

XV.—*On Magnesium.*

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THE magnesium met with in commerce appears to be very pure, as is shown by the following determinations of the quantity of hydrogen evolved on dissolving a known weight of the metal in dilute acids. The magnesium ribbon, such as is sold for exhibiting the magnesium-light, was employed, having been first rubbed bright with sand paper.

I.—0.1275 grm. of magnesium ribbon was dissolved in dilute acetic acid, and the hydrogen evolved measured—

Observed volume of gas	127 cub. cent. (moist)
Temperature	11.2° C.
Barometer	754.8 millimetres

Height of water column in the tube containing the gas corresponding to 0.8 millimetres of mercury.

Tension of aqueous vapour at 11.2° C. = 9.8 mm.

Correction of the barometric reading *i. e.* for reduction for temperature = - 1.0 millimetre.

From this we deduce—

$$\begin{aligned}
 \text{Hydrogen} &= 127 \text{ cub. cent. (dry) at } 11.2^\circ \text{ C. and } 743.2 \\
 &\quad \text{millimetres pressure.} \\
 &= 116.31 \text{ c.c. (dry) at } 0^\circ \text{ C. and } 760 \text{ m.m. pressure} \\
 &= .010665 \text{ grm.}
 \end{aligned}$$

(the weight of 1,000 c.c. of hydrogen at normal temperature and pressure being taken at .08939 grm.)

Taking 12 for the equivalent of magnesium, this will correspond to 0.127980 grm. of real magnesium.

Therefore, 100 parts of magnesium-ribbon contain 100.38 parts of real magnesium.

II.—0.1410 grm. of magnesium-ribbon was dissolved in dilute hydrochloric acid, and the hydrogen evolved measured—

Observed volume of gas	141 cub. cent.
Temperature	11.2° C.

Barometer	754·8 mm.
Height of water column in milli-	
metres of mercury	= 0·8 mm.
Tension of aqueous vapour at 11·2° C.	= 9·8 mm.
Correction of barometer	= 1 mm.

From which we deduce—

$$\begin{aligned}
 \text{Hydrogen} &= 141 \text{ cubic centimeters (dry) at } 11\cdot2^\circ \text{ C. and} \\
 &743\cdot2 \text{ m.m. pressure.} \\
 &= 132\cdot46 \text{ c.c. (dry) at } 0^\circ \text{ C. and } 760 \text{ m.m. pressure} \\
 &= 0\cdot011841 \text{ gm.}
 \end{aligned}$$

which corresponds to ·142092 gm. of real magnesium.

Therefore, 100 parts of magnesium-ribbon contain 100·78 parts of real magnesium.

III.—0·1340 gm. of magnesium-ribbon was dissolved in dilute sulphuric acid, and the hydrogen evolved measured—

Observed vol. of gas.	133·2 c.c.
Temperature	11° C.
Barometer	754·8 mm.
Height of water column in mercury ..	1·1 mm.
Tension of aqueous vapour at 11° C. . .	9·8 mm.
Correction of barometer	1 mm.

From which we deduce—

$$\begin{aligned}
 \text{Hydrogen} &= 133\cdot2 \text{ c.c. (dry) at } 11^\circ \text{ C. and } 742\cdot9 \text{ m.m.} \\
 &\text{pressure} \\
 &= 125\cdot16 \text{ c.c. (dry) at } 0^\circ \text{ C. and } 760 \text{ m.m.} \\
 &\text{pressure} \\
 &= 0\cdot011188 \text{ gm.}
 \end{aligned}$$

