much below that of the free gas. However, the curve, as shown in Fig. 1, has direct quantitative significance only below 20°K. It is well known that charcoal catalytically hastens the conversion into the equilibrium mixture of ortho and para hydrogen. The amount of heat required to maintain this equilibrium mixture varies with the temperature but reaches a maximum of nearly 4 cal./mole at 40°K. Below 20°K. this effect is not noticeable, and the heat capacity of the sorbed gas is less than 20% of that of the free solid hydrogen, which seems to indicate that the sorbed molecules are held even more firmly than those in the solid state.

Finally, the low specific heat of the sorbed gases, argon and hydrogen, and the high specific heat of sorbed water is hardly to be explained by the classical hypothesis in which the sorbed substance is supposed to be under a high pressure depending only upon the coefficient a of van der Waals' equation. This is further evidence that the sorption of water is of a wholly different type from the usual adsorption of gases and vapors, being held as much by mutual polarization as by attachment to the charcoal.

Summary.—Values for the heat capacity of water, argon and hydrogen sorbed in charcoal have been utilized as evidence of the state of the sorbed substance and of the type of sorption bond. A distinction is made between the physically adsorbed gases and the persorption of water as a two-dimensional liquid film permeating the charcoal.

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A Divided Titration Pipet-Stirring Rod

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The end-point of a titration is often tediously approached. This may be overcome by rapid titration followed by a back titration but this requires preparation of a second standard solution and the accuracy is reduced. In certain cases it is advisable to part the solution into two beakers, titrate one part rapidly, and from the information obtained to titrate more confidently the second portion. An adaptation of this method making use of a special stirring rod has been in use in this Laboratory for three years.

The method, while extremely simple, saves much time in precision work and has also the added benefit of making it possible to conduct titrations in many instances in a given or constant time. This has been found to increase the accuracy, as the drainage, etc., factors are constant.

The pipet-stirring rod is made of hollow glass tubing. The lower half consists of a cylindrical barrel about twice the diameter of the tubing above and having a capacity (each case has its own most suitable dimensions) of about four cc. The lower end of the barrel is drawn out to a restricted tip, small enough to reduce considerably diffusion between the contents of the

barrel and the surrounding liquor, but large enough to permit ready flow between them when desired. The pipet is fitted at the top with an ordinary glass stopcock, leaving a mouthpiece of glass about 2.5 cm. above the cock. Its total length is not longer than a stirring rod.

The sample to be analyzed is secured in a beaker, diluted suitably, and indicator added if necessary. The portion is adjusted when possible to require a set amount of standard solution. The stirring rod is introduced and the barrel filled. The pipet stopcock is closed and the standard solution run into the beaker as rapidly as possible from the buret to a slight excess, the buret stopcock being full open until the end-point is signaled. The pipet meanwhile functions as a stirring rod. Half of the withdrawn barrel portion is now drained into the beaker and titration repeated to excess, this time by additions of say twenty drops each. This cycle is repeated with say five drop portions. The rod is then rinsed in the solution by running liquid in and out several times. The final titration in one drop portions is rapid. The color variation or other indication of the end-point is fresh in the memory. Judgment is not strained. It was found even when duplicates were being run that it was quicker and easier to titrate by this method. A medicine dropper arrangement is similar but not satisfactory. It is not precise and not readily cleaned.

Fig. 1.—Diagram of pipet - stirring rod.

If the sample can be adjusted approximately to require a set volume of standard solution the titration (with a set procedure) will always occur in a fixed time.

CONTRIBUTION FROM THE
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A New Glass Packing for Laboratory Fractionating Columns

BY C. D. WILSON, G. T. PARKER AND K. C. LAUGHLIN

A highly efficient packing suitable for general use in laboratory fractionating columns has recently been developed in this Laboratory. The packing is a glass modification of the single and double-turn wire helixes which have been used here with excellent results.

The apparatus required for making the glass coils is very simple: a brass (or other metal) rod of 3.2 mm. diameter and about 31 cm. long is equipped to hold a 2–3 mm. glass rod (by flattening a portion of the metal rod and drilling a hole or by slotting the end of the metal rod and bending the prongs to fit the glass rod). The end of a 2–3 mm. soft glass rod is inserted into this opening and heated in a moderate Bunsen flame to softening. The metal rod, held in the right hand at right angles to the glass rod, is then