101. *The Dissociation Constants of Organic Acids. Part XX. The Thermodynamic Primary Dissociation Constants of Some Alkylglutaric Acids.*

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The conductivities over the range 0·0001—0·01N of a number of alkylglutaric acids and their sodium salts have been determined at 25°. The thermodynamic primary dissociation constants have been evaluated.

THE present communication provides accurate conductivity data at 25° over the range 0·0001—0·01N for a number of substituted glutaric acids and their sodium salts. These have been employed for the evaluation of the thermodynamic primary dissociation constants by the method described in previous papers of this series. The acids studied were β-methyl-, β-ethyl-, β-*n*-propyl-, ββ-dimethyl-, β-methyl-β-ethyl-, ββ-diethyl-, β-methyl-β-*n*-propyl-, and β-ethyl-β-*n*-propyl-glutaric acids; their sodium salts and that of ββ-di-*n*-propylglutaric acid were also studied, the last acid not being sufficiently soluble to yield trustworthy results for K_1, therm.

	Malonic acid.		Glutaric acid (β- or ββ-).				
	K_1, therm. $\times 10^4$.	$l_{0X''}$.	K_1, therm. $\times 10^4$.	$l_{0X''}$.	$K_1 \times 10^4$.*	$K_2 \times 10^6$.*	K_1, class $\times 10^4$.†
Methyl-	8·47	61·4	0·5815	53·6	0·57 0·56 ‡	6·0 § 3·91 ‡	0·60
Ethyl-	10·94	57·7	0·5189	52·2	0·52	4·7 §	0·53
n-Propyl-	10·26	53·7	0·4910	50·5	0·48	4·1 §	—
Dimethyl-	7·06	57·2	1·903	49·5	1·98 2·01 ‡	0·51 § 0·46 ‡	1·98
Methylethyl-	15·43	53·1	2·335	48·5	2·40	0·020 §	2·44
Diethyl-	70·80	52·5	3·286	47·9	2·38	0·075 §	3·44
Methyl-*n*-propyl- ...	—	—	2·367	48·0	—	—	—
Ethyl-*n*-propyl- ...	78·37	51·7	3·086	47·0	—	—	—
Di-*n*-propyl-	91·98	51·1	—	46·5	2·05	0·049 §	3·39

* Measurements by Gane and Ingold, except those marked ‡.
† ,, ,, Spiers and Thorpe.
‡ Measurements by Jones and Soper.
All other measurements are recorded in the present paper.

§ Ingold and Mohrhenn (J., 1935, 951) point out that Gane and Ingold's figures are in error by a factor of 10, and this correction has been made in these cases.

Earlier determinations of K_1 by conductivity must now be regarded as very approximate and need not be considered here. Spiers and Thorpe (J., 1925, **127**, **544**) determined certain classical primary dissociation constants, but their method for the calculation of Λ_0 cannot now be accepted as satisfactory. Gane and Ingold (J., 1928, 2267; 1931, 2158) determined both K_1 and K_2 for most of the above acids by potentiometric titration, and computed K, therm. by an extrapolation method. Jones and Soper (J., 1936, 135) determined both the primary and the secondary thermodynamic dissociation constants by potentiometric titration for β-methyl- and ββ-dimethyl-glutaric acids. Our results, together with those of the workers just referred to, and also the values of K_1, therm. for the substituted malonic acids (Part XVI, J., 1936, 1756) are summarised in the table on p. **446**. The figures for the limiting mobilities of the bivalent ions, $l_{0_{X''}}$, are also included.

There is a serious discrepancy between our value and that of Gane and Ingold for K_1 of ββ-diethylglutaric acid. Our collected results will be discussed from a theoretical standpoint when measurements of K_2, therm. by a new potentiometric method, now in progress, have been completed.

Experimental.

Preparation of Materials.—Acids. β-Methyl-, ββ-dimethyl-, β-methyl-β-ethyl-, ββ-diethyl-, β-methyl-β-*n*-propyl-, β-ethyl-β-*n*-propyl-, and ββ-di-*n*-propyl-glutaric acids were prepared as described by Vogel (J., 1934, 1761). The purification was carried out in Pyrex vessels, and all the solvents for recrystallisation were of analytical reagent purity. The m. p.'s were identical with those already given (*loc. cit.*).

