Letter to the Editor

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THEORY OF SPECIFIC HEAT OF LIQUID HYDROGEN.

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As the three physical states are continuous, the liquid state may be taken as a transition from solid to the gaseous state. So, in the theory of specific heat of liquids we must consider the motion of oscillation of the particles as in the solid state and also the motion of translation of the particles as in the gaseous state. Hence total specific heat at any temperature will be determined by relative contribution of the two terms or $C_v \propto C_{osc} + C_{trans}$

By comparing the formulae of Debye (Debye's Theory of specific heat of solids) and Planck (Theory of black body radiation) it is found that

$$C_{osc} = 3R - C_v$$

where R is the usual gas constant

C_v is the Debye term and its characteristic temperature (θ_m) is to be determined by trial.

$$\text{and } C_{trans} = \frac{3}{2} R\left[1 - e^{-\lambda(T-T_m)}\ (1 - T\lambda)\ \right]$$

where R is the usual gas constant

T is the temperature at which the specific heat is observed.

T_m is the melting point.

λ is an arbitrary constant independent of temperature.

In the case of liquid hydrogen it is found that the best results are obtained by assuming that $\theta_m = 24°K$ and $\lambda = 0.04$.

The experimental values are taken from Eucken (1936). In the case of hydrogen the rotation starts at 50°K and it is not taken into account.

In the table below the last four readings are given separately, for one can notice a sudden change in the specific heat at 21.09°K. Such changes are observed in solids also (perhaps some change in the internal structure takes place here.) So, for these readings θ_m is taken to be 21°K.

Temp. (abs)	Sp. heat obs.	Sp. heat calc.	Temp. (abs)	Sp. heat obs.	Sp. heat calc.
15.33	2.54	2.56	20.5	2.98	2.96
15.86	2.56	2.60			
16.23	2.63	2.63			
16.87	2.70	2.68			
17.22	2.70	2.71			
17.88	2.78	2.76	21.0[illegible]	2.93	2.92
18.92	2.84	2.84	21.4[illegible]	2.94	2.95
19.5	2.89	2.89	22.1[illegible]	3.00	3.00
20.0	2.92	2.92	23.1[illegible]	2.99	3.06

Similarly, in the case of liquid heavy hydrogen we get the best values of the specific heat for $\theta_m = 54°K$ and $\lambda = 0.02918$. On the whole in both the cases the agreement with our suggestion is quite satisfactory.

REFERENCES

Eucken, 1936, *Z. Electrochem*, **42**, 547.