tests is very small. The influence of the nature of the hot surfaces, like porcelain or glass, is so great as to warrant the assumption that the decomposition takes place almost altogether on the impact of the ammonia molecule against the solid surface. With a rough surface a larger proportion of impinging molecules are decomposed than with a smooth surface. Experimentally, it has been found that ammonia gas in contact with a hot glass tube may be decomposed only slightly, while at the same temperature in contact with an equal extent of porcelain, the decomposition may be fifty times as great.

It follows as a conclusion that in the destructive distillation of coal, the decomposition of ammonia may be prevented by keeping the temperature low, and by lessening, so far as possible, the time which the red-hot gases remain in contact with rough substances like coke or the fire-clay retort. The introduction of blue water-gas into the retorts, as in the Lewes process, should, by rapidly sweeping out the gases, lessen the ammonia decomposition. The high yield of ammonia in the Mond gas producer may be assigned to the combination of lower temperature and rapid withdrawal of the gases.

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NOTE ON THE CONSTITUTION OF CERTAIN ORGANIC SALTS OF NICKEL AND COBALT AS THEY EXIST IN AQUEOUS SOLUTION.

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IN A former paper[1] it was shown that the nickel and cobalt salts of succinic, malic and tartaric acids exist in a polymerized state in aqueous solution, and that this polymerized condition becomes more noticeable the more hydroxyl groups are present in the molecule; that is, the tartrates are more polymerized than the malates, and these latter than the succinates. These facts were brought out by means of measurements of the electrical conductivity and determinations of the depression of the freezing-point of solutions of these salts. An extension of these determinations[2] to the salts of malonic and tartronic acids showed

[1] This Journal, **24**, 1012 (1902).

[2] *Loc. cit.*, pp. 1020–1022.

that the salts of the latter were no more polymerized than those of the former, that is, that the hydroxyl group in this case apparently did not increase polymerization of the molecules. It was, however, stated at the time that this was probably an exceptional case, as the lowest members of many of the organic series exhibit peculiar behavior.

To throw further light on this subject, I have recently extended these investigations to the salts of the glutaric acid series. The nickel, cobalt, and magnesium salts of glutaric, α-hydroxyglutaric, and trihydroxyglutaric acids have been prepared and their conductivity and freezing-points determined. The first of these acids was a preparation of Merck, the second of Gerhardt, and the last was made by myself from arabinose, according to the method of Kiliani.[1] The yield of trihydroxyglutaric acid was small, but after crystallizing from alcohol enough was obtained to prepare the three salts in sufficient quantity to make one complete series of determinations. The solutions were prepared in the manner detailed in the paper already referred to, and almost all of the phenomena mentioned there were observed here. All of the solutions, except that of magnesium trihydroxyglutarate, which seemed to be exceptionally soluble, were practically saturated. The analyses of the solutions and the details of the measurements were likewise the same as before. The conductivity of the water used in preparing the solutions was 1.8×10^{-6}. This was subtracted from the conductivity of the solutions. The molecular conductivity, M, of the salts is shown in Table I; v represents the number of liters in which a gram-molecule of the salt was dissolved.

TABLE I.

NICKEL GLUTARATE.

v	M	v	M
33.15	84.7	34.47	91.3
2×33.15	99.3	2×34.47	106.4
4×33.15	115.9	4×34.47	122.3
8×33.15	129.9	8×34.47	135.4
16×33.15	142.7	16×34.47	147.1
32×33.15	154.5	32×34.47	157.7
64×33.15	165.6	64×34.47	167.8

[1] *Ber. d. chem. Ges.*, **21**, 3007 (1888).

MAGNESIUM GLUTARATE.

v	M	v	M
22.80	87.5	25.56	86.8
2×22.80	96.7	2×25.56	97.6
4×22.80	107.7	4×25.56	108.6
8×22.80	119.4	8×25.56	119.5
16×22.80	130.4	16×25.56	131.1
32×22.80	140.7	32×25.56	141.8
64×22.80	149.2	64×25.56	152.4

COBALT HYDROXYGLUTARATE.

v	M	v	M
23.48	67.1	24.16	66.6
2×23.48	81.6	2×24.16	81.0
4×23.48	97.6	4×24.16	95.3
8×23.48	110.0	8×24.16	109.9
16×23.48	125.3	16×24.16	123.1
32×23.48	138.8	32×24.16	137.5
64×23.48	150.6	64×24.16	151.1

COBALT GLUTARATE.

v	M	v	M
31.38	90.7	29.70	86.7
2×31.38	104.5	2×29.70	101.3
4×31.38	118.6	4×29.70	114.7
8×31.38	132.8	8×29.70	129.3
16×31.38	146.7	16×29.70	143.7
32×31.38	158.5	32×29.70	155.4
64×31.38	170.0	64×29.70	165.3

NICKEL HYDROXYGLUTARATE.

v	M	v	M
33.31	71.3	30.41	71.4
2×33.31	87.3	2×30.41	86.6
4×33.31	102.8	4×30.41	101.9
8×33.31	121.8	8×30.41	116.6
16×33.31	138.8	16×30.41	132.2
32×33.31	156.2	32×30.41	147.0
64×33.31	168.9	64×30.41	161.2

MAGNESIUM HYDROXYGLUTARATE.

v	M	v	M
21.54	85.1	23.32	88.4
2×21.54	98.6	2×23.32	101.9
4×21.54	113.2	4×23.32	115.5
8×21.54	127.7	8×23.32	127.6
16×21.54	139.5	16×23.32	139.4
32×21.54	151.3	32×23.32	150.7
64×21.54	161.0	64×23.32	160.6

Nickel Trihydroxyglutarate.		Cobalt Trihydroxyglutarate.		Magnesium Trihydroxyglutarate.	
v	M	v	M	v	M
39.13	53.0	42.14	51.6	10.600	38.8
2×39.13	62.8	2×42.14	62.9	2×10.600	47.8
4×39.13	72.4	4×42.14	74.7	4×10.600	57.8
8×39.13	82.6	8×42.14	89.1	8×10.600	70.3
16×39.13	92.1	16×42.14	100.6	16×10.600	84.0
32×39.13	101.6	32×42.14	116.0	32×10.600	99.0
64×39.13	111.6	64×42.14	131.6	64×10.600	114.9
				128×10.600	130.7

From these results, interpolations have been made graphically for the dilutions, $v=16$, 32, etc. These interpolated values are given in Table II. In cases where the conductivity was determined in duplicate, only the averages are given in the table.