β-*Ethylglutaric acid.* A modification of Day and Thorpe's method (J., 1920, **117**, 1470) was employed. 31 G. of cyanoacetamide (from alcohol, and dried at 100°), m. p. 118°, were dissolved in 220 ml. of water with slight warming, and the cooled solution was treated with 10·7 g. of propaldehyde (B.D.H., freshly distilled, b. p. 48—50°). 0·55 Ml. of 50% potassium hydroxide solution was immediately added to the mixture, which thereupon became slightly warm and yellow. After standing overnight, the separated solid was filtered off, washed with water, ground with concentrated hydrochloric acid, and then dried in a vacuum desiccator over calcium chloride and potassium hydroxide. The resultant αα'-dicyano-β-ethylglutarimide (13 g.), m. p. 147° (Day and Thorpe, *loc. cit.*, give m. p. 147°), was refluxed with 55 ml. of concentrated hydrochloric acid for 8 hours, and then cooled in ice water. The solid (*A*) which separated was filtered off and washed with concentrated hydrochloric acid; its m. p. was above 300°. The filtrate almost immediately deposited a white solid (*B*), which was collected after about ½ hour; it melted partly at 60—70°, but had not melted completely at 150°. Solids *A* and *B* were mixed and refluxed with 200 ml. of 50% sulphuric acid (by vol.) for 6 hours. The liquid was saturated with ammonium sulphate and extracted several times with ether and the extract dried (sodium sulphate) and evaporated. The residue crystallised in a vacuum desiccator after about 15 minutes, and had m. p. 68—70°. Upon recrystallisation from benzene–light petroleum (b. p. 40—60°), the β-ethylglutaric acid melted sharply at 72°.

β-n-*Propylglutaric acid.* 34 G. of pure dry cyanoacetamide were dissolved in 240 ml. of water and 14·5 g. of *n*-butaldehyde (B.D.H., freshly distilled, b. p. 73—74°/758 mm.) were added, together with sufficient alcohol to give a homogeneous liquid. After the addition of 0·60 ml. of 50% potassium hydroxide solution, the liquid was left overnight. The solid which had separated was filtered off, and ground with concentrated hydrochloric acid; upon drying as above, it had m. p. 136° (Day and Thorpe, *loc. cit.*, give m. p. 136°). 30 G. of the αα'-dicyano-β-*n*-propylglutarimide were refluxed with 84 ml. of concentrated hydrochloric acid and 120 ml. of water for 5 hours. The acid was extracted with ether, the ethereal solution dried (sodium sulphate), the ether removed, and the residue kept in a vacuum desiccator until it crystallised. After trituration with concentrated hydrochloric acid it had m. p. 50—52°; yield, 20 g. Recrystallised as for the ethyl acid, it had m. p. 52°.

Sodium salts. These were prepared in the usual manner from weighed amounts of the acids and standard (approximately 2N) sodium hydroxide. They were recrystallised from dilute ethyl alcohol (methyl alcohol was used for sodium β-methylglutarate) and dried at 130°. Their purity was checked by analysis :

Substituent :	Me.	Et.	Pr^a.	Me$_2$.	Et$_2$.	Pr$^a_2$.	MeEt.	MePr^a.	EtPr^a.
Na, % Found :	24·2	22·5	21·1	22·5	19·8	17·65	21·1	19·8	18·7
Na, % Calc. :	24·2	22·5	21·1	22·5	19·8	17·7	21·1	19·8	18·7

General Technique and Apparatus for Conductivity Measurements.—This has been described in earlier papers of this series; the symbols have the same significance. All the measurements were carried out at 25° $\pm$ 0·01°. The same Pyrex and silica cells as were used in the previous work were employed, and their constants were found to be unchanged.

For the sodium salts, the application of a " normal " solvent correction yielded the following results for the preliminary calculation of the mobilities required for the application of the combined solvent and hydrolysis correction (J., 1935, 24).

