No.	Solids per liter.	Sodium chloride per liter.	Specific gravity $\frac{25^\circ}{4^\circ}$.	Sp. gr. of sodium chloride solution.	Coefficient for total solids.	Coefficient for solids less salt.
13	63.79	13.87	1.0238	1.0065	0.267	0.288
14	65.43	15.51	1.0260	1.0076	0.251	0.271
15	56.77	13.65	1.0234	1.0062	0.243	0.251
16	61.50	15.19	1.0238	1.0072	0.259	0.278
17	44.34	13.56	1.0172	1.0062	0.258	0.280
18	51.52	17.64	1.0202	1.0092	0.255	0.308
19	59.96	18.97	1.0235	1.0102	0.255	0.306
20	40.09	11.55	1.0154	1.0048	0.263	0.269
21	58.92	15.13	1.0230	1.0071	0.256	0.275
22	52.18	14.64	1.0213	1.0069	0.245	0.261
23	52.99	10.25	1.0190	1.0040	0.278	0.285
24	55.03	15.24	1.0220	1.0073	0.250	0.257
Mean,	53.05	14.63	1.0211	1.0069	0.251	0.271

It will be observed that the coefficient for the total solids is 0.251 and slightly smaller than the mean value found before, 0.260. The coefficient for solids, less sodium chloride, is considerably larger and, contrary to expectations, is the mean of results which show wider variations than in the other case. Most of the individual results are, however, near the mean value and for certain classes of calculations, therefore, the coefficient may be used with only a small probable error. It will be noted that the urines tested showed a range of concentration between about 30 and 70 grams per liter of solids.

NORTHWESTERN UNIVERSITY,
CHICAGO, JUNE, 1903.

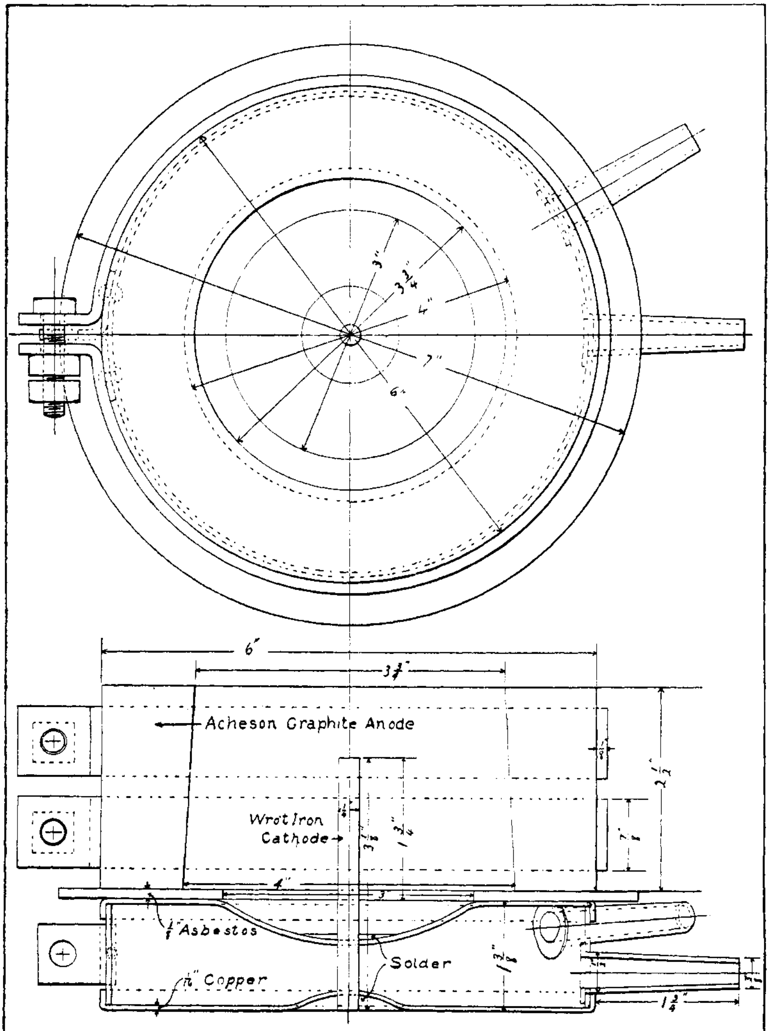
[CONTRIBUTION FROM THE JOHN HARRISON LABORATORY OF CHEMISTRY, No. 69.]

