

Physics. — *The vapour pressures of solid and liquid neon.* By C. A. CROMMELIN and R. O. GIBSON. Communication N^o. 185*b* from the Physical Laboratory at Leiden. (Communicated by Prof. W. H. KEESOM).

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§ 1. *Introduction.* During the purification of some neon by a method similar to that already described by one of us (C. A. C.)¹⁾ it was observed that the vapour pressure of the solid neon at the temperature of boiling hydrogen ($\pm 20^\circ$ K.) was about 4 cm, whilst TRAVERS and JAQUEROD give ± 1.2 cm. As a matter of fact TRAVERS and JAQUEROD²⁾ give the following values

20 ^o .4 K.	12.8 mm Hg and
15 ^o .65 K.	2.4 mm Hg.

The latter were the results of preliminary measurements only and, as no others have been made, it seemed desirable to make an extended series of determinations of the vapour pressures of solid neon.

The vapour pressures of the liquid between the triple and critical points have been measured formerly in the Physical Laboratory at Leyden³⁾.

§ 2. *Details of the measurements.* The apparatus used was similar to that already described by CATH⁴⁾.

Two sets of apparatus were used, one filled with neon taken from a cylinder of the gas purified by the method mentioned above, and the other with neon that had been further fractionated by condensing some neon from the cylinder and allowing a middle fraction to evaporate directly into the previously washed and evacuated apparatus. The two sets were placed side by side in the cryostat and measured alternately. Only slight unsystematic differences, well within the experimental error, were found in the vapour pressures of the two samples of neon, indicating that they were of the same purity.

The measurements up to 20^o.4 K. were made in a liquid hydrogen cryostat, the temperatures being measured by means of one or two

¹⁾ C. A. CROMMELIN, *Rec. des Trav. chim. des Pays-Bas* (4) **42**, 814, 1923; *Comm. Leiden* N^o. 162c.

²⁾ M. W. TRAVERS and A. JAQUEROD, *Phil. Trans. A* **200**, 175, 1903.

³⁾ H. KAMERLINGH ONNES and C. A. CROMMELIN, *These Proceedings* **18**, 515; *Comm. Leiden* N^o. 147*d*; P. G. CATH and H. KAMERLINGH ONNES, *These Proceedings* **20**, 1160; *Comm. Leiden* N^o. 152*b*.

⁴⁾ P. G. CATH, *These Proceedings* **21**, 656; *Comm. Leiden* N^o. 152*d*.

platinum resistance thermometers. The pressures were measured by reading the heights of the mercury in the two arms of the manometer with a carefully levelled cathetometer and standard scale.

A hydrogen vapour cryostat was used for the measurements above the boiling point of hydrogen.¹⁾

§ 3. *Purity of the neon.* On several occasions vapour pressure measurements at the same temperature but with different volumes of the phases were made. The slight, if any, differences found were quite irregular and well inside the experimental error.

§ 4. *Experimental accuracy.* The accuracy of the temperature measurement was somewhat higher in the liquid cryostat than in the vapour cryostat (0.01 and 0.02 to 0.03 degree respectively), which appeared from the constancy of the temperatures and the concordance of the resistance thermometers. In the region of the higher temperatures the vapour pressures could only be determined to 1 mm, which becomes clear when one takes into consideration that e.g. at -248° C., 0.01 degree difference in temperature means 1.5 mm difference in pressure.

§ 5. *Results.* The results of the measurements in the solid and liquid regions, together with those previously published, are given in table I.

The temperatures are given in degrees KELVIN, while $-273^{\circ}.09$ C. is assumed for the absolute zero. The pressures are given in international cm mercury and in international atmospheres. At Leyden the international atmosphere is aequivalent with 75.9529 local cm mercury.

§ 6. *Triple point.* From a large scale graph of the present results the following values of the triple point constants were found:

$$\Theta = -248^{\circ}.52 \text{ C.}, \quad T = 24^{\circ}.57 \text{ K.}, \quad p = 32.35 \text{ int. cm.}$$

During one days measurements when special attention was fixed on the region round the triple point, it was observed that at one temperature the neon in one apparatus, that into which the neon had been distilled, was solid whilst that in the other, containing neon from the cylinder, was still liquid. Both were obtained solid on lowering the temperature still further, and on warming both appeared to melt at the same time. The phenomena was therefore due to supercooling and not, as was first thought, to impurities in the neon from the cylinder.

We are grateful to several assistants of the laboratory for their ready assistance in the measurement of temperatures, and one of us (R. O. G.) wishes to acknowledge his indebtedness to the SALTERS' Company of London for a Fellowship which made participation in this work possible.

¹⁾ H. KAMERLINGH ONNES, These Proceedings **19**, 1049; Comm. Leiden N^o. 151a; H. KAMERLINGH ONNES and C. A. CROMMELIN, These Proceedings **23**, 1185; Comm. Leiden N^o. 154c.

TABLE I.

	Θ	T	Pressure		
			int. cms Hg	int. atm.	
Solid	—257.62 C.	15.47 K.	0.055	0.00072	
	—256.79	16.30	0.13	0.0017	
	—256.46	16.63	0.21	0.0028	
	—255.79	17.30	0.37	0.0049	
	—255.43	17.66	0.51	0.0067	
	—254.92	18.17	0.78	0.0103	
	—254.63	18.46	0.98	0.0129	
	—254.07	19.02	1.49	0.0196	
	—253.64	19.45	2.00	0.0263	
	—253.30	19.79	2.53	0.0333	
	—253.22	19.87	2.71	0.0357	
	—253.16	19.93	2.82	0.0371	
	—252.62	20.47	4.00	0.0527	
	—251.24	21.85	9.1	0.120	
	—250.84	22.25	11.1	0.146	
	—250.22	22.87	14.8	0.195	
	—249.62	23.47	19.5	0.257	
	—249.09	24.00	25.0	0.329	
	—248.84	24.25	27.9	0.367	
	—248.58	24.51	31.5	0.415	
—248.56	24.53	31.7	0.417		
Liquid	Comm. 147d	—248.51	24.58	32.4	0.427
		—248.51	24.58	32.50	0.4276
		—248.29	24.80	35.0	0.461
		—248.10	24.99	37.3	0.491
		—247.82	25.27	41.0	0.540
	" 147d	—247.49	25.60	45.16	0.5942
		—247.33	25.76	48.6	0.640
	" 147d	—246.66	26.43	60.52	0.7963
	" 147d	—245.88	27.21	76.71	1.0094
		—245.79	27.30	79.1	1.041
	" 147d	—245.68	27.41	81.62	1.0740
	" 152b	—243.69	29.40		1.888
	" "	—241.77	31.32		2.980
	" "	—240.25	32.84		4.173
	" "	—236.82	36.27		7.970
	" "	—233.60	39.49		13.213
	" "	—231.71	41.38		17.428
	" "	—229.26	43.83		24.305
" "	—228.66	44.43		26.049	

Measurements of H. KAMERLINGH ONNES and C. A. CROMMELIN, These Proceedings 18, 515; Comm. Leiden N^o. 147d.
Measurements of P. G. CATH and H. KAMERLINGH ONNES, These Proceedings 20, 1160; Comm. Leiden N^o. 152b.