Substituent.		$l_{0X''}$.	$l_{0HX'}$.	$K_2 \times 10^7$.
Me	$\mu_0 = \mu_c + 604{\cdot}5C^{0{\cdot}637} = 195{\cdot}4$	47·9	25·4	40
Et	$\mu_0 = \mu_c + 432{\cdot}9C^{0{\cdot}584} = 191{\cdot}8$	46·1	24·4	40
Pr^a	$\mu_0 = \mu_c + 456{\cdot}7C^{0{\cdot}586} = 187{\cdot}9$	44·2	23·4	40
Me_2	$\mu_0 = \mu_c + 578{\cdot}2C^{0{\cdot}621} = 191{\cdot}5$	46·0	24·4	5·0
Et_2	$\mu_0 = \mu_c + 542{\cdot}6C^{0{\cdot}612} = 187{\cdot}4$	43·9	23·3	0·8
Pr^a_2	$\mu_0 = \mu_c + 839{\cdot}3C^{0{\cdot}655} = 183{\cdot}7$	42·1	22·3	0·5
MeEt	$\mu_0 = \mu_c + 601{\cdot}2C^{0{\cdot}597} = 187{\cdot}9$	44·2	23·4	2·0
$MePr^a$	$\mu_0 = \mu_c + 491{\cdot}0C^{0{\cdot}590} = 186{\cdot}4$	43·4	23·0	1·0
$EtPr^a$	$\mu_0 = \mu_c + 554{\cdot}5C^{0{\cdot}587} = 185{\cdot}4$	42·9	22·7	0·5

The limiting mobilities of the acid ions were calculated from the relation $l_{0HX'} = 0{\cdot}53 l_{0X'}$ (Part XI, J., 1935, 22). The approximate values of the secondary dissociation constants employed are given in the last column of the above table.

In the evaluation of K_1, therm., the following figures were used for the monosodium salts (Part XI, J., 1935, 26):

	Me.	Et.	Pr^a.	Me_2.	Et_2.	MeEt.	$MePr^a$.	$EtPr^a$.
Λ_0	78·2	77·5	76·6	76·0	75·2	75·5	75·2	74·7
x	77·63	77·47	77·27	77·13	76·94	77·01	76·94	76·83

The results for the sodium salts and acids are collected in the following tables. For the acids, c_i is the ionic concentration corresponding to the molecular concentration C, calculated as described in Part IX (J., 1934, 1104). Two approximations were sufficient for those acids in which $K_1 < 10^{-4}$; for the other acids three approximations were necessary. The values for K_1, therm. were not calculated for some of the results at low concentrations, for experience has shown that they are of little value in its final evaluation.

Sodium β-methylglutarate (M = 190·06).

$\mu_0^n = \mu_c + 165{\cdot}5C^{0{\cdot}318}$; $\mu_0^n = 206{\cdot}71$; $l_{0X''} = 53{\cdot}6$; $l_{0HX'} = 28{\cdot}4$.

$C \times 10^4$.	$\mu_{obs.}$.	$[H^+] \times 10^8$.	$\mu_{corr.}$.	μ_0^n.	$C \times 10^4$.	$\mu_{obs.}$.	$[H^+] \times 10^8$.	$\mu_{corr.}$.	μ_0^n.
	Run 1.	Cell V.	$\kappa = 0{\cdot}768$.			Run 2.	Cell S.	$\kappa = 0{\cdot}772$.	
1·473	193·18	13·10	197·61	—	3·672	191·64	7·89	193·18	—
7·707	189·09	2·80	189·86	206·81	12·49	186·55	2·85	186·89	206·63
13·81	185·66	1·69	186·08	206·47	23·75	182·36	1·13	182·47	206·69
31·44	180·05	0·88	180·21	206·69	43·28	177·38	0·63	177·44	206·74
45·70	176·73	0·57	176·79	206·76	56·09	174·71	0·48	174·75	206·61
59·70	174·30	0·46	174·33	206·76	77·41	171·72	0·39	171·74	(207·04)
72·10	172·38	0·40	172·41	206·93	100·4	169·56	0·28	169·56	(207·91)
85·70	170·96	0·34	170·97	(207·51)					

Sodium β-ethylglutarate (M = 204·07).

$\mu_0^n = \mu_c + 167{\cdot}8C^{0{\cdot}318}$; $\mu_0^n = 203{\cdot}93$; $l_{0X''} = 52{\cdot}2$; $l_{0HX'} = 27{\cdot}7$.

	Run 1.	Cell V.	$\kappa = 0{\cdot}685$.			Run 2.	Cell S.	$\kappa = 0{\cdot}683$.	
1·308	189·29	14·07	193·99	—	5·250	186·78	3·81	188·61	203·80
10·22	184·05	2·28	184·63	203·93	16·19	181·59	1·54	181·94	203·71
23·19	179·16	1·13	179·38	203·74	29·97	177·11	0·94	177·32	203·79
40·40	174·93	0·68	175·00	204·08	48·81	173·21	0·53	173·23	204·12
58·14	171·91	0·47	191·92	203·87	66·70	170·75	0·43	170·76	203·87
86·35	168·37	0·35	186·37	204·16	79·74	169·02	0·38	169·03	204·14
07·9	166·39	0·27	166·35	(204·62)	100·3	167·01	0·29	166·97	(204·82)

Sodium β-n-propylglutarate (M = 218·09).

