The Raman Spectra of the Dichlorobenzenes

James W. Swaine and John W. Murray

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LETTERS TO THE EDITOR

In response to requests from our contributors, and after a canvass of the opinions of the Editorial Board, the Journal of Chemical Physics wishes to announce that a "Letters to the Editor" section will be carried by the Journal. This section will accept reports of new work, provided these are terse and contain few figures, and especially few halftone cuts. The Editorial Board will not hold itself responsible for opinions expressed by the correspondents. Contributions to this section must reach the office of the Managing Editor not later than the 15th of the month preceding that of the issue in which the letter is to appear. No proof will be sent to the authors. The usual page charge ($3.00 per page) will not be made and no reprints will be furnished free.

The Raman Spectra of the Dichlorobenzenes

In connection with a study of the Raman spectra of benzene derivatives, the earlier work on the three isomeric dichlorobenzenes has been repeated.[1, 2, 3] The results reported at this time were obtained with the technique described elsewhere by one of us and Donald H. Andrews.[4] The following Raman frequencies were found:

Ortho-dichlorobenzene:—154 (10), 203 (3), 239 (1b), 330 (0b), 430 (1), 469 (1), 483 (2), 658 (5), 756 (0b), 860* (1b), 1020 (1), 1041 (10), 1129 (5), 1160 (1b), (1228) (0), 1274 (1b), 1577 (4), 1607 (0b), 2994* (1), 3073 (10), 3146 (3).

Meta-dichlorobenzene:—178 (3), 202 (3), 216 (2), 366 (1), 399 (4b), 428 (2), 530* (0), 666 (4), 999 (10), 1018* (0), 1070 (3b), 1109* (2), 1126 (4), 1240 (0), 1425* (0), 1456* (0), 1544* (0), 1579 (5b), 1625* (0), 3076 (10), 3152* (2).

Para-dichlorobenzene:—302 (4), 333 (8), 355* (1), 627 (5), 710* (00), 748 (10b), 885* (0), 942* (0), 1070 (3), 1087 (2), 1109 (10), (1147) (0), 1170* (1), 1217* (0), 1294* (0), 1331* (0), 1379 (0), 1576 (8), 1630* (1), 2953* (0), 3079 (10), 3153* (2), (3213)* (0).

The numbers in parentheses after the frequencies are visual estimates of intensity. The frequencies in parentheses are so weak as to be doubtful. The lines were excited by the blue and violet mercury lines separately by using filters.

The line reported by Mlodzianowska at 625 in the ortho compound was not found. The lines which he found at 21,565 cm^{-1} appear with violet excitation and not with blue and hence should be assigned to 3143 rather than 1376. Filters were not used in his work and hence this point could not be decided as the plate is rather insensitive in the region of the 3143 line excited by the blue mercury line. The lines marked with an asterisk are reported here for the first time.

JAMES W. SWAINE
JOHN W. MURRAY

Chemistry Laboratory,
The Johns Hopkins University,
June 15, 1933.

[1] Dadieu and Kohlrausch, Monats. f. Chem. **52**, 379 (1929).

[2] Mlodzianowska, Zeits. f. Physik **65**, 124 (1930).

[3] Dadieu, Kohlrausch and Pongratz, Monats. f. Chem. **61**, 426 (1932).

[4] Murray and Andrews, J. Chem. Phys. **1**, 406 (1933).

A Name and Symbol for H^{2*}

Various lines of evidence lead to the conclusion that the isotope of hydrogen of atomic weight two has properties which differ considerably from those of the isotope of hydrogen of mass one. Thus, the boiling points of the liquid hydrogen are appreciably different;[1] the two isotopes are rapidly separated in electrolysis;[2] the equilibrium constants involving the two atoms of hydrogen have been shown to be appreciably different;[3] it is found that the melting points and the boiling points of water containing the two varieties of isotopes are not the same;[4] and finally, the refractive index of water varies with the amount of the heavier isotope present.[4, 5] It appears very probable that similar differences will be found in other compounds, depending upon whether the one or the other isotope is

* Publication approved by the Director, Bureau of Standards, Department of Commerce.

[1] Urey, Brickwedde and Murphy, Phys. Rev. **40**, 1 (1932).

[2] Washburn and Urey, Proc. Nat. Acad. Sci. **18**, 496 (1932).

[3] Urey and Rittenberg, J. Chem. Phys. **1**, 137 (1933).

[4] Washburn, Smith and Frandsen, J. Chem. Phys. **1**, 288 (1933); Washburn and Smith, J. Chem. Phys. **1**, 426 (1933).

[5] Lewis. J. Am. Chem. Soc. **55**, 1297 (1933). J. Chem. Phys. **1**, 341 (1933).

present in them. Moreover, the electrolytic method for the separation of the isotopes has proved to be very effective in the separation,[5] and it thus seems certain that very appreciable amounts of the heavy isotope will be available for experimental work.

It is inconvenient to refer to the heavy isotope of hydrogen as "hydrogen two" because this is so easily confused with the usual methods of referring to chemical compounds. This difficulty is not met in the case of any other isotopes because of the large mass numbers, and thus leads to no confusion, but in the case of hydrogen it seems desirable that special names should be given to the isotopes of hydrogen.

Two procedures might be followed in regard to this. In the first place, we might reserve the name hydrogen for the H^1 isotope and give a new name to the H^2 isotope or, second, we might reserve the name hydrogen for the natural mixture of the hydrogen isotopes, or for any other mixture where the isotopic composition is not important, and then give special names to both the H^1 and H^2 isotopes. After considerable thought, we believe that this latter procedure is the better one. We wish to propose that the names for the H^1 and H^2 isotopes be protium and deuterium, respectively, from the Greek words protos and deuteros, meaning first and second. These names will permit the formation of the usual prefixes and suffixes in common use in chemistry. Thus, we will have protides and deuterides, protoxyl and deuteroxyl, protates and deuterates, proto-compounds and deutero-compounds, in analogy to hydrides, hydroxyl, hydrates, hydro-compounds, etc.

If the H^3 isotope is discovered, we would recommend to the discoverer the consideration of the name tritium for it.

Lewis (private communication) proposed the name deuton for the deuterium nucleus. We do not wish to propose any name for this nucleus, other than the deuterium nucleus, or if it is convenient to so refer to it, the hydrogen two nucleus, because it is not a fundamental particle and we hesitate to suggest a name which would classify it along with the proton, neutron, electron, photon, as fundamental particles. However, in case workers in the field of nuclear transmutations find such a term desirable, it would appear to us that the name deuteron would follow the Greek derivation better.

The symbols of protium and deuterium should be, we believe, H^1 and H^2 to be read protium and deuterium, respectively. These symbols show that these two isotopes are indeed hydrogen and these symbols are in accordance with the usual symbols for other isotopes. It is perhaps somewhat confusing at first to read these symbols as protium and deuterium, but certainly it is no more so than in many other cases in common use.

HAROLD C. UREY
G. M. MURPHY
Department of Chemistry,
Columbia University,
F. G. BRICKWEDDE
Bureau of Standards

June 15, 1933