where T is temperature absolute, and k and C are constants. This expression can only be a first approximation, since it assumes k and C independent of temperature. None the less, it was found to represent the relation of fluidity to temperature for every liquid so far tested—more than fifty—over a very wide range of temperature with an accuracy generally comparable with the experimental error. Deviations become considerable as the temperature approaches the freezing-point.

This result confirms Prof. A. W. Porter's observation that log ϕ plotted against log p, where p is vapour pressure, gives a straight line, and specialises his deduction that some function of ϕ should have the form $f(\phi) = \dfrac{k}{T} + C$ (*Phil. Mag.* [vi], **23**, 458 ; 1912).

From the derivation from the distribution function, it appears that k, the slope of the line, should be a work function involving the specific heat of the liquid. A simple work function which has given very interesting results is obtained as follows : The observed specific heat C_p—mean value over temperature range—refers to unit mass. Hence specific heat per unit volume is $C_p \delta$, where $\delta = $ density, mean value over temperature range. The heat per molar area is obtained as $C_p \times (M\delta)^{2/3}$, where M is the formula molecular weight, that is, uncorrected for possible association or dissociation.

It follows that to a first approximation, if k be the slope of the line log $\phi \propto 1/T$, the expression: $\dfrac{\text{Specific heat} \times (M\delta)^{2/3}}{k}$ should equal a constant K, the same for all normal liquids, while a relative indication of molecular association should be obtained as $a = \left(\dfrac{K}{K'}\right)^{3/2}$ for deviating liquids.

The data available—principally the fundamental studies of Thorpe and Rodgers—give quite good confirmation of this relation. For liquids which have been previously deduced to be ' normal ' by other methods (cf. W. E. S. Turner, " Molecular Association " : Longmans Green and Co.) the values of the molar work function, in arbitrary units, ranged from 21·9 to 19·8. The values of the association factor a calculated for the abnormal liquids are generally of the right order of absolute magnitude, and place them in a relative order agreeing reasonably well with such orders as are obtained by other methods ; it is admitted that these are somewhat discordant. Thus the following values for a were obtained for typical cognate series of compounds :

Substance.	Formula.	a.
Water	H_2O	3·51
Methyl alcohol . . .	$CH_3 . OH$	2·70
Ethyl alcohol	$C_2H_5 . OH$	3·15
Propyl alcohol . . .	$C_3H_7 . OH$	3·04
Butyl alcohol	$C_4H_9 . OH$	2·95
Iso-butyl alcohol . . .	$C_4H_9 . OH$	3·52
Formic acid	$H . COOH$	2·66
Acetic acid . . .	$CH_3 . COOH$	1·64
Butyric acid . . .	$C_3H_7 . COOH$	1·35
Iso-butyric acid . . .	$C_3H_7 . COOH$	1·66

Except for methyl alcohol, the trend of these values is regular and plausible. The alcohols show a slow declination of association with increasing molecular weight, the fatty acids a more rapid one, while in both cases iso-bodies show increased association compared with normal bodies.

It is realised that the association factors found can

be only relative, since the temperature variation is not allowed for. It may be remarked that on considering modifications of the formulæ to include this variation, it was found that the published data on the variation with temperature of the specific heats of liquids appear to be very sparse and discordant.

My thanks are due to Dr. R. C. Houck for essential assistance in testing the formulæ suggested. Should further applications give encouragement, a joint paper will be published in the *Journal of Rheology*.

S. E. SHEPPARD.

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        Rochester, N.Y.,
            Feb. 3.

Since my letter of Feb. 3, a further search of the literature has shown that the specific form of Porter's function,

$$f(\phi) = -\frac{k}{T} + C, \text{ putting } f(\phi) = \log \phi,$$

has been used before. The original application is by Señor J. de Guzman, " Relación entre la Fluidez y el Calor de Fusion " (*Anales de la Sociedad Española de Fisica y Quimica*, **11**, p. 353 ; 1913). The author refers to a future article to be published jointly with Prof. C. Drucker, of Leipzig, in whose laboratory he was then working. This article does not appear to have been published, so far as I can ascertain ; but in an article, " Untersuchungen über Fluidität " (*Zeit. phys. Chem.*, **92**, 287 ; 1918), Prof. Drucker recapitulates and expands the application of the formula, used as an integration between temperatures T_1, T_2 of its differential form

$$\frac{d \log \phi}{dT} = \frac{w}{RT^2}$$

to deduce the work function w, which, as previously stated by Señor de Guzman, is found to be nearly equal in many cases to the *molecular latent heat of fusion*.

On the other hand, the form of the work function suggested in my letter above appears correct, to an equal degree of approximation. Certain interesting consequences follow from this, with which I hope to deal more fully elsewhere.

I shall not regret having unwittingly assumed some novelty in the specialisation of Porter's formula, if so doing should help to affirm and extend the previous work of the authors cited. S. E. S.
    Feb. 15.

[When Dr. Sheppard sent the above communication for publication, he was, of course, unaware that Prof. Andrade had recently been giving attention to the relation between temperature and the viscosity of liquids, and had stated preliminary results of his investigations in NATURE of Mar. 1. Since that letter was published, we have received several others discussing some points raised in it, and we hope to include these in an early issue, together with Prof. Andrade's remarks upon them.—Editor, NATURE.]

The Age of Iron Meteorites.

IF meteorites are scattered portions of our solar system, derived from some disintegrated planet or from the earth, then their age cannot be greater than that of the solar system. This is assumed to be about 3×10^9 years at the utmost. If, however, meteorites come from other stars, it is possible that the period