

RESULTS

WATER.—Measurements at 1 bar were made at 5 deg intervals from 5 to 65°C (table 2). The pressure-dependence was measured at 10, 25, 45 and 65°C (table 3).

FORMAMIDE.—Table 4 gives results at 1 bar in the range 5-60°C. Pressure runs were made at 10, 25 and 45°C (table 5). The pressure range at 10°C is restricted by the need to avoid solidification. At the foot of each table are eqn (1)-(4) fitted to the data by least-squares methods. Eqn (2) and (4), analogues of the Tait equation, gave much more satisfactory representations of the data than did simple polynomials in *P*.

TABLE 3.—DIELECTRIC CONSTANTS OF WATER AT VARIOUS TEMPERATURES AND PRESSURES

<i>P</i> /bar	10°C	25°C	45°C	65°C
1	83.82 ₈	78.30 ₄	71.50 ₃	65.30 ₃
163	84.42 ₁	78.85 ₂	72.05 ₁	65.87 ₉
339	85.08 ₁	79.47 ₈	72.62 ₇	66.45 ₁
517	85.75 ₇	80.10 ₂	73.25 ₁	67.03 ₁
689	86.37 ₄	80.67 ₆	73.82 ₃	67.54 ₆
862	86.99 ₈	81.30 ₃	74.35 ₂	68.01 ₈
1034	87.60 ₃	81.83 ₁	74.89 ₉	68.54 ₆
1207	88.23 ₇	82.40 ₁	75.45 ₂	69.03 ₃
1379	88.81 ₆	82.99 ₈	75.95 ₁	69.50 ₂
1551	89.38 ₁	83.49 ₈	76.41 ₃	69.90 ₅
1724	89.94 ₈	84.02 ₃	76.92 ₄	70.38 ₃
1896	90.52 ₈	84.54 ₆	77.42 ₃	70.84 ₉
2068	91.10 ₀	85.09 ₃	77.90 ₀	71.27 ₄

At fixed temperatures,

$$\epsilon(P) = A + [BP/(1 + CP)], \quad (2)$$

where *A*, *B*, *C* have the following values:

<i>t</i> /°C	<i>A</i>	10 ³ <i>B</i> /bar	10 ³ <i>C</i> /bar	<i>P</i> _{max} /bar	s.d. of ϵ
10	83.810	3.840 9	4.394 5	2 100	0.012
25	78.281	3.618 1	4.840 0	2 100	0.018
45	71.486	3.529 4	6.730 0	2 100	0.016
65	65.324	3.403 0	9.0345	2 100	0.021

TABLE 4.—DIELECTRIC CONSTANTS OF FORMAMIDE AT 1 BAR IN THE TEMPERATURE RANGE 5-60°C

<i>t</i> /°C	ϵ	$\delta\epsilon$	$-10^3 (\partial \ln \epsilon / \partial t)_P = 1 \text{ bar}$
5	117.19	-0.02	3.50
10	115.07	0.04	3.57
15	113.04	0.01	3.64
20	111.00	-0.01	3.70
25	109.03	-0.08	3.75
30	106.85	0.05	3.80
35	104.89	0.00	3.84
40	102.87	0.01	3.88
45	100.89	0.00	3.90
50	98.92	0.03	3.92
55	97.09	-0.06	3.93
60	95.11	0.03	3.92

$$\epsilon(1 \text{ bar}) = 119.208 - 0.408 3 t - 2.311 \times 10^{-4} t^2 + 5.833 \times 10^{-6} t^3, \quad (3)$$

$$\delta\epsilon = \epsilon(\text{eqn (3)}) - \epsilon$$

TABLE 5.—DIELECTRIC CONSTANTS OF FORMAMIDE AT VARIOUS TEMPERATURES AND PRESSURES

<i>P</i> /bar	10°C	25°C	45°C
1	115.06 ₆	109.02 ₇	100.89 ₃
20	115.17 ₂	109.14 ₆	101.01 ₂
50	115.30 ₈	109.30 ₀	101.15 ₁
120	115.64 ₉	109.64 ₂	101.51 ₄
156	115.81 ₀	109.80 ₃	101.73 ₁
195	115.99 ₀	109.98 ₅	101.90 ₇
339	116.69 ₀	110.64 ₁	102.60 ₇
414	117.00 ₃	110.96 ₄	102.98 ₇
517	117.47 ₀	111.38 ₃	103.45 ₃
689	118.14 ₆	112.08 ₃	104.15 ₃
862	118.78 ₃	112.75 ₁	104.85 ₃
1034		113.32 ₃	105.55 ₃
1207		114.01 ₀	106.17 ₆
1379		114.59 ₃	106.75 ₄
1551		115.11 ₃	107.28 ₁
1724		115.64 ₇	107.81 ₃
1896		116.15 ₃	108.31 ₁
2068		116.64 ₇	108.76 ₃

At fixed temperatures,

$$\epsilon(P) = A + [BP/(1 + CP)], \quad (4)$$

where *A*, *B*, *C* have the following values:

<i>t</i> /°C	<i>A</i>	10 ³ <i>B</i> /bar	10 ³ <i>C</i> /bar	<i>P</i> _{max} /bar	s.d. of ϵ
10	115.054	5.133 5	2.116 9	900	0.014
25	109.055	4.880 1	1.598 2	2 100	0.020
45	100.888	5.474 8	2.105 1	2 100	0.015

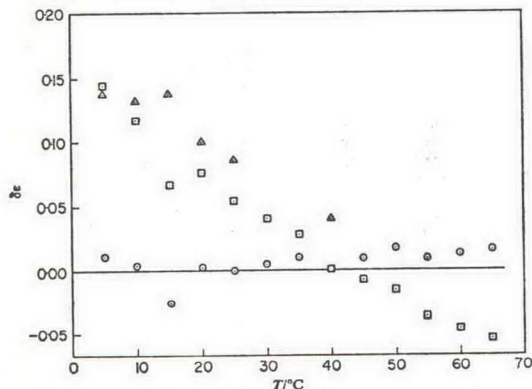


FIG. 5.—Dielectric constants of water at 1 bar—comparison with earlier work. $\delta\epsilon = \epsilon(\text{lit.}) - \epsilon$ (this work): \circ , ref. (7); \square , ref. (3); \triangle , ref. (9).