THE ELECTROLYTIC PRODUCTION OF CALCIUM.

BY JOSEPH H. GOODWIN.

Received June 26, 1903.

SEVERAL suggestions have been offered during the past year for the preparation of metallic calcium in the electrolytic way. The attempts made by the writer, with various furnaces, were fruitless. After much experimentation, the furnace, pictured below, was devised, and as it gave an excellent yield of metal it was thought that perhaps it would be helpful to others, hence this communication. Its construction is evident from the sketch. The cathode of wrought iron is firmly fastened in electrical contact with a copper water-jacket, which serves as a cooler and as base for the furnace. Separated from this base by asbestos is a ring of graphite, made by boring out a 2.5-inch disk from a 6-inch Acheson graphite electrode. This ring constitutes the walls of the furnace and is also the anode, its electric connection being made by two wrought iron bands clamped firmly about it.



CALCIUM FURNACE

When the furnace has been arranged, spread powdered lime to the depth of half an inch over the bottom, pressing it down until it forms a firm, smooth floor. A stream of water is then sent through the jacket and the switch closed. Anhydrous calcium chloride, fused for half an hour in a wind furnace, is next poured into the furnace. It does not readily "wet" the graphite, it shrinks away from it; consequently a sheet of beautiful purple light separates the chloride from the graphite. It is an electric arc with a back electromotive force of 50 volts, which lowers the current. Contact between the chloride and graphite can be made by immersing a carbon rod along side the anode or by splashing the electrolyte against the graphite ring. The resistance should be cut out until a current of 100 amperes is passing. There will be a copious evolution of chlorine, for the removal of which a good "hood" is essential. Calcium chloride should be poured in from time to time, the temperature of the cell being kept at 950°. The liberated calcium melts from the iron rod upon which it has been deposited and floats to the surface, forming there a globule which, when about an inch in diameter, is removed with a small sheet-iron spoon.

The purity of the metal obtained in this manner varies with the purity of the chloride. Specimens made from chloride gotten from ordinary calcite showed, on analysis:

	Per cent.
Ca	94.80
Mg	4.16
Fe	1.03
	99.99

The metal calcium is rather brittle. On a fractured surface it is more brilliant than steel, with a gray-white color. When cut or filed, it exhibits a yellow tinge, resembling German silver or gold alloyed with a great excess of silver. Globules of metal may be freed from chloride with alcohol and then ground on an emery wheel, when they become very bright. If preserved under petroleum, their metallic luster is retained.

Metallic calcium is quite stable. The red-hot, molten metal can be stirred about in the furnace quite vigorously, and even be dipped out and poured back without igniting. If, however, some of the metal be collected on a wire and struck smartly on the table, it will fly in all directions with a hissing sound and burn violently with a blinding light. Similar energetic action takes place when the hot metal comes in contact with asbestos or with other reducible substances.

The attempts to prepare strontium were not very successful. It is quite probable that the furnace will have to be somewhat modified for this purpose and also for the isolation of barium.

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NOTES.

The Preparation of Oxygen.—The action of dilute sulphuric acid on potassium permanganate affords a satisfactory method of making oxygen in small quantities. The possibilities are well known, but do not appear to have been utilized to that end except in connection with hydrogen peroxide.

The operation consists in heating gently a mixture of potassium permanganate and an excess of dilute sulphuric acid, in a generating flask provided with safety and delivery tubes. As this mixture begins to give off oxygen freely at 50°, very little heat is needed. The evolution of gas is continuous and quiet and under easy control.

The amount of oxygen to be obtained by this reaction is approximately represented by the equation

$$2KMnO_4 + H_2SO_4 = K_2SO_4 + 2MnO_2 + H_2O + 3O.$$

Ten grams of potassium permanganate (treated with 40-50 cc. of 1:4 sulphuric acid) give somewhat more than a liter of oxygen.

Convenient and safe, this method may be used to advantage in making oxygen for experimental purposes in courses in general chemistry.

R. B. RIGGS.

Note on the Effect of Combined Carbon in Iron on the Test for Tin.—A common test for tin depends on the reducing action of stannous chloride on mercuric chloride. If iron be used to reduce the tin, it should not contain any considerable amount of combined carbon, otherwise a counterfeit test may be obtained, no tin being present.

On making blank tests, it was found that, when the iron contained as much as 0.2 per cent. of combined carbon, its hydro-