THE HYDROGEN-MAGNESIUM RATIO LABORATORY EXERCISES.

By ROBERT W. CURTIS,

College of the City of New York, New York.

In a former number of this journal,¹ there was presented a form of experiment in which the determination of the ratio of the hydrogen evolved to the magnesium dissolved in the reaction with dilute sulphuric acid was made the object of a laboratory exercise. Use was made of the principle of displacement of the Victor Meyer apparatus.

The purpose of the present communication is to show one or two improvements, together with an indication of results obtained therewith.

A form of the experiment appeared in a recently published manual,² in which the hydrogen is evolved in a large test-tube, and collected in a Hempel gas burette. Contact between magnesium and acid was brought about by the turn of a glass rod inserted through the stopper, on which the folded magnesium ribbon was hung. It was seen that the application of this ingen-

¹SCHOOL SCIENCE AND MATHEMATICS, VOL. 13, P. 37 (1913).

²Mattill: *Laboratory Directions for Elementary Chemistry*, Holt, 1914, p. 98.

ious device, as a part of the apparatus formerly described in these pages, would obviate the nuisance of the small homeopathic vial, and eliminate the error due to the heat of dilution of the acid. The modification was immediately tried out with classes numbering about two hundred students.

Diagram 1 shows the arrangement of apparatus. At the proper time the folded magnesium ribbon is allowed to slide off the hook by inclining the flask (taking hold of the flask at the edge of the mouth) to avoid expanding the air in the flask by the heat of the hand).

In subsequent exercises also, the superficial oxide was removed from the magnesium ribbon used, by fastening one end of a long strip in a vise and drawing it between fine emery cloth and then removing the dust by drawing between cloth.

Diagram 2, though not a curve in the mathematical sense, shows, graphically, results obtained with the new form of apparatus compared with same obtained with the form first described.

The errors are here plotted in order of magnitude without regard to algebraic sign.

Inspection shows that in the 1913 exercises about sixty per cent of the students obtained results with errors less than 6 cc. of gas, while the plot for 1915, with the modified apparatus, shows nearly seventy per cent obtained their results with errors less than 3 cc. It would appear that an error of ± 3 cc. under the conditions of the exercise is fair allowance as a criterion for acceptance of a student's results.

The average volume of hydrogen at 0° , 760 mm. from 1 cm. of ribbon was 4.18 cc. in the 1915 experiments. This value, multiplied by the length of ribbon used by the student and the factor for correction to room temperature and barometric pressure for a gas collected over water, for the day on which the class performs the experiment, may be taken as the value from which the student's error, is to be calculated.

The average volume per cm. ribbon should be determined each year from the students' results in order to get an idea of the working of the exercise, and bring to attention any unusual condition, such as lack of uniformity in the magnesium ribbon, for example. This is conveniently accomplished by plotting the values in order of magnitude and taking the average from inspection of the approximate curve so formed.

The author would be pleased to send a mimeographed copy of directions for this experiment, such as is put in the students' hands, to anyone sending a stamped addressed envelope.

PRODUCTION OF COKE.

During the year 1914 there was produced in the United States 34,555,914 short tons of coke, valued at \$88,334,217, according to the annual statement on the manufacture of coke now available for distribution by the Geological Survey.

TYPHOID FEVER CONTROLLED.

Three years ago the field men of the Geological Survey, as well as some of the office force, took advantage of the offer of the War Department to supply official antityphoid serum, and practically the entire force of men was inoculated. Since that time, as far as reported, there has been no serious case of typhoid fever among those inoculated. Two cases of typhoid among the topographic engineers indicate the great effectiveness of this inoculation. In both these cases the men simply felt "off feed" for a couple or three days and refused to go on the sick list; in fact typhoid would not have been suspected in either case except that in one of them somebody suggested the possibility, and an exhaustive hospital examination, blood test, etc., showed that the engineer had a theoretically well-developed case of typhoid, the practical results of which, however, failed to incapacitate him for duty, so that he did not even go to bed for one day.