

DIFFRACTION GRATINGS FOR GRATUITOUS DISTRIBUTION.

TO THE EDITOR OF SCIENCE: Two or three years ago while engaged in some experimental work on the reproduction of diffraction gratings by photography, I devised a method of copying a Rowland 14,000 line to the inch grating, and silvering the copy, transforming it into a reflecting grating. The original was an excellent glass grating kindly loaned to us by the Johns Hopkins University. I was unable to get satisfactory copies with the bichromated gelatine but succeeded very well with albumin. I found this difficult, however. To reproduce so fine a spacing it was necessary to use an exceedingly thin film, so thin, in fact, that the retardation of the light waves in traversing the 'bars' was insufficient to give spectra of any brilliancy. By thickening the film I was able to get a brilliant grating occasionally, but usually the lines ran together. It then occurred to me to silver the gratings, for the retardation by reflection is four times the retardation by transmission. The thin film failures, which I had thrown into a drawer as scrap plate-glass, were accordingly immersed in a chemical silvering solution, and when washed and dried were found to give brilliant spectra. One of these was exhibited by Professor Boys at a conversation of the Royal Society about two years ago. Having about thirty of these gratings, which, while not as perfect as an original Rowland grating, being made on ordinary plate glass, are nevertheless suited for the ordinary purposes of the laboratory, I am desirous of placing them where they will do the most good. There must be among our many universities some physical laboratories which are not fortunate enough to have a good diffraction grating. I shall be very glad to distribute these copies to laboratories desiring them, as long as the supply holds out. I shall be glad if applicants will state whether the laboratory possesses a good spectrometer, and also the number of students engaged in the pursuit of physics. Some of the gratings are very good indeed, others quite poor as to general appearance, but all will give tolerably good spectra, and can be used for wave-length determinations. They will show the nickel line between the sodium lines in the solar

spectrum very distinctly. Applications from high-schools will not be considered. Failure to receive any reply must be taken as evidence that the supply has been exhausted.

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NOTES ON INORGANIC CHEMISTRY.

ARGON AND ITS COMPANIONS.

ON November 15 a paper was read before the Royal Society by Professor William Ramsay and Dr. Morris W. Travers on 'Argon and its Companions,' which was a continuation of the previous papers of the same authors on the inert gases of the atmosphere. In the early summer of 1898 the discovery of neon and krypton was announced, and later a heavier atmospheric gas was found, to which the name xenon was given. At that time krypton and xenon were not obtained in a condition pure enough for the investigation of their physical constants.

The present paper deals chiefly with these three gases, which have been isolated and studied. By the evaporation of a large amount of liquid air a mixture of argon, krypton and xenon was obtained, the former largely predominating. This mixture was liquefied by liquid air and the three separated by fractional distillation, many times repeated. At the temperature of boiling air krypton has considerable vapor-tension, while that of xenon is scarcely appreciable. Neon was isolated from the first portion of gas escaping from boiling air. This consisted chiefly of nitrogen, which was then liquefied and a part of the liquid evaporated by passing through it a current of air. This gas, after the removal of the oxygen by hot copper, contained most of the helium and neon present in the air. After purification from nitrogen in the usual manner, the helium and neon were separated from the argon present by fractional distillation. To separate these gases was very difficult, but was finally accomplished by condensing the neon by means of boiling hydrogen. In this way pure neon was obtained.

A determination of the ratio of the specific heats of these gases showed that they are all monatomic. A number of the physical prop-