$\mu_0^n = \mu + 165{\cdot}7C^{0{\cdot}306}$; $\mu_0^n = 200{\cdot}62$; $l_{0_{X''}} = 50{\cdot}5$; $l_{0_{HX'}} = 26{\cdot}8$.

$C\times 10^4$.	$\mu_{obs.}$.	$[H^+]\times 10^8$.	$\mu_{corr.}$.	μ_0^n.	$C\times 10^4$.	$\mu_{obs.}$.	$[H^+]\times 10^8$.	$\mu_{corr.}$.	μ_0^n.
	Run 1.	Cell V.	κ = 0·667.			Run 2.	Cell S.	κ = 0·680.	
1·707	184·50	12·51	188·29	—	4·231	183·13	6·01	184·90	—
6·755	181·89	3·09	182·74	200·49	10·58	179·59	2·25	180·05	200·41
12·93	178·54	1·90	179·00	200·65	20·66	175·25	1·23	175·55	200·55
24·47	174·54	1·10	174·75	200·44	34·22	171·45	0·82	171·58	200·73
40·68	170·08	0·67	170·12	200·88	50·81	168·14	0·52	168·12	200·59
57·25	167·15	0·47	167·10	200·83	70·02	165·38	0·41	165·34	(201·16)
77·60	164·28	0·38	164·23	(201·36)	95·69	162·23	0·30	162·25	(201·46)
104·4	161·45	0·28	161·37	(201·52)					

Sodium ββ-dimethylglutarate (M = 204·07).

$\mu_0^n = \mu_c + 200{\cdot}6C^{0{\cdot}376}$; $\mu_0^n = 198{\cdot}51$; $l_{0_{X''}} = 49{\cdot}5$; $l_{0_{HX'}} = 26{\cdot}2$.

	Run 1.	Cell V.	κ = 0·730.			Run 2.	Cell S.	κ = 0·732.	
1·499	189·64	3·81	196·16	—	3·981	187·01	1·27	189·05	—
7·170	184·53	0·83	185·71	(198·91)	7·692	184·24	0·77	185·56	198·58
12·66	181·90	0·53	182·50	198·23	15·74	180·18	0·42	180·70	198·39
23·52	177·70	0·30	177·96	198·55	33·32	175·19	0·23	175·29	198·69
40·61	173·52	0·19	173·58	198·61	50·45	171·67	0·17	171·67	198·72
56·51	170·62	0·14	170·61	198·22	70·31	168·83	0·13	168·80	198·69
77·15	168·21	0·12	168·17	198·37	87·46	167·12	0·10	167·07	(199·82)
103·6	166·16	0·07	166·06	(199·13)					

Sodium ββ-diethylglutarate (M = 232·11).

$\mu_0^n = \mu_c + 186{\cdot}3C^{0{\cdot}353}$; $\mu_0^n = 195{\cdot}33$; $l_{0_{X''}} = 47{\cdot}9$; $l_{0_{HX'}} = 25{\cdot}4$.

	Run 1.	Cell V.	κ = 0·717.			Run 2.	Cell S.	κ = 0·730.	
1·051	184·62	0·581	190·61	—	3·321	183·52	0·195	185·18	—
6·630	181·69	0·131	181·39	195·45	9·710	179·66	0·104	179·35	195·45
12·52	178·07	0·087	177·51	195·13	19·41	175·29	0·064	174·57	195·12
25·14	173·57	0·056	172·89	195·39	38·46	169·35	0·045	168·80	194·95
47·49	167·53	0·037	166·87	195·06	58·53	165·37	0·032	164·81	195·14
66·93	164·28	0·030	163·67	195·64	77·29	162·72	0·028	162·13	195·58
87·87	161·27	0·027	160·71	195·66	96·20	160·41	0·025	159·89	(196·03)
108·6	159·11	0·024	158·65	(196·41)					

Sodium ββ-di-n-propylglutarate (M = 232·11).