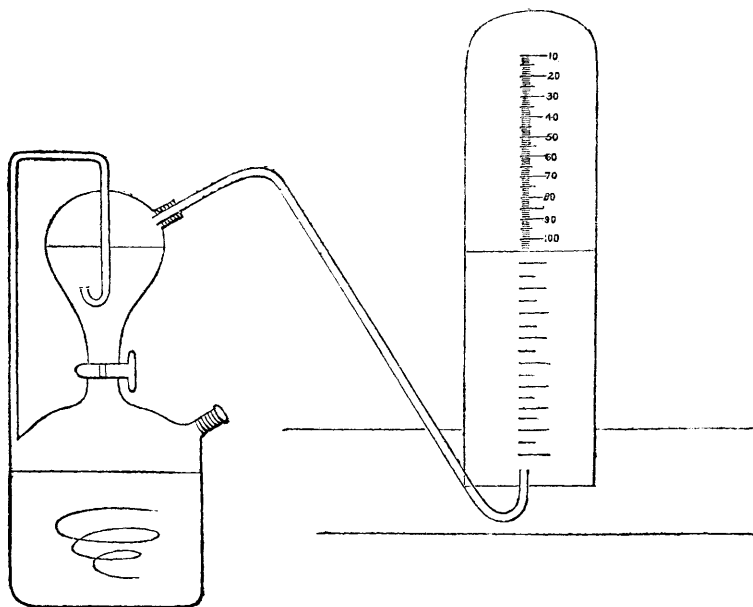
which corresponds to ·134256 gm. of real magnesium.

Therefore, 100 parts of magnesium-ribbon contain 100·19 parts of real magnesium.

The apparatus employed in these determinations was very simple. A small vessel, such as is made for determinations of carbonic acid, was used for the generation of the hydrogen (see fig.).

The upper part of the vessel contained the dilute acid, the lower portion below the glass stop-cock contained water and the

weighed magnesium-ribbon. The method of using the apparatus, together with the fact that accurate measurements of hydrogen



can be made over water saturated with atmospheric air, will be familiar to those who are conversant with the ordinary processes of gas-analysis. It will, moreover, be obvious that instead of employing the pneumatic trough, as we did, it is quite practicable to use the mercurial trough. We are, however, of opinion that in this particular instance there would be no advantage in doing so.

When it is considered that, next to lithium, the metal which has the lowest equivalent is magnesium, it will be obvious that this determination of the percentage of metallic magnesium from the quantity of hydrogen gas liberated is an extremely rigorous proceeding. Moreover, the determinations may be made with great facility, and are susceptible of a very high degree of precision.

Indeed, this measurement of the hydrogen evolved, when the metal is dissolved in a dilute acid, offers such advantages that we propose to determine equivalents by means of it, believing, that with suitable precautions, it will be found to rival in accuracy the methods hitherto employed.

We have made some observations on the chemical properties of metallic magnesium, which appear to be of interest. Towards the halogens this metal is very indifferent. At ordinary temperatures a solution of iodine in alcohol or ether has very little action on it, and even at 100° C. a solution of iodine in iodide of methyl is only very slowly decolorised by it.

Magnesium may be dipped into liquid bromine without being attacked, and when plunged into chlorine gas it is not immediately tarnished. This inertness of magnesium would seem to be connected with the well-known decomposition of its haloid salts when their aqueous solutions are evaporated to dryness.

With mercury it forms an amalgam endowed with very singular properties. To obtain this amalgam, magnesium is heated with mercury nearly to the boiling point of the latter, whereupon combination takes place, attended with very violent action, somewhat like that between mercury and sodium. An amalgam of magnesium, containing only one part by weight of magnesium to two hundred parts of mercury, tarnishes instantly on exposure to the air, swells up, and becomes very hot when just moistened with water, and decomposes water violently when immersed in it. A comparison was made between sodium-amalgam and magnesium-amalgam. The magnesium-amalgam which has just been described, containing one part of magnesium to two hundred parts of mercury, decomposed water far more rapidly than a sodium-amalgam containing the same proportion, or even twice as much sodium.

It is worthy of note, that whilst amalgamation diminishes the energy of sodium, it increases the energy of magnesium.

The foregoing observations are, for the most part, in accordance with the results obtained by Dr. Phipson, who has shown that iodine may be distilled from magnesium without attacking the metal, and that magnesium alloys with tin, forming with it an alloy capable of decomposing water. It would seem that magnesium has a great tendency to form these alloys capable of decomposing water.

Dr. Phipson's observation that mercury does not amalgamate with magnesium in the cold, depends, most probably, on his not having polished the magnesium. When perfectly clean, magnesium combines slowly with mercury, even in the cold. Dr. Phipson's paper, *Proc. Roy. Soc.* xiii, 217, contains no account of the amalgam of magnesium.

The experiments above described were made in the Laboratory of the London Institution.