2. On the Computation of the Specific Heat of Liquid Water at various Temperatures, from the Experiments of M. Regnault. By W. J. Macquorn Rankine.

The experiments of M. Regnault having been made by introducing water at a high temperature from a boiler into a calorimeter, containing water at a low temperature, and power exercised by the steam in the boiler in expelling the water was converted into heat by fluid friction, thus producing a rise of temperature in the calorimeter, for which allowance ought to be made in calculating the specific heat of liquid water from each experiment. Mr Joule's determination of the dynamical value of the specific heat of liquid water at low temperatures affords the means of calculating the correction required in each case.

The author of this paper having thus corrected several of the results computed by M. Regnault, shews that they agree nearly with this empirical formula :—

$$\frac{K}{K_0} = 1 + \alpha (T - T_0)^2$$

Where K is the specific heat of liquid water at the temperature T of an air thermometer, K_0 its specific heat at T_0 , the temperature of its maximum density (which is 4.1° centigrade, or 39.4° Fahr.) and α , a constant coefficient, whose values are—

For the centigrade scale,	.	.	0.000001
For Fahrenheit's scale,	.	.	0.000000309

The paper is illustrated by three tables: the first shewing the correction of M. Regnault's results; the second exhibiting a comparison between the experiments and the formula, and the third giving the results of the formula for every tenth degree of the centigrade scale, from 0° to 260° .

3. On the Quantities of Mechanical Energy contained in a Fluid Mass, in different states, as to Temperature and Density. By Professor William Thomson.

Let p be the pressure of a fluid mass when its volume and temperature are v and t respectively, and let $M dv + N dt$ be the

quantity of heat that must be supplied to it to augment its volume by $d v$ and its temperature by $d t$. The mechanical value of the work done upon it to produce this change is the excess of the mechanical value of the quantity of heat that has to be added above that of the work done by the fluid in expanding, and is therefore

$$J (M d v + N d t) - p d v.$$

It was shewn in the author's paper on the Dynamical Theory of Heat, that this expression is the differential of a function of v and t , so that, if this function be denoted by ϕ , we have,—

$$\phi (v, t) = \int \{ (J M - p) d v + N d t \}$$

This function would, if the constant of integration were properly assigned, express the *absolute quantity of mechanical energy contained in the fluid mass*. Failing an *absolute* determination of the constant, we may regard the function ϕ as expressing the mechanical value of the whole agency required to bring the fluid mass from a specified *zero* state to the state of occupying the volume v and being at the temperature t . In the present paper some formulæ are given, by means of which it is shewn that nearly all the physical properties of a fluid may be deduced from a table of the values of ϕ for all values of v and t ; and experimental methods connected with the experimental researches proposed in the author's last paper, are suggested for determining values of ϕ for a gaseous fluid mass.

4. On a Mechanical Theory of Thermo-Electric Currents.

By Professor William Thomson.

It was discovered by Peltier that heat is absorbed at a surface of contact of bismuth and antimony in a compound metallic conductor, when electricity traverses it from the bismuth to the antimony, and that heat is generated when electricity traverses it in the contrary direction. This fact, taken in connection with Joule's law of the electrical generation of heat in a homogeneous metallic conductor, suggests the following assumption, which is the foundation of the theory at present laid before the Royal Society.

When electricity passes in a current of uniform strength γ through a heterogeneous linear conductor, no part of which is permitted to