$\mu_0^n = \mu_c + 181{\cdot}2C^{0{\cdot}326}$; $\mu_0^n = 192{\cdot}64$; $l_{0_{X''}} = 46{\cdot}5$; $l_{0_{HX'}} = 24{\cdot}6$.

	Run 1.	Cell V.	κ = 0·871.			Run 2.	Cell S.	κ = 0·850.	
1·832	181·63	0·475	186·03	—	3·512	179·52	0·183	180·71	—
6·554	176·46	0·133	176·06	192·65	7·486	175·98	0·123	175·59	192·93
12·40	172·62	0·087	171·98	192·42	13·21	172·16	0·079	171·60	192·45
21·54	168·68	0·061	167·95	192·42	24·18	167·81	0·057	166·99	192·39
42·09	163·32	0·043	162·76	193·05	43·84	162·67	0·042	161·98	192·84
57·54	160·31	0·034	159·70	192·41	63·78	159·38	0·030	158·70	192·86
79·82	157·39	0·028	156·72	(194·44)	88·92	156·19	0·026	155·56	(194·42)
106·6	154·64	0·024	154·15	(195·30)					

Sodium β-methyl-β-ethylglutarate (M = 218·09).

$\mu_0^n = \mu_c + 207{\cdot}1C^{0{\cdot}351}$; $\mu_0^n = 196{\cdot}55$; $l_{0_{X''}} = 48{\cdot}5$; $l_{0_{HX'}} = 25{\cdot}7$.

	Run 1.	Cell V.	κ = 0·850.			Run 2.	Cell S.	κ = 0·841.	
1·940	184·13	1·114	189·24	—	3·116	182·47	0·815	186·12	—
5·380	180·55	0·426	182·00	196·72	9·004	177·96	0·271	178·78	196·45
12·27	176·35	0·214	176·65	196·33	19·08	173·51	0·156	173·47	196·47
22·41	172·19	0·135	172·14	196·45	28·26	170·33	0·116	170·38	196·66
36·13	168·05	0·096	167·99	196·66	45·85	165·98	0·079	165·91	196·61
48·75	165·45	0·078	165·39	196·34	57·51	164·07	0·067	163·94	196·82
69·52	161·98	0·062	161·80	(197·01)	81·39	160·13	0·058	159·95	(197·22)
90·59	159·26	0·053	159·10	(197·82)	101·4	157·79	0·048	157·60	(197·92)

Sodium β-methyl-β-n-propylglutarate (M = 232·11).

$\mu_0'' = \mu_c + 183{\cdot}9C^{0{\cdot}344}$; $\mu_0'' = 195{\cdot}62$; $l_{0_{X''}} = 48{\cdot}0$; $l_{0_{HX'}} = 25{\cdot}4$.

$C \times 10^4$.	$\mu_{obs.}$.	$[H^+] \times 10^8$.	$\mu_{corr.}$.	μ_0''.	$C \times 10^4$.	$\mu_{obs.}$.	$[H^+] \times 10^8$.	$\mu_{corr.}$.	μ_0''.
	Run 1.	Cell *V*.	κ = 0·850.			Run 2.	Cell *S*.	κ = 0·855.	
1·354	182·55	1·171	187·90	—	4·231	180·39	0·608	182·71	—
6·300	179·23	0·347	180·15	195·71	10·68	176·81	0·237	178·26	195·72
11·69	175·93	0·224	176·29	195·31	16·96	173·87	0·173	176·08	195·56
21·08	172·39	0·142	172·42	195·51	29·94	169·72	0·109	169·66	195·53
37·09	167·85	0·091	167·75	195·56	48·35	165·68	0·077	165·57	195·94
53·16	164·89	0·072	164·67	195·73	62·17	163·54	0·064	163·38	(196·41)
70·61	162·29	0·060	162·12	(196·59)	79·51	161·33	0·057	162·13	(196·97)
97·53	159·20	0·050	159·00	(197·39)					

Sodium β-ethyl-β-n-propylglutarate (M = 246·12).

$\mu_0'' = \mu_c + 188{\cdot}3C^{0{\cdot}336}$; $\mu_0'' = 193{\cdot}54$; $l_{0_{X''}} = 47{\cdot}0$; $l_{0_{HX'}} = 24{\cdot}9$.

