from a straight line over the region investigated by 1% (the total change in the parachor in this range being 11%).

Sugden[1] had obtained 457.6 as the parachor of molten aluminum bromide, assuming the same formula Al_2Br_6. The value obtained here deviates by 3% from Sugden's value. If Sugden had used the formulas $AlBr_3$ or Al_3Br_9, he would have obtained parachors of 228.8 and 686.4, respectively; in this work the same formulas give values of 232.9 and 703.2 after extrapolation, which represent deviations of a little less than 3%.

Our extrapolation is over a large range, so that any errors made at low concentrations will magnify greatly the error in the final value of the parachor. For this reason, it is somewhat surprising that the extrapolated values for the solution fall so near the values for the molten salt.

Owing to the above uncertainty, we can say only that the results obtained here tend to indicate that the formula of aluminum bromide dissolved in benzene is the same as that for the molten compound.

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RECEIVED JULY 3, 1939

Preparation of Di-*o*-tolylchloromethane

BY EUGENE B. REID

Incidental to a program of measurement of physical properties, di-*o*-tolylchloromethane was prepared. It has not been described previously in the literature.

o,o'-Dimethylbenzohydrol was prepared by reducing *o,o'*-dimethylbenzophenone with 2% sodium amalgam; m. p. 120.5–121.5°. Boyd and Hatt[1] found 119–119.5°. A benzene solution of the carbinol was kept in contact with a concentrated aqueous hydrochloric acid solution for two days; the two layers were separated, and the benzene solvent evaporated. The di-*o*-tolylchloromethane crystallized from petroleum ether as long prisms; m. p. 70–71°; yield 90%.

Anal. Calcd. for $C_{15}H_{15}Cl$: Cl, 15.37. Found: Cl, 15.44.

DEPARTMENT OF CHEMISTRY
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[1] Boyd and Hatt, *J. Chem. Soc.*, 898 (1927).

The Dipole Moment of the Amino Benzoic Acids in Dioxane

BY LLOYD VAN BLARICOM AND E. C. GILBERT

The dipole moments of *o*-, *m*- and *p*-aminobenzoic acid have been determined in water solution[1] in which solvent they occur partially in the zwitter-ion form. In non-polar solvents they should exist in ordinary molecular form but their low solubility has precluded measurements of their moment in such solvents. However, their solubility in dioxane proved upon examination to be sufficiently high to allow satisfactory measurements, which are reported in this paper. Dioxane has an additional advantage in that it does not cause association, in general, and it has therefore been used in the determination of the moments of many acids which associate in the ordinary non-polar solvents.[2]

Apparatus and Method.—The apparatus has been described previously.[3] It is based upon the heterodyne beat method and has been demonstrated to give correct results on substances of known dielectric constant. Refractive index was measured with a Bausch and Lomb dipping refractometer. Densities were determined with a pycnometer designed to avoid evaporation losses.[4] All weights were reduced to vacuum.

Materials.—Eastman Kodak Co. dioxane was refluxed with sodium hydroxide for ten hours and fractionated, discarding the first and last portions. It was then refluxed over sodium metal for another ten hours, and again distilled. That used for the measurements had the following constants: m. p. 11.7°; n^{25}_{D} 1.41990; ϵ^{25} 2.2266; d^{25}_{4} 1.02681.

The amino acids were Eastman best grade, further recrystallized three times. They were boiled with charcoal when necessary to improve the color and fractionally crystallized. They had the melting points: ortho, 144.5–145°; meta, 173–174°; para, 187–188° (all corrected for emergent stem).

Results

The results are shown in Table I, and summarized in Table II. It is frequently assumed that the dipole moments of acids will be similar to those of their methyl esters. Estermann has determined the moments of the three methyl esters of these acids and they are included in the tables for comparison.[5] In each case the moment of the free acid is greater than that of the ester by a considerable percentage.

Dielectric studies of these acids in aqueous solu-

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[1] (a) Hedestrand, *Z. physik. Chem.*, **135A**, 36 (1928); (b) Devoto, *Gazz. chim. ital.*, **63**, 247 (1933).

[2] Wilson and Wenzke, *J. Chem. Phys.*, **2**, 546 (1934).

[3] Frey and Gilbert, THIS JOURNAL, **59**, 1344 (1937).

[4] Gilbert and Stark, *ibid.*, **59**, 1818 (1937).

[5] Estermann, *Z. physik. Chem.*, **1B**, 134 (1928).