in view of the fact that Richards and Cushman did not have the facilities for preparing salt of the highest purity, and were forced to correct the final result for contaminations. Probably the average of all four methods is the best value which can be selected at the present time.

Richards and Cushman	$NiBr_2$: 2 Ag	58.680	Baxter and Parsons	NiO:Ni	58.702
	$NiBr_2$: 2 AgBr	58.683	Baxter and Hilton	$NiCl_2$: 2 Ag	58.697
	$NiBr_2$: Ni	58.682		$NiCl_2$: 2 AgCl	58.700
					Av. 58.691

Summary

1. Nickel extracted from the Cumpas meteorite is found to possess an atomic weight identical with that of terrestrial nickel.

2. The value found for both specimens is 58.70 if Ag = 107.880 and Cl = 35.458.

3. The average of this value with those obtained by Richards and Cushman, and by Baxter and Parsons is 58.69.

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[CONTRIBUTION FROM THE T. JEFFERSON COOLIDGE, JR., CHEMICAL LABORATORY OF HARVARD UNIVERSITY]

THE SPECIFIC GRAVITY OF ANHYDROUS NICKELOUS CHLORIDE. THE DETERMINATION OF SPECIFIC GRAVITY BY DISPLACEMENT OF AIR

BY GREGORY PAUL BAXTER AND FRANK ARTHUR HILTON, JR.

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In order to correct to the vacuum standard the weights of nickelous chloride used in the research described in the preceding paper, a knowledge of the specific gravity of this substance was necessary. This is given as 2.56 by Schiff,[1] a value which we have found much too low.

Two experimental methods have been used in our work. In one the weight of air displaced was determined,[2] in the other the weight of toluene. In the former method 2 glass-stoppered tubes provided with stopcocks were so constructed as to be of nearly the same shape and internal as well as external volume. These were first compared by exhausting the tubes and finding the difference in weight by substituting one for the other on the balance. Pure dry air was then admitted to both and the difference in weight was again found. In three experiments the differences of the difference in weight exhausted and full of air were found to

[1] Schiff, *Ann.*, **108**, 21 (1858).

[2] Baxter and Tilley, THIS JOURNAL, **31**, 214 (1909). Baxter and Jones, *ibid.*, **32**, 298 (1910). Richards and Baxter, *ibid.*, **32**, 507 (1910).

be 0.73, 0.81 and 0.65 mg., respectively. One tube was now weighed, and 20.528 g. of nickelous chloride, which had been sublimed in hydrogen chloride and then heated in this gas,[3] was rapidly introduced. Both tubes were then exhausted and weighed, and after admitting air were weighed again. The density of the air was observed at the time of weighing the tubes full of air.[4]

The experiment was then twice repeated, once after exhausting the tubes to 0.025 mm. and leaving them for 2 days (No. 2), and once after heating the nickelous chloride in a vacuum to 100° for ½ hour (No. 3). The data follow.

TABLE I

SPECIFIC GRAVITY OF NICKELOUS CHLORIDE BY DISPLACEMENT OF AIR

Without $NiCl_2$ (Tube A—Tube B) *exhausted* —(Tube A—Tube B) *filled with air* G.	With $NiCl_2$ in Tube B (Tube A—Tube B) *exhausted* —(Tube A—Tube B) *filled with air* G.	Air displaced by $NiCl_2$ G.	Temp. °C.	Density of air	Vol. of displaced air	Sp. gr. of $NiCl_2$
−0.00073	+0.00621	0.00694	25.0	0.001200	5.78	3.55
−0.00073	+0.00624	0.00697	24.5	0.001182	5.89	3.49
−0.00073	+0.00612	0.00685	27.3	0.001176	5.82	3.53
						Av., 3.52

Before commencing the displacement experiments with toluene, it was determined that nickelous chloride does not dissolve in this liquid.

The toluene was dried over sodium hydroxide and distilled. Its specific gravity was then found at 25° with the use of a 25cc. glass-stoppered pycnometer, the stopper of which was made tight when weighed full of water by means of a weighed amount of grease, and when weighed full of toluene by means of sirupy phosphoric acid. The value found was 0.86093 referred to water at 4°.

The nickelous chloride, after introduction into the pycnometer, was kept in a highly exhausted desiccator for 4 days. Then the pycnometer was partially filled with toluene and again exhausted until air bubbles ceased to rise from the solid, before the final setting was made. All the weighings used are the averages of several settings never differing by much more than a milligram.

The following constants are employed: volume of apparent gram of

TABLE II

SPECIFIC GRAVITY OF NICKELOUS CHLORIDE BY DISPLACEMENT OF TOLUENE

Wt. of $NiCl_2$ in vacuum G.	Wt. of toluene displaced in vacuum G.	Sp. gr. of $NiCl_2$ 25°/4°
18.5378	4.4967	3.549
16.9606	4.1273	3.538
		Av., 3.544

[3] See preceding paper for method.

[4] By weighing a standardized sealed globe. See Baxter, THIS JOURNAL, **43**, 1317 (1921).

water at 25°, 1.00400; vacuum correction for toluene, +0.00126 g.; vacuum correction for $NiCl_2$, +0.000195 g.

The agreement of the densities found by the two methods is reassuring, not only so far as the specific gravity of the nickelous chloride is concerned, but also because it indicates that no appreciable amount of air is adsorbed upon the surface of the rather finely divided flakes of sublimed salt. Using the specific gravity found by the second method, the volume of the specimen of salt used in the first method is 5.79 cc., which differs from that found experimentally from the weight of air displaced and the density of the air by as much as 0.1 cc. in only one of the three experiments. Since this difference represents less than 0.1 mg. in weight, it is obviously within the limit of error of the experiment.

Summary

The specific gravity of anhydrous nickelous chloride has been found by displacement of air to be 3.52, and by displacement of toluene to be 3.54. The latter value is to be preferred. The experiments also indicate that nickelous chloride does not adsorb appreciable amounts of air.

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[CONTRIBUTION FROM THE DEPARTMENT OF PHYSICAL CHEMISTRY OF THE UNIVERSITY OF LIVERPOOL]

THE HYDRATION OF ACETIC AND HYDROCHLORIC ACIDS AND THE FACTORS DETERMINING THE ACTIVITY OF HYDROGEN ION

BY W. C. M. LEWIS, DORIS E. MERRIMAN AND T. MORAN

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In a recent paper[1] it was concluded that the activity of chloride ion (and of potassium ion) in solutions of sucrose was completely accounted for by expressing the activity in terms of solvent space, allowance being made for the volume occupied by the sucrose. The present communication deals with the activity of hydrogen ion produced from acetic and hydrochloric acids, respectively, in presence of sucrose and, as will be shown, the analysis is much more complex than that required in the case of the chloride ion.

The Activity of Hydrogen Ion Produced from Acetic Acid

Acetic acid was primarily chosen since, as it is a weak electrolyte, we should expect it to be simpler in its behavior than a strong acid such as hydrochloric acid would be.

The cell of the following composition was fitted up and its e.m.f. determined: *N* calomel electrode | sat. KCl | *N* acetic acid; sucrose | H_2.

[1] Corran and Lewis, THIS JOURNAL, 44, 1643 (1922).