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smaller molecular compressibility, or with phenomena which would result from appreciable deviations from true spheres in the shape of the molecules, which could therefore, at higher densities, be packed more closely than would be possible with spheres, of which the radius is equal to the average radius, which is to be ascribed to the molecules in the gaseous state. For isopentane, then, a prolate molecule might be assumed. But since carbon dioxide also belongs to the substances under consideration which agree well with VII.1, and as it is not necessary to assume for it a molecule which is either particularly prolate or particularly oblate, the diagram seems to show that in this case it is really molecular incompressibility which determines the behaviour of argon.

Physics. — *"Isotherms of monatomic substances and of their binary mixtures. XI. Remarks upon the critical temperature of neon and upon the melting point of oxygen."* By Prof. H. KAMERLINGH ONNES and C. A. CROMMELIN. Comm. N°. 121c from the physical Laboratory at Leiden.

(Communicated in the meeting of May 27. 1911).

For some time past we have been busy with an investigation of the equation of state for neon in which a place of importance is taken by the isotherms for the temperatures which are repeatedly used with liquid oxygen in our cryostat, viz. —182° C. to —217° C. It is obvious that for the purpose of this branch of the investigation one should be able to take advantage of a knowledge of the critical temperature.

Before, therefore, proceeding to determine a series of isotherms which would be specially arranged with a view to the deduction of the critical temperature from these isotherms — which is the obvious method of obtaining a reliable estimate when the direct determination cannot be made with a bath of liquid oxygen — we have first ascertained if the critical temperature of neon lies above or below the melting point of oxygen. Such an investigation is necessary because the critical temperature of neon is not yet definitely known, and the estimates which have been made of it differ widely. TRAVERS, SENTER and JACQUEROD [1]), who start with the assumption that the critical temperature of neon must lie below — 213° C. obtain the value — 223° C., while A. O. RANKINE found a short time ago from two

[1]) M. W. TRAVERS, G. SENTER and A. JACQUEROD, Phil. Trans. A. 200, 105, 1902

different methods the two values — 210°.4 C. [1]) and — 212°.0 C. [2])

For the melting point of oxygen ESTREICHER [3]) gives — 227° C. Relying upon these data, therefore, one should be able to determine the critical constants for neon by using a cryostat containing oxygen cooled by means of liquid hydrogen to the neighbourhood of its melting point. Indeed, if RANKINE's estimates are correct we should be able to attain the desired temperature by means of oxygen boiling under greatly reduced pressure, by means of which temperatures are usually obtained down to about ± — 217° C.

Experiment has shown that both deductions are incorrect.

A cryostat [4]) consisting of a partly silvered vacuum glass and containing not only the piezometer reservoir full of neon but also a platinum resistance thermometer and a valved stirrer was filled with liquid oxygen and was connected to a BURCKHARDT vacuum pump of great capacity. To minimise as far as possible heat exchange with the surroundings this cryostat was surrounded by a vacuum glass containing liquid air.

When the pressure in the cryostat had been diminished to 1 mm. we noticed that the liquid oxygen was covered with a crust of solid oxygen. A small increase in the pressure caused the solid oxygen to distribute itself throughout the liquid in the form of small transparent pieces (crystals?). As long as these pieces were kept in continual motion in the liquid by means of the stirrer a constant temperature of — 218°.4 C. was observed. Gradual compression of the neon to 60 atm. did not give rise to any trace of liquid in the neon piezometer nor did a gradual expansion from 60 atm. to atmospheric pressure From this we may conclude that the critical temperature of neon lies at least some degrees below — 218° C., and that therefore the determination of the critical temperature had, in the meantime, better be made from the isotherms below — 200° C.

The result obtained for the melting point of oxygen is surprising. The difference between our value [5]) and that given by ESTREICHER can, however, be simply explained from the description of his experiment given by ESTREICHER in which he himself moreover declares that it is quite possible that his result lies somewhat too low. In his experiment half of the helium thermometer reservoir was in oxygen

[1]) A. O. RANKINE, Proc. R. S. A. 84. p. 190.

[2]) A. O. RANKINE. Phil. Mag. Jan. 1911.

[3]) T. ESTREICHER. Bull. A. Sc. Cracovie. Dec. 1903.

[4]) Proc. Febr. March 1903. Comm. N°. 83.

[5]) We hope to shortly communicate the results of a determination more accurate than this preliminary measurement.

frozen solid over liquid hydrogen. It is quite probable that the temperature of that solid phase lay much lower than the true melting point of oxygen.

We gratefully acknowledge our indebtedness to Mr. G. HOLST, who was kind enough to undertake the measurement and calculation of the above temperatures.

Physiology. — *"On different vagus effects upon the heart investigated by means of electrocardiography."* By W. EINTHOVEN and J. H. WIERINGA.

A number of electrocardiograms give evidence, that different effects on the heart action can be obtained by vagus stimulation in dogs. Not only the frequency of the heart beats is diminished by stimulation of a vagus nerve, but at the same time the auricle contractions are weakened and often modified.

There can be produced a partial block, i.e. that not every auricle contraction is followed by a ventricle one, as in normal circumstances. but that two or more auricle contractions precede a single ventricle systole.

There can appear a complete block, auricles and ventricles beating in their own rhythm.

The conduction through the right branch of the auriculo-ventricular bundle can be impeded, effecting an atypical systole. In these circumstances the ventricle electrogram shows the shape of the atypical electrograms, which are produced by stimulation of the left branch of the bundle.

It also happens, that the conduction through the left branch of the bundle is impeded, atypical electrocardiograms being recorded of the opposite form.

There finally can be produced impediments that either affect one of the branches of the bundle partially or that are not purely isolated in that branch. In these cases there appear ventricle electrograms, the shape of which differs from those described.

The different effects of vagus stimulation are explained in the simplest way by assuming, that there are various knots of fibres in the trunk of that nerve, some of which being connected with the auricles, some others with the node of ASCHOFF-TAWARA and again others with each branch of the bundle. If some fibres react more strongly than other fibres upon a stimulus, the heart action will be modified in a special way, every knot of fibres producing its own peculiar effect.