Benzil was used as a standard substance for determining the calibration constant k of the thermistors. The molecular weights of camphor, naphthalene, phenanthrene, and the two detergents 'BRIJ 30' and '35' were checked in two organic solvents, benzene and toluene, at 25° C. The results are summarized in the accompanying table.

Substance	Molecular weight obs.	Molecular weight calc.	Substance	Molecular weight obs.	Molecular weight calc.
Naphthalene	128·0	128·2			
Camphor	151·9	152·2	'BRIJ 30'	435	—
Phenanthrene	177·6	178·2	'BRIJ 35'	747	—

The range of concentration was 0·5–7 gm. of solute per 100 gm. of solvent. The mean average deviation of the readings is $\pm$ 0·25 per cent.

The results shown in the table were reproducible and independent of the concentrations and solvent used, within the limits of experimental error. The thermistor has been found to be extremely sensitive, and has the further advantages of being rapid in its operation and free from the spurious electrical effects that might be encountered within the D.C. thermocouple method of Hill-Baldes[3]. It is also seen to be far more accurate than the chemical boiling-point and vapour-pressure methods, thus permitting the study of very dilute solutions.

The Beckmann freezing-point method is limited to low temperatures, where the solubility of many substances is inadequate. However, the most important advantage of the thermistor technique over the usual Beckmann freezing-point method is the wide range of temperatures and solvents which can be employed in the measurements. Besides being far more accurate than the Beckmann methods, only a few drops of solution are required for the measurement.

With the present set of thermistors, the limit of molecular weight measurement is roughly 2,000 in water and 5,000 in benzene. As soon as more-sensitive thermistors become available, the method can be extended to compounds of higher molecular weight.

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The Laws of Friction

THE laws of static friction are usually described as : (1) $F = \mu R$, which governs the relation between limiting frictional force F and normal reaction R ; and (2) the coefficient of friction μ is independent of the apparent area of contact.

Exceptions to law (1) are now well established, and in the field of fibre friction have been known for some time. In these cases the friction is governed by an expression of the form $F = aR^n$, where n has values for different materials ranging from 0·67 to 1·0, the value for metals. Thus Bowden and Young[1] obtain $n = 0.8$ for diamond, Lincoln[2] 0·67 for nylon and Howell and Mazur[3] 0·96 for cellulose acetate, 0·91 for viscose rayon, 0·90 and 0·80 for undrawn and drawn nylon respectively. This form of the

frictional relation is more general than law (1), and it is the purpose of this note to point out certain consequences which arise from it.

(1) Amontons's law $F = \mu R$ represents the special case of $n = 1$.

(2) The frictional force F now depends upon the apparent area, and only in the particular case of $n = 1$ is it independent. Consequently, the two laws as such are not independent, but law (2) is a natural consequence of law (1).

(3) If the effect of roughening a surface is to produce valleys large compared with the distance between surface asperities, then the area available for real contact is reduced with a consequent reduction in the frictional force.

(4) In the important case of friction of a string around a pin or cylinder, the tension relation $T = T_0 \exp \mu\theta$ is derived on the assumption $F = \mu R$. If the general expression $F = aR^n$ is used in the analysis, the relation becomes

$$\left(\frac{T}{T_0}\right)^{(1-n)} = 1 + (1-n) \cdot a \left(\frac{\rho}{T_0}\right)^{(1-n)} \theta \, ;$$

or, in the limit as n approaches unity,

$$T = T_0 \exp a \left(\frac{\rho}{T_0}\right)^{(1-n)} \theta,$$

where ρ is the radius of the cylinder, which is not involved in the usual treatment. The data on the tensions of wool fibres given by Martin and Mittelman[4] have been examined and found to conform to this expression.

(5) The coefficient a in $F = aR^n$ is not dimensionless except when $n = 1$, but normally has dimensions [force]$^{1-n}$.

Again, in the case of the cylinder, since F and R in the analysis refer to unit length, the dimensions are [force/length]$^{1-n}$.

A full account of this work, which forms part of a programme of fundamental research of the British Rayon Research Association, will be given elsewhere.

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A Method of determining the Electrical Resistance of Fibre Bundles

SOME years ago, one of us[1] showed that the quantity of static electricity developed on textiles during, for example, the carding operation, could be explained in terms of the electrical leak through the fibre ; but the resistance measurements made at that time were limited to the order of 10^{11} ohms by the electric leak of the supporting frame.

We have recently devised a method which enables such resistance measurements to be made up to the order of 10^{17} ohms, and which avoids this leak by eliminating the supporting frame. In this method the bundle of fibres or sliver is hung vertically from a metal support to which is applied a voltage of the order of 5 kV., and the total charge resident on the fibre after a known period of application of voltage is measured by transferring the bundle to a Faraday cylinder.