was charged with a solution of potassium bichromate, another with copper ammonium sulphate solution, and the third with pure water, and all were exposed to sunlight for four hours. The deal in the red light gave only a faint picture, that in the blue light a dark picture, and that with the pure water was only a slightly darker picture. Resin, guaiacum, copal varnish, white oil paint and resin sized paper all acted in the same way and gave similar results.

The light from an arc lamp when passed through a red glass and allowed to fall on a wood section for one and a half hours produced no effect, but when the same light was passed through a blue glass and fell on a similar wood section for only one hour it produced a dark picture. With liquids this same increase of activity by the action of blue light is produced. Turpentine, which has been exposed to blue light, is more active than when in its ordinary condition.

THE DENSITY OF NITROUS OXIDE.[1]

IN the *Proceedings*, vol. lxxii. p. 204, 1897,[2] I have given particulars of weighings of nitrous oxide purified by two distinct methods. In the first procedure, solution in water was employed as a means of separating less soluble impurities, and the result was 3·6356 grams. In the second method a process of fractional distillation was employed. Gas drawn from the liquid so prepared gave 3·6362. These numbers may be taken to represent the corrected weight of the gas which fills the globe at 0° C. and at the pressure of the gauge (at 15°), and they correspond to 2·6276 for oxygen.

Inasmuch as nitrous oxide is heavier than the impurities likely to be contained in it, the second number was the more probable. But as I thought that the first method should also have given a good result, I contented myself with the mean of the two methods, viz. 3·6359, from which I calculated that, referred to air (free from H_2O and CO_2) as unity, the density of nitrous oxide was 1·52951.

The corresponding density found by M. Leduc is 1·5301, appreciably higher than mine; and M. Leduc argues that the gas weighed by me must still have contained one or two thousandths of nitrogen.[3] According to him the weight of the gas contained in my globe should be 3·6374, or 1·5 milligrams above the mean of the two methods.

Wishing, if possible, to resolve the question thus raised, I have lately resumed these researches, purifying the nitrous oxide with the aid of liquid air kindly placed at my disposal by Sir J. Dewar, but I have not succeeded in raising the weight of my gas by more than a fraction of the discrepancy (1·5 milligrams). I have experimented with gas carefully prepared in the laboratory from nitrate of ammonia, but as most of the work related to material specially supplied in an iron bottle I will limit myself to it.

There are two ways in which the gas may be drawn from the supply. When the valve is upwards, the supply comes from the vapourous portion within the bottle, but when the valve is downwards, from the liquid portion. The latter is the more free from relatively volatile impurities, and accordingly gives the higher weight, and the difference between the two affords an indication of the amount of impurity present. After treatment with caustic alkali and sulphuric acid, the gas is conducted through a tap, which is closed when it is desired to make a vacuum over the frozen mass, and thence over phosphoric anhydride to the globe. For the details of apparatus, &c., reference must be made to former papers.

The first experiment on July 13 was upon gas from the top of the bottle as supplied, and without treatment by liquid air, with the view of finding out the worst. The weight was 3·6015, about 35 milligrams too light. The stock of material was then purified, much as in 1896. For this purpose the bottle was cooled in ice and salt[4] and allowed during about one hour to blow off half its contents, being subjected to violent shaking at frequent intervals. Subsequently three weighings were carried out with gas drawn from the bottom, but without treatment by liquid air. The results stand:—July 18, 3·6368; July 20, 3·6360; July 25, 3·6362; mean, 3·63633.

Next followed experiments in which gas, still drawn from the bottom of the bottle, was further purified by condensation with liquid air. On one occasion (August 7) the condensed gas was allowed to *liquefy*, for which purpose the pressure must rise to not far short of atmospheric, and to blow off part of its contents:—August 1, 3·6363; August 3, 3·6367; August 7, 3·6366; mean, 3·63653.

The treatment with liquid air raised the weight by only 0·2 milligram, but the improvement is probably real. That the stock in the bottle still contained appreciable impurity is indicated by a weighing on August 13, in which without liquid air the gas was drawn from the *top* of the bottle. There appeared, August 13, 3·6354, about 1 milligram short of the proper weight.

It will be seen that the result without liquid air is almost identical with that found by the same method in 1896, and that the further purification by means of liquid air raises the weight only to 3·6365. I find it difficult to believe that so purified the gas still contains appreciable quantities of nitrogen.

The corresponding weight of air being 2·3772,[1] we find that, referred to air as unity, the density of nitrous oxide is 3·6365/2·3772 = 1·5297. Again, if oxygen be taken as 16, the density of nitrous oxide will be 3·6365 × 16/2·6276 = 22·143.

The excess above 22 is doubtless principally due to the departure of nitrous oxide from Boyle's law between atmospheric pressure and a condition of great rarefaction. I hope shortly to be in a position to apply the connection which will allow us to infer what is the ratio of molecular weights according to Avogadro's rule.

1 By Lord Rayleigh, O.M., F.R.S. Abridged from a paper received at the Royal Society on September 1.
2 Or "Scientific Papers," vol. iv. p. 350.
3 "Recherches sur les Gaz." (Paris, 1898.)
4 The lower the temperature below the critical point, the more effective is this procedure likely to be.

1 Roy. Soc. *Proc.*, vol. liii. p. 134, 1893; "Scientific Papers," vol p. 47.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. ERNEST SHEARER, Kirkwall, has been appointed lecturer on agriculture at the Pusa Imperial College, Bengal. This model agricultural college for all India, with a farm of 1300 acres attached, is one of the admirable developments resulting from the appointment two or three years ago of Mr. James Mollison as Inspector-General of Agriculture in India. Mr. Alexander Sangster, Montrose, has been appointed junior assistant with the Aboukir Land Reclamation Co., near Alexandria, Egypt, and Mr. John C. Leslie assistant conservator of forests in southern Nigeria.

THE approach of the new sessions at polytechnics and similar institutes is heralded by the appearance of calendars and prospectuses, several of which have been received within the past few days. At the Birkbeck College, Chancery Lane, the session will commence on Monday, October 3, when an inaugural address will be delivered by Dr. J. E. Mackenzie on "The Influence of Pure Science on Progress." The class-rooms and laboratories of the college will afterwards be open to inspection, and demonstrations will be given. A course in science with practical work has been organised to give complete preparation in metallurgy and mining for those qualifying for the mining profession. It is satisfactory to know that within the last few years valuable reference libraries have been provided for the separate departments of science; these have been aided by grants from the County Council. His Majesty's Treasury recently presented to the college forty-nine volumes of the scientific results of the *Challenger* Expedition.

THREE prospectuses have been received from the South-western Polytechnic, referring respectively to the day college for men and women, day school for boys and girls, and evening classes. The principal of the polytechnic is Mr. S. Skinner. The courses at the day college are arranged to occupy three years. On entering the student has to state whether he wishes to be trained as a mechanical, civil, or electrical engineer, or as a consulting or industrial chemist. In any of these cases he will find mapped out for him a complete course of study, involving laboratory instruction, tutorial work, attendance at lectures, exercises in mathematics, geometrical, mechanical and architectural drawing, and instruction in the workshops.