	Run 1.	Cell *V*.	κ = 0·871.			Run 2.	Cell *S*.	κ = 0·862.	
1·298	182·47	0·531	187·57	—	3·246	180·69	0·198	182·55	—
7·325	177·20	0·123	176·75	193·39	9·652	175·88	0·103	175·18	193·44
13·89	173·38	0·082	172·77	193·43	17·88	171·52	0·067	170·67	193·14
19·78	170·75	0·063	170·00	193·25	28·67	167·95	0·053	167·12	193·46
34·24	166·20	0·047	165·58	193·52	49·01	162·73	0·037	162·21	193·64
54·10	162·05	0·034	161·41	194·00	60·77	160·54	0·031	160·04	193·96
74·91	158·54	0·029	157·97	(194·38)	84·95	157·22	0·027	156·72	(194·66)
97·13	155·73	0·025	155·20	(194·87)					

Molecular Conductivities of Sodium Salts of Alkylglutaric Acids at 25°.

$C \times 10^4$.	Me.	Et.	Pr$^{\alpha}$.	Me$_2$.	Et$_2$.	Pr$^{\alpha}_2$.	MeEt.	MePr$^{\alpha}$.	EtPr$^{\alpha}$.
5·0	191·90	188·75	184·30	187·82	182·75	178·53	182·50	181·65	179·28
10·0	188·20	185·05	180·50	183·80	179·05	173·65	178·15	177·50	174·95
20·0	183·65	180·38	175·70	179·15	174·22	168·50	172·95	172·72	169·85
30·0	180·50	177·30	172·60	176·03	171·03	165·25	169·63	169·55	166·75
40·0	177·90	174·95	170·15	173·65	168·48	162·78	167·05	167·15	164·20
50·0	175·75	173·05	168·25	171·72	166·40	160·90	165·18	165·18	162·10
60·0	174·05	171·50	166·55	170·05	164·65	159·35	163·40	163·65	161·25
70·0	172·55	170·15	165·20	168·85	163·18	158·03	161·78	162·11	158·73
80·0	171·43	168·98	163·95	167·83	161·70	156·70	160·38	160·95	157·20
90·0	170·53	167·95	162·85	166·95	160·50	155·55	159·15	159·75	155·95
100·0	169·65	166·98	161·85	166·25	159·55	154·65	157·10	158·75	154·90

Primary Dissociation Constants at 25°.

β-Methylglutaric acid (M = 148·12; Λ_0 = 376·4).

$C \times 10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i \times 10^4$.	K_1, therm. $\times 10^4$.	$C \times 10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i \times 10^4$.	K_1, therm. $\times 10^4$.
	Run 1.	Cell *Q*.	κ = 0·930.				Run 2.	Cell *R*.	κ = 0·713.		
1·554	67·85	0·6165	—	—	—	1·001	83·17	0·6276	—	—	—
2·856	51·21	0·6121	—	—	—	2·127	58·81	0·6158	—	—	—
5·288	38·25	0·6081	374·48	5·4036	0·5823	3·950	43·82	0·6058	374·61	4·6205	0·5823
6·089	35·80	0·6087	374·39	5·8222	0·5820	6·783	34·00	0·6084	374·33	6·1611	0·5811
7·504	32·43	0·6095	374·27	6·5014	0·5812	8·349	30·85	0·6109	374·19	6·8833	0·5818
9·837	28·53	0·6113	374·10	7·5005	0·5808	9·192	29·47	0·6112	374·13	7·2388	0·5815
11·82	25·85	0·6129	373·93	8·3642	0·5809	10·42	27·75	0·6115	374·03	7·7308	0·5808
										Mean	0·5815

β-Ethylglutaric acid (M = 160·10; Λ_0 = 375·7).

	Run 1.	Cell *Q*.	κ = 0·691.				Run 2.	Cell *R*.	κ = 0·695.		
0·904	82·09	0·5524	—	—	—	1·261	70·55	0·5473	—	—	—
1·850	59·13	0·5438	—	—	—	2·705	49·42	0·5389	374·11	3·5371	0·5205
3·617	43·19	0·5401	374·02	4·1770	0·5200	4·350	39·61	0·5404	373·93	4·6079	0·5193
5·002	37·08	0·5406	373·87	4·9605	0·5186	6·002	34·05	0·5421	373·77	5·4676	0·5190
6·856	31·97	0·5425	373·69	5·8646	0·5186	7·428	30·78	0·5432	373·64	6·1191	0·5186
7·946	29·80	0·5430	373·61	6·3233	0·5181	8·328	29·14	0·5433	373·57	6·4978	0·5181
8·969	28·14	0·5440	373·53	6·7572	0·5183	9·754	27·03	0·5441	373·46	7·0613	0·5191
										Mean	0·5189

β-n-Propylglutaric acid ($M = 174{\cdot}11$; $\Lambda_0 = 374{\cdot}8$).

