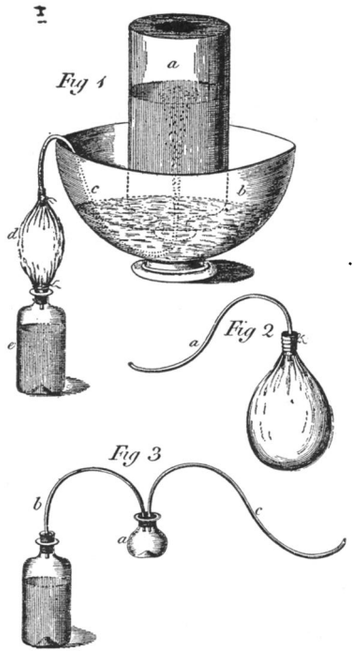
Classics of Science: Preparation of Carbon Dioxid



Priestley's illustration of the apparatus he used for making the first soda-water

In repeating the preparation of the first soda-water, the advantage of modern rubber tubing over that made from leather and sewed with waxed thread is obvious. Three sets of apparatus are offered by Priestley. That shown in Figure 3 is the most convenient today, but the others may be attempted by substituting rubber balloons for the bladders, which are not common now. The vessel holding the water to be impregnated with carbon dioxide held 3 pints (British); this is equivalent to 1.7 liters. For the 10-ounce phial substitute a 300 c. c. flask.

DIRECTIONS FOR IMPREGNATING WATER WITH FIXED AIR; In order to communicate to it the peculiar Spirit and Virtues of Pyrmont Water, and other Mineral Waters of a similar Nature. By Joseph Priestley, LL.D., F.R.S., London, 1772.

Directions

If water be only in contact with fixed air, it will begin to imbibe it, but the mixture is greatly accelerated by agitation, which is continually bringing fresh particles of air and water into contact. All that is necessary, therefore, to make this process expeditious and effectual, is first to procure a sufficient quantity of this fixed air, and then to contrive a method by which the air and water may be strongly agitated in the same vessel, without any danger of admitting the common air to them; and this is easily done by first filling any vessel with water, and introducing the fixed air to it, while it stands inverted in another vessel of water. That every part of the process may be as intelligible as possible, even to those who have no previous knowledge of the subject, I shall describe it very minutely, subjoining several remarks and observations relating to varieties in the process, and other things of a miscellaneous nature.

The Preparation

Take a glass vessel, *a,* fig. 1, with a pretty narrow neck, but so formed that it will stand upright with its mouth downwards, and, having filled it with water, lay a slip of clean paper, or thin pasteboard, upon it. Then, if they be pressed close together, the vessel may be turned upside down, without danger of admitting any, (or, however, much) common air into it; and when it is thus inverted, it must be placed in another vessel in the form of a bowl or bason, *b,* with a little water in it, so much as to permit the slip of paper or pasteboard to be withdrawn, and the end of the pipe *c* to be introduced.

This pipe must be flexible, and air tight, for which purpose it is, I believe, best made of leather, sewed with a waxed thread, in the manner used by shoe-makers. Into each end of this pipe a piece of a quill should be thrust, to keep them open, while one of them is introduced into the vessel of water, and the other into the bladder *d,* the opposite end of which is tied round a cork, which must be perforated, the hole being kept open by a quill; and the cork must fit a phial *e,* two-thirds of which should be filled with chalk just covered with water.

The Process

Things being thus prepared, and the phial containing the chalk and water being detached from the bladder, and the pipe also from the vessel of water; pour a little oil of vitriol upon the chalk and water; and having carefully pressed all the common air out of the bladder, put the cork into the bottle presently after the effervescence has begun. Also press the bladder once more after a little of the newly generated air has got into it, in order the more effectually to clear it of all the remains of the common air; and then introduce the end of the pipe into the mouth of the vessel of water, as in the drawing, and begin to agitate the chalk and water briskly. This will presently produce a considerable quantity of fixed air, which will distend the bladder; and this being pressed, the air will force its way through the pipe, and ascend into the vessel of water, the water, at the same time, descending, and coming into the bason.

When about one half of the water is forced out, let the operator lay his hand upon the uppermost part of the vessel, and shake it as briskly as he can, not to throw the water out of the bason; and in a few minutes the water will absorb the air; and taking its place, will nearly fill the vessel as at the first. Then shake the phial containing the chalk and water again, and force more air into the vessel, till, upon the whole, about an equal bulk of air has been thrown into it. Also shake the water as before, till no more of the air can be imbibed. As soon as this is perceived to be the case, the water is ready for use; and if it be not used immediately, should be put into a bottle as soon as possible, well corked, and cemented. It will keep however very well if the bottle be only well corked, and kept with the mouth downwards.

Joseph Priestley was born March 13, 1733 (old style), in Yorkshire, England, and died February 6, 1804, at Northumberland, Pennsylvania, U. S. A. As a child his studies included geometry, algebra, natural philosophy, and modern languages, and the rudiments of Latin, Greek, and Hebrew. At nineteen he was sent to Daventry as a non-conformist divinity student, where he stayed three years. In 1761 he became professor of belles lettres at the academy at Warrington, and remained there six years. While there he wrote a History of the Discoveries in Electricity, received an honorary LL.D. from Edinburgh, and became a member of the Royal Society. He left the school for financial reasons and returned to preaching at Leeds, but there he also found time to continue his scientific work. He remained there from 1767 to 1773, then went to live with his patron, the marquis of Lansdowne until 1780. During those years, when he was between the ages of 34 and 47, Priestley carried on his researches on various kinds of "airs" or gases. After that he resided at Birmingham, where he enjoyed the friendship of James Watt, Erasmus Darwin, and other scientific leaders of the time. But Priestley had not risen to fame without making enemies, partly on religious, partly on political grounds, and in 1791 a mob chose the occasion of a celebration of the anniversary of the fall of the Bastile, with which he had little to do, to burn his chapel, destroy his house, and drive him and his family out of the town. He was invited to take charge of an appreciative congregation at Hackney, where he stayed until, in 1794, he decided to join his sons who had gone to America, or, as a contemporary writer put it, "to retire as an exile to the remotest limit of the civilized world."