

this value, molecular weights so calculated are given in column 6. These show a small variation with concentration, which extrapolates to a value lying between 132 and 133.

Tetralin (mola)	$\theta$ corr.	$(\theta/m)$ uncorr.	$(\theta/m)$ corr.	$(\theta/m)$ calc.	$M$
0.8422	4.196	5.120	4.982	4.86	135.2
0.6008	3.045	5.267	5.069	4.93	132.9
0.3008	1.516	5.441	5.040	5.03	133.9
0.1495	0.756	5.859	5.056	5.07	133.6
0.0518	(0.201)	(6.197)	(3.880)	—	(172.6)
	Extrapolated		5.1	5.12	132-133

The abnormal data for camphor given by Meldrum, Saxer and Jones<sup>4</sup> can also be explained by assuming the presence of some impurity. This is the explanation offered by Ricci<sup>5</sup>. Another possible source of error is the loss of camphor by sublimation during measurement.

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<sup>1</sup> *Nature*, 153, 407 (1944).

<sup>2</sup> *J. Chem. Soc.*, 688 (1934).

<sup>3</sup> "Int. Crit. Tables", 3, 389.

<sup>4</sup> *J. Amer. Chem. Soc.*, 65, 2023 (1943).

<sup>5</sup> *J. Amer. Chem. Soc.*, 66, 658 (1944).

The exact equation for an ideal solution has the form

$$d \log x/dt = \frac{\Delta H}{RT^2}, \dots \dots \dots (1)$$

where  $x$  is the mol. fraction of the solvent and  $\Delta H$  is the molar latent heat of fusion.

It can be shown that the classical equation

$$\theta = Km \dots \dots \dots (2)$$

where  $m$  is the molality results from two main approximations applied in the reduction of (1) to (2), and it has been assumed in the literature that the variation in  $\theta/m$  found with (2) is due to these approximations.

Banks has now shown that  $\theta/m$  still varies even when an accurate expression derived from (1) is obtained, namely,

$$m = \alpha\theta + \beta^1\theta^2 + \gamma^1\theta^3 \dots \dots \dots (3)$$

Using equation 2,  $K$  found experimentally falls from an abnormally high value at  $m = 0$ , approaching the thermodynamic figure at  $m = 1$ .

Equation 3 likewise shows a fall in the value of  $\theta/m$ , but in this case  $K$  is defined at  $m = 0$ . Because of the difficulty in obtaining experimental data at low concentrations and therefore extrapolating to infinite dilution, we evolved the empirically deduced equation:

$$\theta = Km^b \dots \dots \dots (4)$$

For the ideal case studied by Banks,  $b$  has been found to vary, but as he has pointed out, the order of this variation is such as to be masked by experimental error. From the practical point of view, therefore, this variation must be insignificant.

If, as it has been suggested, the abnormal results of Meldrum, Saxer and Jones were due to sublimation or impurities in the camphor, then we should have to accept the untenable conclusion that in our confirmatory work on camphor the same amount of sublimation and the same unspecified impurities were present. Further, the experimental results on which equation (4) is based have been checked by plotting  $\log x$  against  $1/T$ , and the slopes of the lines obtained at any point gave latent heats of fusion of the solvents in close agreement with the literature values.

Finally, we have applied the moisture correction of 0.120° C. to the tetralin results; also to solutions of naphthalene in a different sample of benzene:

Tetralin: $b = 0.9394$					
Concentration (gm. per 100 gm. solvent)	Molality	$\theta$	$\theta$ corrected	$\theta$ corr./ $m$	$\frac{\theta}{m^b}$
0.685	0.0518	0.321	0.201	3.880	5.180
1.977	0.1495	0.876	0.756	5.056	5.220
3.976	0.3008	1.636	1.516	5.040	5.169
7.942	0.6008	3.165	3.045	5.069	5.107
11.134	0.8422	4.316	4.196	4.982	5.072

  

Naphthalene: $b = 0.9846$					
Concentration (gm. per 100 gm. solvent)	Molality	$\theta$	$\theta$ corrected	$\theta$ corr./ $m$	$\frac{\theta}{m^b}$
0.653	0.0510	0.279	0.159	3.118	5.225
0.922	0.0720	0.390	0.270	3.750	5.201
1.126	0.0880	0.477	0.357	4.058	5.223
3.430	0.2680	1.452	1.332	4.970	5.310
7.181	0.5610	2.922	2.802	4.995	5.162
10.160	0.7938	4.162	4.042	5.092	5.225

If the moisture correction were valid and could be accepted as the explanation of the anomaly found by using (2), then the results given in column 5 of the above table should extrapolate to 5.12 at  $m = 0$ .

In view, however, of the results obtained with naphthalene, we cannot conclude that the water correction can be used as an explanation of the anomaly. The values of  $\theta/m^b$ , however, approximate to a constant value for  $K$ , which we believe can be used in actual determinations of molecular weights.

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## Commutation of Annual Subscriptions

DR. HERON'S letter in *Nature* of September 23 should be of special interest to British scientific men, in that commutation gets over the legal anomaly that subscriptions to technical societies are not chargeable as expenses for the purposes of income tax, unless the taxpayer is working on his own. Those paid by salary cannot enter subscriptions as an expense, even when appointment is conditional on membership of some appropriate technical institution.

The difficulty is eliminated because commutation is equivalent to buying an annuity for the amount of the annual subscription, without the member becoming liable to tax on the capital part of the annuity; and also to tax on the income part, if the body happens to come within the rather artificial legal definition of a charity, and most technical ones do so. With non-charitable bodies commutation fees should necessarily be higher, in that tax has to be paid on the income from the commutation fund.

The fact is that it almost always pays for good lives to commute, even when the purpose is not to avoid income tax; for there is a general tendency to fix commutation fees too low, even in relation to the current annual subscription. Actually the fees should make some provision for the possibility of future rise in annual subscription, necessitated not only on account of the tendency for the value of money to fall in the course of years, but also by the desire of any active institution to widen the scope of its activities, for the general benefit of its members.

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