By absorbing the Oxygen with Pyrogallate of Potash.

Exp. 1.—Take a glass tube, about 1 metre long and 15 mm. in diameter, and divide it into six equal parts by means of small india-rubber bands. Pour through a small glass tube a strong solution of pyrogallic acid till the first division is about one-third full. Wash the tube, place it so that it may pass through the pyrogallic acid, and again pour through it a strong solution of caustic potash till on withdrawing it the liquid may stand a little above the first ring. Place a small piece of india-rubber on the mouth of the tube, shake it well, and invert in a tumbler of water. On withdrawing the thumb, the water rises in the tube, and on adjusting the water to the same level within and without the tube, the water should stand a little above the second ring, showing that about one-fifth of the air has been absorbed. This one-fifth is oxygen, which has been absorbed by the pyrogallate of potash.

By the Eudiometer.

Exp. 2.—To 100 volumes of air in the Eudiometer add 50 volumes of hydrogen and explode. The 150 volumes will shrink (steam being condensed) to 87 volumes; therefore,

150—87=63 vols. loss.

Of these 63 vols. one-third is oxygen; there are, therefore, 21 volumes of oxygen in 100 volumes of air.

By drawing a measured volume of Air over red-hot Copper, and then weighing the Copper Oxide produced.

Exp 3.—Take the hydrogen bottle, press the funnel-tube nearly to the bottom of the flask, and add a little water to cover the end of it. Attach a drying-tube, filled with calcium chloride, and connect this with a tube of hard glass filled with bright copper turnings. Bring the copper turnings to a red heat, and then pour water through the funnel-tube to expel the air and cause it to pass over the red-hot copper, which combines with the oxygen to form copper oxide. The nitrogen may be collected in the usual manner.

This experiment illustrates the principle of the method adopted by Dumas and Boussingault in their precise determination of the composition of air by weight. They passed a given volume of air (1) over *calcium chloride*, then (2) over *caustic potash*, and finally (3) over *ignited copper* reduced from its oxide, severally contained in glass tubes accurately weighed before the experiment was commenced. The increase in the weight of the calcium chloride indicated the moisture, of the caustic potash tube, the carbon dioxide, and of the copper tube the oxygen, severally contained in the volume of air operated upon. The residual gas, which is nitrogen, was collected in an exhausted and weighed globe, the increase in the weight of which gave the nitrogen. The mean of a large number of experiments of this kind, in which every possible precaution against error was taken, gave the following results, with which we give the results of the volumetric analysis:—

		PER CENT.	IN ROUND NUMBERS.
By weight	Nitrogen......	76·995	77
	Oxygen.......	23·005	23
By volume	Nitrogen......	79·04	79
	Oxygen.......	20·96	21

Constancy of Composition.

Atmospheric air is nearly constant in composition. The results of numerous analyses at various points of the earth's surface and at considerable heights above the level of the sea, show but little variation. Angus Smith has found that the percentage of oxygen in air from the sea-shore and from Scottish moors and mountains, is as high as 20·999 per cent., and in the free air of towns, and especially during foggy weather, it may sink as low as 20·82. This constancy of composition led some of the early chemists to consider air as a chemical compound of one volume of oxygen and four volumes of nitrogen. That this is not the case appears from the following facts:—

(1) If pure air were a definite compound of oxygen and nitrogen it should be absolutely constant in composition. But it is not quite constant, and, therefore, this fact alone is sufficient proof that the gases are not combined, but only mixed together, as the constituents of a compound always occur in invariable proportions (Art. 17).

(2) This conclusion is confirmed in many ways. Thus, on mixing oxygen and nitrogen in the proportion in which they are found in the atmosphere, none of the phenomena, such as evolution of heat, and alteration in properties and volume, usually attendant on chemical combination, are perceived; nevertheless, the mixture is actually identical in composition with atmospheric air and possesses all its properties.

(3) Were air a compound it should dissolve in water as such, that is, the proportion of oxygen and nitrogen in dissolved air should be the same as in undissolved air; but if a mixture, the more soluble constituents should dissolve the more readily, and, therefore, more oxygen than nitrogen should dissolve, since oxygen is more soluble than nitrogen. Experiment shows that the latter is the case. If water which has been recently boiled, and then allowed to cool out of contact with air, be shaken with air and the dissolved air be then expelled by boiling, and collected, it will contain 32 instead of 21 per cent. by volume of oxygen.

(4) The oxygen and nitrogen in the air do not present a simple ratio to the atomic weights of these elements.

(To be continued.)

HIGH SCHOOL LITERATURE.

By J. E. Wetherell, M.A.

NINTH PAPER.

"THE ANCIENT MARINER."—Part III.

1. What effect is produced by the complex *epizeuxis* of the first stanza? How can the intended effect be brought out orally?
2. What is the force of the article in "a something" (v. 6), and in "a Death" (v. 46)?
3. *Eye—eye.-Sky*—Why does the poet frequently make a word rhyme with itself? (See *done—Sun—Sun*—below).
4. Point out in this part any words, expressions, mannerisms, or metrical devices that smack of the ancient ballad style.
5. "It moved and moved"—"It neared and neared." Why is the verb repeated?