A cylinder filled to the brim with water is best adapted to this, as it allows the gas cylinder to be held well up so that it may be easily seen by all. The cock of the long tube is now opened, when the water rushes up and spurts up as a fountain, usually striking the head of the cylinder. When the vacuum has been filled by the entering water, the cylinder is lifted up, thus removing the seal from the tubes, the cock of the short tube is opened, which allows more water to flow out and air to enter. The experiment is then repeated as just described. Four to six repetitions can usually be made before the nitric oxide, N_2O , is entirely consumed. The experiment is an unusually effective one.

The apparatus may be made in a simpler and cheaper form by putting in place of the glass stop-cocks on the long tube a four inch piece of soft rubber tube, clamped at the middle by a pinch-cock, and in the short tube a Kronig valve. This form of the apparatus works in every way as well as the other, but is not so elegant.

Experiments with Gaseous Hydriodic Acid.

After some experimenting, I found the following mixture to yield hydriodic acid gas in abundant quantities: In a six ounce flask are placed 20 grammes of iodine, 5 grammes of potassium iodide, 2 grammes of red phosphorus, and 10 c. c. of water. The whole is well mixed by swirling the flask, and then gently heated. As soon as the action begins, the flask is at once thrust under the cold water tap until the violence of the action ceases, which occurs in a few seconds. The mixture at once ceases to evolve the gas, but on heating will evolve a large amount, the evolution ceasing as soon as the heat is removed. It is well to pass the gas through an empty Silliman washer, in order that any of the liquid which may distill over may deposit. As a rule, if the heating is too violent, no distillation will take place till toward the end. Vessels can be easily filled with the gas by displacement, the level of the gas being ascertained by introducing a lighted wax lamp lighter.

Potassium chlorate placed in an iron deflagration spoon and heated to boiling, and introduced into a jar of the gas, takes fire and burns with a large red flame, forming clouds of iodine gas and crystals. The sides of the jar become rapidly coated with a deposit of iodine crystals. The reaction is, of course, simply a flame of oxygen in hydriodic acid.

Magnesium.—I was in hope that magnesium would take the iodine away from hydriodic acid, but it does not. A piece of ribbon, when ignited and in full blaze, was dropped into the bottom of a cylinder filled with the gas. It continued to burn for an instant, and was then extinguished. There was, of course, some dissociation of the hydriodic acid.

Sodium, heated red hot and burning, was introduced into a cylinder of the gas, but behaved like magnesium.

Nitrous oxide.—The experiment is best performed by placing a cylinder of the hydriodic acid gas on a cylinder of the nitrous oxide, drawing the glass covers and allowing the gases to mix. A white cloud forms which gradually becomes reddish. Drops of red liquid collect at the bottom, and soon the tubes become filled with a cloud of minute iodine crystals, which gradually deposit on the sides. The red liquid is a solution of iodine in hydriodic acid, and soon deposits crystals of iodine. The water formed by the reaction dissolves some of the hydriodic acid, and this solution dissolves some of the iodine set free. The liquid gives off ammonia when treated with caustic alkali. The reaction appears to be $N_2O + 12HI = 2NH_4I + H_2O$.

The gradual separation and deposition of the iodine makes an interesting phenomenon. The presence of ammonia in the deposited liquid should be demonstrated.

Nitric acid gas, evolved from a mixture of granulated potassium nitrate and sulphuric acid in a small flask, and allowed to issue from a bent-up glass tip having an orifice of about one-eighth of an inch in diameter, takes fire when introduced into the gas, and burns with a fine red flame tipped with a halo of violet iodine gas and a cloud of minute iodine crystals. The sides of the vessel soon become coated with a deposit of iodine crystals.

Chlorine gas, evolving from the apparatus just described, takes fire when introduced into the hydriodic acid gas, and burns with a fine red flame resembling the preceding phenomenon. The stream of chlorine should be rapid, or else no flame, but only the separation of iodine described by Heumann, will be obtained.

Sulphur dioxide makes an effective experiment, and one which is particularly appropriate in demonstrating a chemical change between gases. The cylinder full of hydriodic acid gas is placed on the one containing sulphur dioxide and the glass covers drawn. The colorless gases mix, flashing out deep red, and the sides of the cylinders are at once covered with a deposit of iodine crystals.—*Am. Chem. Journal*.

NITROGEN FOR LECTURE PURPOSES.

By CHARLES R. C. TICHBORNE, LL.D., F.I.C., etc.

THE best method of preparing nitrogen for lecture experiments, or when required in a pure form, is unquestionably (in my opinion) based upon the decomposition of ammonium nitrite. That process possesses numerous advantages over all the others. It is sufficient to enumerate the simplicity of the reaction, the purity of the product, and the ease with which the experiment is performed. The apparatus required is a retort of the right size and a bent tube.

For the last ten years I have been in the habit at my lectures of falling back upon this method when I came to the subject of the oxygen compounds of nitrogen. The symmetric manner in which this reaction harmonizes with the production of laughing gas is most instructive, and is a special inducement to use it as a lecture illustration. Here we have the production of a molecule of nitrogen by the splitting up of the nitrite, while the nitrate gives us a molecule of the monoxide.

A statement in the article (*Chemical News*, vol. lix., p. 135) runs as follows: "The action of potassium nitrite, when heated in a suitable apparatus in admixture with ammonium chloride, produces when prepared cautiously a moderately pure gas, but, owing to the

inconsistency of the reaction, the same is rendered considerably tedious and unprofitable.

As this is contrary to my experience, I think it desirable to give the *modus operandi* which I have adopted, presuming that if the modifications and precautions which I indicate be strictly carried out, the experiment will turn out satisfactorily.

Ten grms. of ammonium sulphate and ten grms. of sodium nitrite are mixed in a capacious retort with 40 c. c. of glycerin and 60 c. c. of water. The retort should be of the capacity of half a liter, or about 16 ounces. The retort is placed with the neck elevated to an angle of about forty degrees, so that the water may condense and fall back into the retort. A bent tube is fitted with a cork into the neck, and conducts the gas into a wash bottle, or it may be collected at once for general purposes without washing.

100 c. c. of water may be used in place of the mixture of glycerin and water, but it does not seem to work quite so regularly. Heat is applied directly to the retort, and the disengagement of free nitrogen begins at a temperature a few degrees below the boiling point of water. It steadily but rapidly proceeds—the temperature generally rises a few degrees above the boiling point, but after a little time again begins to fall. A gentle but constant heat will, however, keep up the disengagement of gas until the nitrite is all decomposed. It is desirable to slightly increase the heat toward the end of the reaction.

There is nothing specially new in this process, except the substitution of the sulphate for the chloride, and in the determining of the exact conditions under which the experiment may be carried on successfully for class illustrations, or for the purposes of procuring pure nitrogen with the least expenditure of trouble. If the reaction is pushed on very rapidly, ammonia will be evolved, and this phenomenon is most marked when using the chloride in place of the sulphate. If carried on slowly with the sulphate, no ammonia is evolved, but a trace of nitrogen dioxide is produced, which may be easily removed by washing with a dilute solution of permanganate of potassium. By carefully regulating the temperature, almost pure and neutral nitrogen will be evolved.—*Chem. News*.

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