two glass tubes bent to an angle of about sixty degrees. One of these tubes should reach nearly to the top of the water in the flask and the other merely through the cork. Now blow from a bellows or from the lungs through the shorter tube. Moist air will be driven out through the longer tube and coming in contact with the cooler air of the room the temperature of the mixed air will not be sufficiently high to keep the contained moisture in the form of invisible vapor and a small cloud will be formed. This is not a condensation of steam, for the flask was kept far below the point at which steam is formed, but is a mixture of moist warm air and a colder air. This is one of the most common methods of cloud formation.

XV. Composition of the Air.—In a large, tightly corked bottle, burn by means of a deflagrating spoon a small piece of phosphorus. When the phosphorus has ceased to burn and the fumes have settled, open the mouth of the bottle under water. Water rises in the bottle to take the place of something which was removed by the burning of the phosphorus, but there still remains a gas present with which the phosphorus did not combine. This residue is colorless and transparent like the air, but unlike it neither phosphorus nor a match will burn in it. It cannot be air. Now replace the water which has entered the bottle with oxygen made in the ordinary laboratory way and see if phosphorus will burn in this mixture of the unburnable gas and oxygen in the same way that it did in air. It will be found to do so. It is fairly evident then that one of the constituents of air is oxygen and that another is the unburnable gas which may be called nitrogen. To show whether there is any other constituent, draw, by means of suction, oxygen and nitrogen through lime water and afterwards draw air through it. Neither the oxygen or the nitrogen affect the lime water while the air makes it milky. There must be some other invisible constituent in the air besides nitrogen and oxygen which may be called carbon dioxide.

PRESSURE OF LIQUIDS.

BY H. D. MINCHIN.

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The problem of determining the pressure of liquids due to their depth has been given much attention, but the methods hitherto adopted have, in general, been quite unsatisfactory. My experiments have been directed towards determining the amount of pressure in terms of our standard weights. The method employed is that of using a tube with a rubber diaphragm stretched

across one end. This is submerged in water at different depths and the pressure recorded for each position.

The apparatus (Fig. 1) consists of a glass cylinder for water, a thistle-tube, and an indicator. Across the bowl of the thistle-tube is fastened a rubber diaphragm, and into the tube passes a plunger with a flat disk of wood on its lower end that rests upon the diaphragm. To the upper end of the plunger is fitted a pan for the weights. To the outside of the glass cylinder is attached a scale for reading the depth of the water. A thin board is clamped across the top of the cylinder; this serves as a support

Fig. 1

for the thistle-tube, the indicator and scale, and any other parts which may be added for convenience, such as a thistle-tube for filling the cylinder with water, and a siphon for removing water when desired.

When readings are to be made the apparatus is set up, adjusted and the zero of the indicator marked. To eliminate the error due to the difference in tension of the diaphragm, the indicator is brought to the zero mark at each reading and the weight required to so adjust it is recorded.

Water is added to any depth and weights are then placed in the pan sufficient to bring the indicator to the zero mark. Then

more water is added and the adjustment is again made, and so on.

The following results show what the apparatus can do:

	Depth of water in cylinder. cm.	Depth of gauge in water. cm.	Weight added to adjust. gram.	Pressure per cm. Depth. gram.	Depth per 1 g. pressure. cm.
1	11.00	0.00	0.00	0.00	0.00
2	15.50	4.50	48.00	10.66	0.093
3	19.50	8.50	90.00	10.59	0.094
4	25.00	14.00	148.00	10.57	0.094
5	29.50	18.50	196.00	10.59	0.094
6	36.50	25.50	268.00	10.51	0.095
7	44.00	33.00	350.00	10.60	0.094

The fourth column, by the constancy of the results, indicates the relation between the depth and the pressure.

THE COEFFICIENT OF EXPANSION OF AIR AT CONSTANT VOLUME.

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The accompanying figure will give all necessary details concerning the construction of the apparatus, which is simply the Boyles' Law Apparatus of Mr. N. H. Williams, of the Indianapolis High School, slightly changed in form.

The bulb has a capacity of about 250 cc. capacity. It is immersed in ice-water for 10 or 15 minutes, and then the mercury, by means of a bicycle pump is forced up to the mark *o* on the capillary stem. The readings at *o* and *l* are taken by means of a mirror-scale placed back of the tubes. The temperature should also

be read at this time.

The bulb is then put into water at a temperature not much