[MILLER & KENRICK] IDENTIFICATION OF BASIC SALTS

The first theorem does not exclude the possibility of the coexistence of n+1 or even n+2 phases under certain conditions of temperature and pressure; but if ne experiments be carried out at atmospheric pressure in a thermostat set for some temperature below the boiling-point of the solution, the chance of meeting with such special conditions is negligible.

These theorems, which were reached by Gibbs in 1876, in the course of an abstract thermodynamical study of the conditions of equilibrium in heterogeneous systems, have often been verified; their importance, however, as furnishing a means—often the only means of discovering the chemical individuals in ill-defined muddly precipitates, is only now beginning to be generally realized.

Applied to a particular case, for instance the formation of basic salts by the action of water on the chloride of antimony or on the nitrate of bismuth (temperature and pressure fixed as above), the theorems affirm:

(i) That if the system, which consists of three components (see below), has arrived at equilibrium, not more than three phases can coexist. Of these the solution forms one, the precipitate consequently must be either one single homogeneous substance (one phase), or a mixture of two phases—for instance, of two basic salts, or of one basic salt with the oxide.

•) That i is observed difference in composition between two precipitates, formed by the action of different quantities of water on the same salt, is due to their being mixtures of the same pair of basic salts in different proportions, the composition of the mother-liquors will be the same in the two eases.

The possible cases are thus divided into three groups:-

- 1. The solutions are identical in composition in different experiments, while the composition of the precipitate varies.—The precipitate is a mixture of two phases.
- 2. The solutions differ in composition, but the precipitates have the same composition.—The precipitate is a single chemical compound.
- 3. Both solutions and precipitates vary.-The precipitate is a single phase of variable commissition, a "solid solution."

If it were possible to represent the compositions of the solutions by abscissæ, and those of the precipitates by ordinates, the results of a series of experiments could be represented by a curve perpendicular lines would then correspond to case 1 above, horizon'al lines to case 2, and slanting lines to case 3. In a three-component system this is in general not possible. In many cases, however, a pair or pairs of com-

37