Chase LL.D. (1880) Cosmical determination of Joule's equivalent, Philosophical Magazine Series 5, 10:59, 70-70, DOI: 10.1080/14786448008626889

To link to this article: http://dx.doi.org/10.1080/14786448008626889

Published online: 28 Apr 2009.

battery E' on board the repairing-boat. This method will always be found of great use in all cable expeditions, as it can be applied without difficulty to the longest cable.

COSMICAL DETERMINATION OF JOULE'S EQUIVALENT. BY PLINY EARLE CHASE, LL.D., PROFESSOR OF PHILOSOPHY IN HAVERFORD COLLEGE*.

In estimating heat of dissociation, Pfaundler has shown† that the mean should be taken between the temperatures of incipient and of complete dissociation. On this principle, in expressing the temperature of water-crystallization we should have regard to all stages of the expansion in molecular rearrangement, and take the mean (36°·6 F. = 2°·6) between the temperatures of greatest density (4°·6) and of complete crystallization (0°·6). So long as water continues to condense, its tendencies are centripetal and polar; while it is expanding, they are centrifugal and equatorial. The thermodynamic relations between heat and work should be shown in the comparative motions and temperatures of polar and equatorial waters as surely, and with as abundant facilities for accurate measurement, as in the experiments of the laboratory or in the processes of the workshop.

Johnston's Physical Atlas gives 82°·6 F. (28°·1 C.) as the mean temperature of the oceanic warmth-equator. This indicates a polar-equatorial difference of 82°·6 to 35°·6 F. = 47 J, or 28°·1 to 2° C. = 26·1 calories. The difference in gravitating measure may be readily deduced from the difference of motion. The velocity of equatorial rotation is 1525·78 feet, which represents a virtual fall of $\left(\frac{1525{\cdot}78}{32{\cdot}088}\right)^2 \times 16{\cdot}044$ ft. = 47 J. Hence we find J=771·816 foot-pounds; calorie =423·44 kilogrammetres.

ON SUBSTANCES POSSESSING THE POWER OF DEVELOPING THE LATENT PHOTOGRAPHIC IMAGE. BY M. CAREY LEA, PHILADELPHIA.

About three years since, I communicated to Silliman's American Journal the results of a long series of studies on development. At the time when these were undertaken there were but four substances known to possess the power of development:—ferrous sulphate, gallic acid, and pyrogallol, which had been long known to have this property; and hæmatoxylene, which I had some years before added to the number.

The studies made three years ago prove that the power of development, so far from being possessed by this small number of substances only, extends to a large number of chemical compounds, and is exhibited by many cuprous salts, by several vegetable acids,

* Communicated to the American Philosophical Society, April 16, 1880.

† Pogg. *Ann.* 1867, cxxxi. p. 603.