Physics. — *Isotherms of monatomic substances and their binary mixtures.* XXVII. *Isotherms of helium between —103.6° C. and —259.0° C. and at pressures of 1.5 to 14 atmospheres.* By G. P. NIJHOFF, W. H. KEESOM and B. ILIIN. (Comm. N°. 188*c* from the Physical Laboratory at Leiden.)

(Communicated at the meeting of October 29, 1927).

We have measured isotherms of helium in the same way as has been described in the communication about oxygen [1]) with the same arrangement of the piezometer and the manometers.

The temperatures were obtained with the aid of liquid ethylene, liquid hydrogen and with the hydrogen vapour cryostat.

The piezometer with which the volumes were measured consisted of the same stem of 108 cm³, with which also the oxygen isotherms have been measured; however, with a view to the so much lower temperatures at which we wished to measure, the gas reservoir had been replaced by a larger one of 400 cm³ so that the normal volume with which we worked, amounted to about 500 cm³. The small reservoir in the cryostat had a capacity of 20 cm³, so that our greatest density amounts to about 25 Amagat-units.

The following table gives the values found by us. The B_A's, which can be calculated from these, have been published in the preceding communication [2]). The last column gives the differences between the observed values of pv_A, and those which have been calculated with the just mentioned B_A's.

As could also be expected from an estimation of that term using the reduced virial coefficients VII 1 [3]), it appears from the column *O—C* that the term with C_A in the development of pv_A to ascending powers of v_A^{-1} does not come into account in the region of temperatures and pressures treated here. It is evident that this benefits the exactness of the determination of B_A [4]).

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[1]) G. P. NIJHOFF and W. H. KEESOM, These Proc. **28**, 963, 1925, Comm. Leiden N°. 179*b*.

[2]) G. P. NIJHOFF and W. H. KEESOM, These Proc., page 404; Comm. Leiden N°. 188*b*.

[3]) H. KAMERLINGH ONNES and W. H. KEESOM, Comm. Leiden Suppl. N°. 23, § 36.

[4]) For the interest which exact measurements of the isotherms of gases and in connection with this, the determination of the attraction quantity of VAN DER WAALS have for the theory of absorption, compare B. ILIIN, Phil. Mag. (6) **48**, 193. 1924. Zs. f. Phys. **33**, 435, 1925.

TABLE I.

θ °C.	p int. atm.	pv_A	d_A	$O-C(pv_A)$
—103.30	14.242	0.62988	22.610	+0.0002
	9.910	.62743	15.792	+ 2
— 146.62	9.6830	.46792	20.694	
— 224.94	4.4156	.17769	24.848	0.00000
	4.1425	.17759^5	23.326	0
	2.7909	.17721	15.747	+ 6
— 235.77	3.4229^5	.13737	24.966	+0.00004
	2.9017	.13720	21.150	— 1
	2.4784	.13713	18.074	+ 1
	2.1585	.13709	15.745	+ 4
— 249.80	2.1315^5	.085008	25.075	+0.00002
	2.0766	.085017	24.426	+ 1
	1.9183	.085027	22.561	+ 2
	1.7267	.085035	20.308	— 3^5
— 252.57	1.8842	.074865	25.168^5	+0.00002
	1.8816	.074865	25.133	+ 2
	1.8373	.074865	24.542	+ 1
	1.4710	.074882^5	19.644^5	— 2
— 255.84^5	1.5793	.062504^5	25.249	—0.00001
	1.5430	.062533	24.661	0
	1.4611	.062565	23.326	+ 0^5
	1.3109^5	.062673	20.299	+ 4
— 258.99	1.28305	.050756	25.279	+0.00001
	1.12572	.050850^5	22.075	0