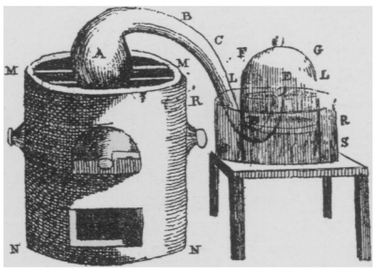
Classics of Science: Composition of The Atmosphere

LAVOISIER as he appears in the procession of great scientists that adorns the face of the building of the National Academy of Science in Washington.



An engraving made by Mme. Lavoisier to illustrate the experiment reprinted below.

LAVOISIER: ELEMENTS OF CHEMISTRY. Translated from the French by Robert Kerr, 1790.

ANALYSIS AND SYNTHESIS OF RED OXIDE OF MERCURY. SEPARATION OF OXYGEN FROM AIR, AND ITS RECOVERY.

You can, if you wish, repeat Lavoisier's experiment on the constitution of air with apparatus found in any school laboratory. For his matrass use a flask connected with glass tubing. The second part of this experiment is found in most elementary chemistry textbooks.

I took a matrass of about 36 cubical inches capacity, having a long neck BCDE, of six or seven lines internal diameter, and having bent the neck so as to allow of its being placed in the furnace MMNN, in such a manner that the extremity of its neck E might be inserted under a bell-glass FG, placed in a trough of quicksilver RRSS; I introduced four ounces of pure mercury into the matrass, and, by means of a syphon, exhausted the air in the receiver FG, so as to raise the quicksilver to LL, and I carefully marked the height at which it stood by pasting on a slip of paper. Having accurately noted the height of the thermometer and barometer, I lighted a fire in the furnace MMNN, which I kept up almost continually during twelve days, so as to keep the quicksilver always almost at its boiling point. Nothing remarkable took place during the first day: The Mercury, though not boiling, was continually evaporating, and covered the interior surface of the vessels with small drops, at first very minute, which gradually augmenting to a sufficient size, fell back into the mass at the bottom of the vessel. On the second day, small red particles began to appear on the surface of the mercury which, during the four or five following days, gradually increased in size and number; after which they ceased to increase in either respect. At the end of twelve days, feeling that the calcination of the mercury did not at all increase, I extinguished the fire, and allowed the vessels to cool. The bulk of air in the body and neck of the matrass, and in the bell-glass, reduced to a medium of 28 inches of the barometer and 10° Reaumeur (54.5° Fahrenheit) of the thermometer, at the commencement of the experiment was about 50 cubical inches. At the end of the experiment the remaining air, reduced to the same medium pressure and temperature, was only between 42 and 43 cubical inches; consequently, it had lost about 1/6 of its bulk. Afterwards, having collected all the red particles, formed during the experiment, from the running mercury in which they floated, I found these to amount to 45 grains.

I was obliged to repeat this experiment several times, as it is difficult in one experiment both to preserve the whole air upon which we operate and to collect the whole of the red particles, or calx of mercury, which is formed during the calcination. It will often happen in the sequel, that I shall, in this manner give, in one detail the results of two or three experiments of the same nature.

(*Just turn the page*)

Starvation for Epilepsy

Will a starvation diet cure epilepsy, one of man's most ancient diseases?

Acting upon the observation that epileptics deprived of food had fewer "fits," a group of specialists in children's diseases, Drs. F. B. Talbot, K. M. Metcalf, and Margaret E. Moriarty of the Massachusetts General Hospital set out to analyze the condition of starvation that brought about the favorable reaction. This done they proceeded to work out a diet that would reproduce these conditions and yet provide nourishment so their patients would not die from starving.

Their results have been so successful that they feel justified in making the statement that this method of treatment gives the greatest promise of improvement of any yet devised for the treatment of epilepsy in childhood.

The condition brought about by starving that seems to be unfavorable for epileptic seizures is known as ketosis and can be produced by feeding a diet high in fat but low in carbohydrate and protein. The investigators found that among other changes resulting from fasting were an increase in the amount of uric acid in the blood, a lowering in the amount of sugar, and a more pronounced acid reaction of the blood. The epileptic children treated with diets that produced changes like these showed marked decrease in the number of attacks.

