...d their mean value for the given temperature is calcu-...ted [$h'_{t\,mean} = (h'_1 + h'_2)/2$]. The thermostat is then re-set, ...d h'_{mean} is measured at some other temperatures.

The pyknometer is then removed from the thermostat, ...ighed, cut open, emptied, carefully dried, and re-...ighed. The mass of the calibrating liquid present in the ...knometer is found from the weight difference. Knowing ...e density of the calibrating liquid, the volumes corre-...nding to the measured heights can be calculated. Hence ...e can write the first pyknometric equation in the form

$$V' = a' + b'h'_{t\,mean} + c'(h'_{t\,mean})^2, \qquad (1)$$

...ere the constants a', b', and c' are calculated by least ...uares.

Using exactly the same procedure, the pyknometer is ...alibrated a second time with enough liquid to reach to the ...ark 5. The distances h''_1 and h''_2 for the liquid menisci in ...bes 4 and 10 are measured, and the mean values $h''_{mean} = (h''_1 + h''_2)/2$ are calculated for the chosen calibra-...n temperatures. From these results we obtain the ...econd pyknometric equation

$$V'' = a'' + b''h''_{t\,mean} + c''(h''_{t\,mean})^2. \qquad (2)$$

After calibration, the apparatus is washed and dried, and ...sed to measure the density of two liquids with limited ...utual solubility. The heavier liquid is added through ...be 2, followed by the lighter liquid, in amounts such that ...e interface is in tube 7 and the meniscus of the lighter ...quid is above mark 5. Tube 2 is again sealed off, the ...pparatus is clamped in a rotary shaker, and placed in the ...ermostat.

When the apparatus has reached the desired tempera-...re, it is rotated round an axis perpendicular to the ...lane of the paper through 180° anticlockwise, and then ...turned to the vertical position, using a hydraulic device ...r a servo-motor. This motion causes mixing of the ...quids in the mixing reservoir 1, and no liquid enters ...be 2. Mixing is continued for several hours at the ...osen temperature until mutually saturated solutions are ...tained. The pyknometer is returned to the vertical ...sition, and the liquids are allowed to settle until inter-...cial boundaries appear in tubes 7 and 10. The pyknome-...r is rotated round an axis perpendicular to the plane of ...e paper, and some of the lighter liquid is poured out of ...be 10 so as to bring the interface to the middle section of ...be 7. The apparatus is allowed to reach thermostat ...mperature for several hours, until the positions of the ...nisci have become stable, and the density measurement ...s begun. The distances from the mark 3 to the menisci ...the lighter (h_{l_1} and h_{l_2}) and the heavier (h_{h_1} and h_{h_2}) ...uid in tubes 4, 7, and 10 are noted.

Using the calibrating equations (1) and (2), the volume ...of the heavier liquid is determined by inserting into ...n. (1) the value $h_{l\,mean} = (h_{h_1} + h_{h_2})/2$, and the total ...lume V by inserting into Eqn. (2) the value $h_{l\,mean} = (h_{l_1} + h_{l_2})/2$. The volume of V_1 of the lighter liquid is obtained ...y difference. We can write the two equations

$$V_1\rho_1 + V_2\rho_2 = m, \qquad (3)$$

$$(h_{h_2} - h_{l_2})\rho_1 = \Delta h_h\rho_2 + (h_{h_1} - h_{l_1})\rho_1, \qquad (4)$$

...ere m is the combined mass of the two liquids, Δh_h is ...e difference between the levels of the solution of the ...hter liquid in the heavier liquid in tubes 7 and 10, ρ_1 ...d ρ_2 are the densities of the saturated solutions of the ...avier in the lighter liquid and vice-versa.

Inserting values of V_1, V_2, m, h_{l_2}, h_{l_1}, h_{h_2}, h_{h_1}, and Δh_h in Eqns. (3) and (4), the densities ρ_1 and ρ_2 are determined by solving the equations simultaneously. An important feature of the present pyknometer is the fact that the masses of the individual liquid phases (which vary with temperature because of solubility differences) do not need to be separately known. The total mass, however, remains constant irrespective of temperature, and is readily determined by weighing at the end of the experiment.

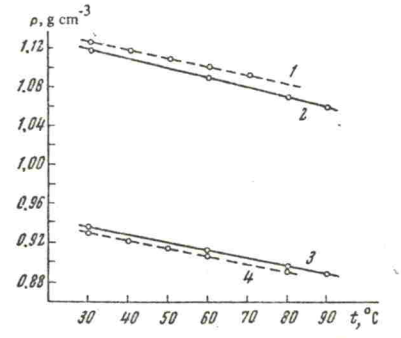

Figure 2. Density polytherms for the PEG–DBS system:
1) for pure PEG; *2*) for a saturated solution of DBS in PEG; *3*) for a saturated solution of PEG in DBS; *4*) for pure DBS

The pyknometer has been used in our laboratory to measure the density of a number of systems. In particular, the following polytherm equations have been obtained for the density in the poly(ethylene glycol)–dibutyl sebacate (PEG–DBS) system (see Fig. 2):

$$\rho_{DBS} = 0.9504 - 0.0005619\,t - 0.000001731\,t^2, \qquad (5)$$

$$\rho_{PEG} = 1.14704 - 0.0011236\,t + 0.000001485\,t^2. \qquad (6)$$

The mean scatter of the experimentally measured densities from these curves is less than 0.0001 g cm^{-3}.

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Mass-spectrometric Assembly for Studying the Solubility of Gases and Gas Mixtures in Liquids at High Pressures

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A fast mass-spectrometric procedure for measuring the solubility of gases and gas mixtures in volatile liquids at different temperatures and at pressures between 1 and 150 atm has been developed. The mass spectrometer has a capillary sample injection system which allows the composition of the liquid in the high-pressure vessel to be determined by continuously sampling the liquid at a rate of $\sim 10^{-8}$ g s^{-1}. Plots of the solubility of argon in benzene and in toluene as a function of pressure at 20 ± 1 and 17.3 ± 0.2°C are given.

Several methods of measuring the solubility of gases in liquids are known [1,2], but they all suffer from serious shortcomings. The most widely used is the manometric