$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.	$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.
Run 1. Cell Q. $\kappa = 0{\cdot}697$.						Run 2. Cell R. $\kappa = 0{\cdot}713$.					
0·893	79·94	0·5162	—	—	—	1·367	65·95	0·5135	—	—	—
1·728	59·25	0·5128	—	—	—	2·515	49·82	0·5125	—	—	—
3·278	43·99	0·5116	373·18	3·8637	0·4910	4·223	39·05	0·5117	373·05	4·4205	0·4921
5·174	35·48	0·5122	372·94	4·9227	0·4915	5·672	33·97	0·5123	372·91	5·1669	0·4912
6·025	33·01	0·5126	372·89	5·3336	0·4910	6·782	31·20	0·5127	372·83	5·6755	0·4905
7·669	29·44	0·5135	372·75	6·0568	0·4905	8·407	28·19	0·5142	372·72	6·3585	0·4912
10·16	25·74	0·5146	372·64	7·0201	0·4898	9·579	26·48	0·5145	372·66	6·8065	0·4906
										Mean	0·4910

ββ-Dimethylglutaric acid ($M = 160{\cdot}10$; $\Lambda_0 = 374{\cdot}2$).

$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.	$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.
Run 1. Cell Q. $\kappa = 0{\cdot}930$.						Run 2. Cell R. $\kappa = 0{\cdot}713$.					
1·243	125·26	2·094	—	—	—	0·955	139·95	2·135	—	—	—
2·224	97·68	2·050	—	—	—	3·008	85·61	2·042	—	—	—
4·303	72·90	2·028	371·72	8·4378	(1·924)	3·578	79·03	2·024	—	—	—
6·097	62·14	2·017	371·39	10·2022	1·903	4·948	68·24	2·013	371·59	9·0863	1·905
7·051	58·20	2·020	371·22	11·0546	1·903	6·486	60·47	2·020	371·31	10·8090	1·904
8·370	53·84	2·024	371·02	12·1451	1·901	7·690	56·00	2·026	371·12	11·6011	1·904
10·34	48·76	2·028	370·75	13·6243	1·899	9·344	51·19	2·027	370·89	12·8956	1·902
										Mean	1·903

ββ-Diethylglutaric acid ($M = 188{\cdot}13$; $\Lambda_0 = 373{\cdot}4$).

$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.	$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.
Run 1. Cells J and V. $\kappa = 0{\cdot}932$.						Run 2. Cells J and V. $\kappa = 0{\cdot}685$.					
0·623*J*	205·54	4·231	—	—	—	1·001*J*	173·74	3·826	—	—	—
4·050*V*	94·63	3·423	370·73	10·3379	3·288	2·167*V*	116·61	3·718	—	—	—
5·334*V*	84·21	3·503	370·38	12·1281	3·291	4·374*V*	91·15	3·448	370·64	10·7568	3·295
5·514*J*	82·87	3·490	370·34	12·3376	3·278	6·066*J*	79·62	3·505	370·19	13·0467	3·287
7·816*V*	71·34	3·528	369·73	15·0824	3·285	6·908*J*	75·23	3·512	369·97	14·0468	3·284
9·097*V*	67·22	3·595	369·49	16·1721	3·275	8·491*J*	69·09	3·567	369·59	15·8728	3·288
						9·886*V*	64·96	3·614	369·28	17·3905	3·293
										Mean	3·286

β-Methyl-β-ethylglutaric acid ($M = 174{\cdot}11$; $\Lambda_0 = 373{\cdot}7$).

