same solvent. The pure diphenylbenzidine separates on cooling; after filtering off and washing with alcohol until the washings fail to yield a white cloud upon dilution with water, the product is dried at 110°. The yield is 60–65%,[2] m. p. 244–245° (uncorr.).

About 10% of the crude product is insoluble in boiling xylene, and 25–30% remains in solution in the cold mother liquor. This more soluble product probably consists largely of 2,2'-dianilinodiphenyl. One liter of xylene dissolves 0.3 g. of diphenylbenzidine at 25°.

The indicator may be employed satisfactorily by mixing 1 drop of a 0.1% solution in sulfuric acid with 10 cc. of a mixture of equal parts of glacial acetic acid and sirupy phosphoric acid. By the use of such a solution, good end-points are obtained with 0.01 N standard solutions, provided stirring has been continuous and thorough.

(2) This method has been repeated by Dr. R. E. Montonna and Mr. L. T. Jilk, of this Laboratory, who have obtained a yield of 50% when working on a ten times larger scale.

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Heat of Vaporization of a Pure Substance from the Measurement of the Temperature at Two Points and the Vertical Distance between Them

BY S. C. COLLINS

Consider a vertical tube containing a small quantity of the pure liquid and its saturated vapor. Sufficient heat is applied to the liquid to maintain the desired temperature. Since the insulation is not perfect, the walls of the tube are kept moist by condensation of the vapor. The temperature at A, a point near the lower end, will be slightly higher than that at B, a point near the upper end, because the pressure is higher. Let the difference in temperature, dT, be measured with a differential thermocouple. Denoting the difference of pressure by dp, $dp = gh/V'$, where V' is the specific volume of the saturated vapor, g the acceleration of gravity and h the vertical distance between the points A and B.

Substituting for dp in Clapeyron's equation

$$L = \frac{dp}{dT}\,T(V' - V) \qquad (1)$$

its value, gh/V', one obtains the relation

$$L = \frac{T}{dT}\,gh\left(1 - \frac{V}{V'}\right) \qquad (2)$$

At temperatures not too near the critical point V' may now be calculated with sufficient precision by means of the equation of state for ideal gases. The value of V, the specific volume of the liquid need be known only roughly.

In the case of water vapor at 100° the calculated value of V' is incorrect to the extent of 1.6%. The error in the latent heat, L, resulting from the use of the calculated value of V' in equation (1) is 1.6%, whereas the same value used in equation (2) produces an error of only 0.001%.

To illustrate the order of magnitude of the quantities to be measured the following table is prepared. The length of the tube is assumed to be 20 meters. The values of dT were calculated from existing data.

Substance	Temp., °C.	dT
H_2O	50	0.0265
	100	.0324
CCl_4	50	.304
	65	.343

It is anticipated that difficulties in preparing samples of sufficient purity and in measuring dT with the required precision may prove serious but not insurmountable.

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x-Ray Diffraction Studies of Built-up Films of Long-Chain Compounds

BY G. L. CLARK, R. R. STERRETT AND P. W. LEPPLA

The technique developed by Blodgett and Langmuir[1] for transferring monomolecular films of long-chain compounds from a water surface to a glass surface and the opportunity thus afforded to apply a known number of layers of molecules, one on top of the other, has proved to be exceedingly valuable in x-ray diffraction studies of long-chain compounds. For a number of years studies have been made on films of these compounds produced by melting the substances into a thin film on a suitable backing or by evaporating a solution of the substance in a suitable solvent. The unknown factor has been the actual number of molecular layers in the oriented film. With a little practice, we have now found it possible to build up successive monomolecular films of vari-

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(1) THIS JOURNAL, **56**, 495 (1934); *J. Franklin Inst.*, **218**, 143 (1934).