

the pipette was adjusted to the desired pressure, sealed by closing the needle valve B, the system and opened to the gas burette lines. After this had been done the mercury and the gas enclosed in the pipette were maintained at constant temperature in an oil bath connected to a mercury manometer. From volume and number of moles of gas initially enclosed in the pipette at the high pressure calculated. The correction was applied in these measurements to the cryostat temperature.

containing liquid nitrogen and fitted with a connecting line to the pipette. Temperature was measured in a pocket immersed in the liquid nitrogen. A line to a vacuum pump was also provided.

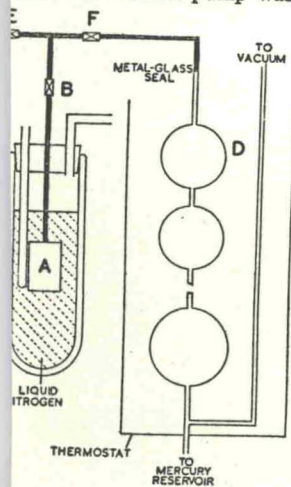


Diagram of apparatus.

and so obtain temperatures below the normal boiling point of the gas. The proportion of the enclosed gas was approximately 10% of the total. Care was taken to ensure that the gas was at the same temperature as the cryostat. Care was taken to ensure that the gas was at the same temperature as the cryostat. Care was taken to ensure that the gas was at the same temperature as the cryostat.

reaction of this volume which was immersed in the cryostat. These volume measurements of the compressibility of Michels and Goudek 7 and of Johns-

erg standard test gauges of the Bourdon type were used for the purpose of the investigation. The pressure was measured by the method of Hainsworth at a pressure of 100-150 atm through a liquid nitrogen trap at 110° C and then through a steel trap immersed in Dry Ice and alcohol. It was next opened and 50 ml of D₂

was added. The reactor was closed and returned to the Dry Ice bath for about 20 minutes to "deep freezing" of the D₂O. After this period it was opened and 100 g of calcium was added. The vessel was again evacuated, then sealed and the Dry Ice bath removed. After a short while an extremely rapid exothermic reaction took place, the pressure rose to 100 atm in about half a minute. The deuterium was then passed at about 40

TABLE 1.—ISOTHERMS OF HYDROGEN

T = 64.5° K		T = 78.9° K	
pressure (atm)	density (mole cm ⁻³)	pressure (atm)	density (mole cm ⁻³)
350	0.0344	300‡	0.0299‡
500	0.0387	500	0.0358
790	0.0440	600‡	0.0385‡
1000	0.0467	700	0.0404
1250	0.0493	800‡	0.0422‡
		950	0.0442
		1250	0.0478

‡ measurements using hydrogen prepared by reaction of H₂O with calcium.

TABLE 2.—ISOTHERMS OF DEUTERIUM

T = 64.5° K		T = 78.9° K	
pressure (atm)	density (mole cm ⁻³)	pressure (atm)	density (mole cm ⁻³)
150	0.0265	150	0.0215
200	0.0296	200	0.0258
300	0.0348	300	0.0313
350	0.0369	350	0.0335
400	0.0381	400	0.0352
500	0.0408	500	0.0380
700	0.0446	700	0.0424
900	0.0474	900	0.0456

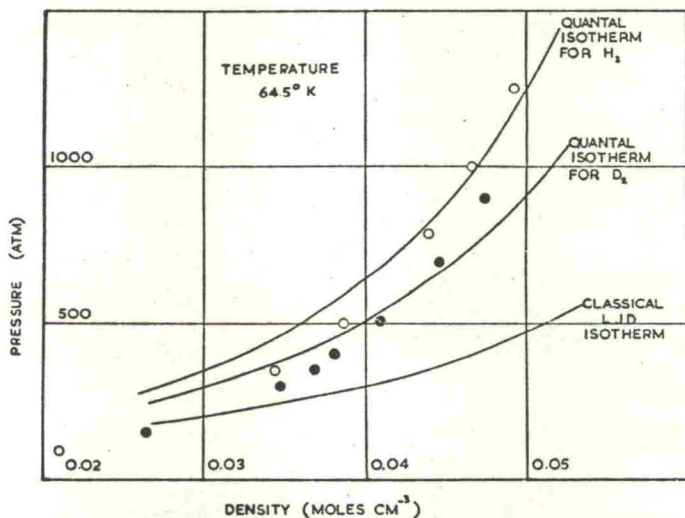


FIG. 2.—Theoretical and experimental isotherms at 64.5° K. The open circles are the experimental points for H₂, the filled circles are for D₂.

atm through a liquid nitrogen trap into the gas compressor. It is, perhaps, noteworthy that Schiff and Steacie¹⁰ carried out the reaction at 260° C; in our case the reaction started while the reactor was still below 0° C. A few density measurements were made on a sample of hydrogen prepared by the same method, using H₂O instead of D₂O.