$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.	$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.
Run 1. Cell Q. $\kappa = 0{\cdot}922$.						Run 2. Cell R. $\kappa = 0{\cdot}689$.					
1·551	123·08	2·510	—	—	—	1·012	148·71	2·661	—	—	—
2·389	102·81	2·495	—	—	—	3·060	92·00	2·460	—	—	—
4·366	78·96	2·471	371·07	9·2846	2·337	5·276	72·61	2·472	370·89	10·3290	2·333
6·100	68·10	2·477	370·71	11·2066	2·333	6·751	65·15	2·484	370·60	11·8680	2·336
8·173	59·74	2·486	370·33	13·1849	2·331	7·739	61·23	2·485	370·42	12·7925	2·337
9·184	56·65	2·489	370·18	14·0547	2·333	8·715	58·04	2·489	370·25	13·6616	2·331
10·24	53·96	2·495	370·00	14·9337	2·341	9·959	54·62	2·492	370·05	14·6998	2·333
										Mean	2·335

β-Methyl-β-n-propylglutaric acid ($M = 188{\cdot}13$; $\Lambda_0 = 373{\cdot}4$).

$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.	$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.
Run 1. Cells J and V. $\kappa = 0{\cdot}924$.						Run 2. Cells J and V. $\kappa = 0{\cdot}721$.					
0·897*J*	152·28	2·519	—	—	—	3·259*V*	90·02	2·497	—	—	—
2·076*J*	109·30	2·514	—	—	—	4·270*J*	80·15	2·505	370·79	9·1665	2·372
3·609*V*	86·14	2·497	370·95	8·3818	2·370	5·296*J*	72·99	2·516	370·57	10·4314	2·368
5·126*J*	74·00	2·511	370·59	10·2358	2·371	6·115*V*	68·46	2·518	370·41	11·3019	2·369
6·645*J*	65·97	2·520	370·30	11·8387	2·369	7·200*V*	63·65	2·522	370·21	12·3789	2·368
8·946*V*	57·45	2·508	369·90	13·8931	(2·342)	8·398*J*	58·38	2·525	369·99	13·4780	2·366
10·62*V*	53·21	2·525	369·62	15·2909	2·358	9·931*V*	55·01	2·528	369·75	15·1291	2·365
10·84*V*	52·90	2·534	369·59	15·5107	2·364					Mean	2·367

β-Ethyl-β-n-propylglutaric acid ($M = 202{\cdot}14$; $\Lambda_0 = 372{\cdot}9$).

$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.	$C\times10^3$.	μ_c.	K_1, class. $\times 10^4$.	Λ_e.	$c_i\times10^4$.	K_1, therm. $\times10^4$.
Run 1. Cells J and V. $\kappa = 0{\cdot}930$.						Run 2. Cells J and V. $\kappa = 0{\cdot}761$.					
0·665*J*	169·12	3·601	—	—	—	2·020*V*	124·85	3·402	—	—	—
1·678*V*	134·36	3·405	—	—	—	4·133*J*	91·27	3·279	370·12	10·1920	3·097
3·966*V*	93·37	3·317	—	—	—	5·459*J*	80·94	3·285	369·78	11·9491	3·090
4·891*J*	84·90	3·282	369·91	11·2242	3·093	6·502*V*	75·02	3·295	369·54	13·1996	3·090
6·830*J*	73·26	3·286	369·48	13·5416	3·081	7·513*J*	70·38	3·299	369·33	14·3169	3·087
6·890*V*	73·04	3·288	369·47	13·6199	3·080	8·650*V*	66·07	3·300	369·10	15·4838	3·081
7·956*J*	68·61	3·300	369·24	14·7819	3·085	9·569*J*	63·15	3·304	368·93	16·3794	3·086
10·17*V*	61·47	3·309	368·82	16·9497	3·079					Mean	3·086

Molar Conductivities of Acids at Round Concentrations at 25°.

$C \times 10^3$.	Me.	Et.	Pr^a.	Me_2.	Et_2.	MeEt.	$MePr^a$.	$EtPr^a$.
1·0	83·2	78·6	75·7	137·0	174·0	150·0	148·0	169·2
2·0	60·2	57·1	53·4	100·0	121·8	108·4	108·3	124·4
3·0	50·1	46·3	43·8	84·4	105·0	92·3	92·6	103·9
4·0	43·8	41·0	40·2	75·2	94·9	82·1	82·7	92·6
5·0	39·3	37·0	36·0	68·2	86·7	74·5	75·1	84·2
6·0	36·0	34·1	33·0	62·9	80·2	68·6	69·4	77·7
7·0	33·4	31·8	30·4	58·6	75·1	64·1	64·5	72·6
8·0	31·3	29·8	28·7	53·1	70·8	60·3	60·6	68·5
9·0	29·7	28·2	27·2	52·2	67·5	57·1	57·4	65·1
10·0	28·3	27·4	25·9	49·7	64·9	54·3	54·8	62·0

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