Dr. M. G. Peterman, of Milwaukee, Wisconsin, has been following out practically the same program in treating epileptic children and has just reported to the American Medical Association his results with fourteen cases of several years' standing. These children have completed their diet treatment and are now on normal food and have been free from the attacks from six months to three years since they have resumed eating regular food like the rest of the family.

Science News-Letter, September 24, 1927

Diagnosis Revised

Quotation from "Brighter Biochemistry" published by the Biochemical Laboratory, Cambridge University.

Jack Sprat could eat no fat,
His wife could eat no lean.
Rickets and scurvy were their fates,
From lack of vitamin.

Science News-Letter, September 24, 1927

News-Letter Features

Born over five years ago of the demand and interest of those individuals who had caught a glimpse of *Science Service's* news reports to newspapers, the SCIENCE NEWS-LETTER has since proved interesting to laymen, scientists, students, teachers and children.

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Photographs aid in the telling of the week's science.

Great care is taken to keep its editorial content not only *interesting* but *accurate* as to fact and implication.

Composition of the Atmosphere

(*Continued from page* 201)

The air which remained after the calcination of the mercury in this experiment, and which was reduced to 5/6 of its former bulk, was no longer fit either for respiration or for combustion; animals being introduced into it were suffocated in a few seconds, and when a taper was plunged into it, it was extinguished as if it had been immersed into water.

In the next place, I took the 45 grains of red matter formed during this experiment, which I put into a small glass retort, having a proper apparatus for receiving such liquid, or gaseous product, as might be extracted: Having applied a fire to the retort in a furnace, I observed that, in proportion as the red matter became heated, the intensity of its colour augmented. When the retort was almost red hot, the red matter began gradually to decrease in bulk, and in a few minutes after it disappeared altogether; at the same time 41½ grains of running mercury were collected in the recipient, and 7 or 8 cubical inches of elastic fluid, greatly more capable of supporting both respiration and combustion than atmospherical air, were collected in the bell-glass.

A part of this air being put into a glass tube of about an inch diameter, showed the following properties: A taper burned in it with a dazzling splendor, and charcoal, instead of consuming quietly as it does in common air, burnt with a flame, attended with a decrepitating noise, like phosphorus, and threw out such a brilliant light that the eyes could hardly endure it. This species of air was discovered almost at the same time by Mr. Priestley, Mr. Scheele, and myself. Mr. Pristley gave it the name of *dephlogisticated air.* Mr. Scheele called it *empyreal air.* At first I named it *highly respirable air,* to which has since been substituted the term of *vital air.* We shall presently see what we ought to think of these denominations.

In reflecting upon the circumstances of this experiment, we readily perceive, that the mercury, during its calcination, absorbs the salubrious and respirable part of the air, or, to speak more strictly, the base of this respirable part; that the remaining air is a species of mephitis, incapable of supporting combustion or respiration; and consequently that atmospheric air is composed of two elastic fluids of different and opposite qualities. As a proof of this important truth, if we recombine these two elastic fluids, which we have separately obtained in the above experiment, viz. the 42 cubical inches of mephitis, with the 8 cubical inches of respirable air, we reproduce an air precisely similar to that of the atmosphere, and possessing nearly the same power of supporting combustion and respiration, and of contributing to the calcination of metals.

Antoine Laurent Lavoisier, born August 26, 1743, guillotined during the French Revolution, May 8, 1794, performed his greatest service to chemistry by accurate weighing of all the substances in his experiments. He helped revise chemical nomenclature to express the exact composition of the substances named. His experiments upon the constitution of air, here reprinted, illustrate the principle upon which he insisted that both analysis and synthesis are necessary to the proof of a chemical theory. So exact was Lavoisier's work upon the constitution of air that he appears actually to have discovered, but misinterpreted, the residue of rare gases left with nitrogen after the removal of oxygen.

Mme. Lavoisier helped in the writing of his books, drew and engraved the plates for the illustrations, and edited his works after his death. In 1805 she married Count Rumford, the American-born British scientist, but they did not get along well together, and finally separated.

Science News-Letter, September 24, 1927