Letters to the Editor.

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The Separation of the Isotopes of Chlorine.

THE method outlined in our letter of September 30, 1920 (NATURE, vol. cvi., p. 144), and used for the partial separation of the isotopes of mercury, has enabled us to accomplish a partial separation of the isotopes of chlorine. When about half of a strong solution of hydrochloric acid cooled down to about −50° C. was evaporated in a high vacuum, the mixture of water and hydrogen chloride being condensed on a surface cooled with liquid air, the condensed part of the hydrochloric acid was found richer, and the remaining part poorer, as regards the lighter constituent of chlorine than the ordinary HCl.

Starting from about 1 litre of 8·6 mol. solution, we obtained, by repeated separations, about 100 c.c. of the lightest, as well as of the heaviest, fraction, the difference of which was examined by two different methods after transforming the acid into sodium chloride. In the first method the density of the two saturated NaCl solutions was determined. The salts were precipitated several times by alcohol from their aqueous solutions, and density measurements carried out after each precipitation. We found uniformly a higher density of the solution prepared from the residual acid, the mean values at 20° C. being

$$d_d = 1{\cdot}20242$$
$$d_r = 1{\cdot}20235$$

from distilled and residual acid respectively. On the assumption of equal atomic volume of the two isotopes these figures correspond to a difference of 0·024 unit in the atomic weight of chlorine, or 6·5 per cent. in the atomic ratio of the isotopes.

In the second method equal quantities (5·7500 g.) of the molten isotopic sodium chlorides were dissolved in water and each precipitated with accurately the same volume of 0·2 n. silver nitrate. The latter was added in a slight excess. After precipitation and dilution to 2000 c.c. the approximate concentration of the filtrate was determined by titration with potassium rhodanide, and the ratio of the silver concentrations of the two solutions measured by combining them to a concentration cell. From the concentration $c = 0{\cdot}00040$ n. and the electromotive force of the cell, 0·0011 volt at 18°, we calculated that the difference in the atomic weight of the two samples was 0·021 unit, in close agreement with the result of the first-mentioned method.

The hydrochloric acid used in these experiments was thoroughly purified with potassium permanganate in order to remove bromine contingently present. Moreover, the repeated precipitation of the sodium chloride by alcohol would have given decreasing values for the estimated separation of the isotopes if any bromine should have been present. We think ourselves justified, therefore, in regarding the above-mentioned results as conclusive.

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Physico-Chemical Laboratory of the Polytechnic Institute of Copenhagen, June 29.

A Novel Magneto-Optical Effect.

PROF. ELIHU THOMSON'S explanation of the interesting magneto-optical effect which he describes in NATURE of June 23, p. 520, is supported by some experiments we have made recently on various oxides dispersed in air. When the vapour of zinc ethyl diluted with carbonic acid gas is mixed rapidly with a large volume of air, a fine fume is produced the particles of which when examined with the ultramicroscope exhibit rapid Brownian motion. In a short time the motion becomes slower and the particles brighter, but fewer in number. This continues until the fume has aggregated into a number of loose complexes formed of irregular chains or strings of particles. These chains are flexible and whirl and twist about under molecular bombardment in a striking manner, but fall under gravity at a surprisingly slow rate. In an electrostatic field the complexes straighten out and arrange themselves parallel to the lines of force, and on reversal of the field rotate through 180°.

When caught on a slide and examined with a high-power objective the same structure is seen more clearly. The individual particles are not in contact, but appear to be held together by invisible threads, consisting probably of strings of molecules or fine molecular aggregates. The zinc oxide fume given off from a zinc arc in air behaves in a precisely similar way. When a dense cloud is produced initially the particles agglomerate to large and irregular masses. By transmitted light the connecting hairs are invisible, but by a strong beam of reflected light of short wave-length obtained by suitable screens the particles appear to be surrounded by a nebulous haze. That the particles in these large complexes are really linked together can be demonstrated in another way by allowing a drop of immersion oil to flow slowly across the slide on which the deposit has been caught; the particles as they are lifted up by surface tension are seen to be attached to constellations of others, and drag these with them from a considerable distance in front of the advancing oil. The individual particles are about 100$\mu\mu$ in diameter, and the complexes about 30μ. Even after several hours these clouds always contain a number of single particles.

The particles in clouds obtained by the arc discharge between electrodes of other metals form complexes of varying structure. The tendency to aggregation seems weakest with the oxides of Pb, Cu, Mn, and Cr. It is slightly greater with Fe, whilst the oxides of Mg, Al, and Sb give similar results to zinc oxide. The particles of CdO show a great tendency to aggregate in strings of a remarkable length, which under the microscope look like beads strung on a thread. Clouds of this structure might be expected to show in a strong electrostatic field an optical effect analogous to that described by Prof. Thomson, but so far we have not observed it. The work is being continued.

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Eton College, Windsor, July 4.

IN the former account of this novel effect (NATURE, June 23, p. 520) it was pointed out that a microscopic examination of the iron arc smoke deposited on a glass surface gave evidence of the existence of fine particles of iron compound arranged in short chain sections of bead-like relation.

It is now thought that this peculiar formation may have its origin in the outer envelope of the arc flame where the particles are formed and where they are lined up around the arc stream by the circular magnetism surrounding the current conducted by the hot vapour stream of the arc. The particles, being magnetic, would tend to form chains or rings surrounding the arc. These would not be stable, however, but would float away as they became shattered by gas