Table II.

Molecular Conductivity of Glutarates.

v.	Nickel.	Cobalt.	Magnesium.
16	..	..	81.8
32	87.0	89.5	91.0
64	102.1	103.4	101.4
128	117.8	117.6	112.7
256	131.5	131.9	124.1
512	143.9	145.9	135.3
1024	155.3	157.6	145.1
2048	165.9	168.3	154.5

Molecular Conductivity of Hydroxyglutarates.

v.	Nickel.	Cobalt.	Magnesium.
16	....	....	80.0
32	71.6	72.9	93.7
64	87.1	87.5	107.7
128	102.4	101.7	121.1
256	119.0	116.3	134.0
512	134.6	130.5	145.6
1024	151.7	143.7	156.3
2048	165.4	155.6	165.7

Molecular Conductivity of Trihydroxyglutarates.

v.	Nickel.	Cobalt.	Magnesium.
16	....	....	43.6
32	50.1	47.0	52.0
64	60.0	58.5	64.0
128	69.5	69.8	78.2
256	79.3	83.0	92.9

v.	Nickel.	Cobalt.	Magnesium.
512	89.2	96.8	108.0
1024	99.1	110.5	124.0
2048	108.8	125.5	140.2

Although the conductivity of the cobalt and nickel salts is, in general, somewhat greater than the conductivity of the corresponding salts of malic and tartaric acids, still the conductivity seems to decrease as the number of hydroxyl groups increases in a manner quite similar to that of the succinic acid series.

The depression of the freezing-point for different solutions of these salts is given in Table III, together with the apparent molecular weights calculated from them.

TABLE III.

NICKEL GLUTARATE. Mol. wt. = 189.

Substance in 100 cc. Grams.	Depression.	Apparent mol. wt.
0.5508	0.121°	84
0.5476	0.108	94
0.2754	0.065	78
0.2738	0.059	86
0.1377	0.033	77
0.1369	0.031	82

COBALT GLUTARATE. Mol. wt. = 189.

Substance in 100 cc. Grams.	Depression.	Apparent mol. wt.
0.6365	0.119°	99
0.6144	0.118	96
0.3183	0.063	94
0.3072	0.061	93
0.1592	0.038	78
0.1536	0.032	89

MAGNESIUM GLUTARATE. Mol. wt. = 154.

0.6769	0.127°	99
0.6038	0.114	98
0.5077	0.100	94
0.3019	0.064	87
0.2538	0.055	85
0.1510	0.033	85

NICKEL HYDROXYGLUTARATE. Mol. wt. = 205.

0.6733	0.108°	115
0.6147	0.106	107
0.3367	0.058	107
0.3024	0.054	105
0.1864	0.030	104
0.1512	0.029	98

COBALT HYDROXYGLUTARATE. Mol. wt. = 205.

0.8734	0.148°	109
0.8487	0.147	108
0.4367	0.077	103
0.4244	0.075	105
0.2184	0.043	94
0.2122	0.041	96

MAGNESIUM HYDROXYGLUTARATE. Mol. wt. = 170.

0.7907	0.164°	89
0.7304	0.141	96
0.3954	0.083	88
0.3652	0.074	91
0.1977	0.044	83
0.1826	0.042	80

Nickel Trihydroxyglutarate. Mol. wt. = 237.			Cobalt Hydroxyglutarate. Mol. wt. = 237.		
0.6050	0.080°	140	0.5625	0.072°	145
0.3025	0.042	317	0.2813	0.037	141
0.1513	0.025	112	0.1407	0.021	124

Magnesium Trihydroxyglutarate.

Mol. wt. = 202.

1.9087	0.293°	121
0.9544	0.154	115
0.4772	0.092	96

When we compare the apparent molecular weight with the molecular weight calculated on the basis of the simple formula in the above table there appears to be but little evidence of polymerization. In the case of the tartrates of nickel and cobalt, apparent molecular weights were obtained which exceeded the calculated molecular weights, and this was the reason for postulating polymerization in those cases. Since, however, the trihydroxyglutarates yield somewhat higher apparent molecular weights than the other glutarates and also molecular conductivities, it can be said that, if there is any tendency toward polymerization of these salts, it is strongest when the maximum number of hydroxyl groups are present in the molecule.

It may, however, be stated that the tendency toward polymerization shown by the cobalt and nickel salts of malates and tartrates apparently grows no stronger with similar salts of the higher hydroxy-acids of this series.

Western Reserve University,
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[Contribution from the Kent Chemical Laboratory of the University of Chicago.]

RADIOACTIVITY AS AN ATOMIC PROPERTY.

By Herbert N. McCoy.

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It is now generally considered that the radioactivity of any element is independent of its form of chemical combination, that, in fact, radioactivity is a property of the atom rather than of the molecule. There is already much evidence in favor of this view. Thus it is well established that the rate of decay of activity of temporarily radioactive products is wholly independent of all