

tiplication, problems which with us would lead to equations were solved by a process of trial, a general rule was often derived from special numerical examples. In the same way to-day mathematicians by a kind of induction often find a rule from a special example, but this must afterwards be proved.

One receives the impression from Professor Peet's work that the mathematics of the Egyptians was developed largely in caring for the needs of their daily life. On the other hand, in a recent account of the Edwin Smith Medical Papyrus, J. H. Breasted, professor of Egyptology and Oriental history at the University of Chicago, has expressed the opinion that the surviving mathematical papyri clearly demonstrate the Egyptian's scientific interest in pure mathematics for its own sake. With this point of view I am in entire sympathy. To me the whole papyrus seems to be constructed on a scientific basis, and is not a mere collection of problems for practical use. Easier problems come before more difficult ones in the same way as in a modern arithmetic.

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LABORATORY APPARATUS AND METHODS

INDICATOR REACTION AS A SOURCE OF ERROR IN pH DETERMINATIONS

THE colorimetric determinations of hydrogen-ion concentrations, expressed as pH, are now a part of routine procedure in various lines of work. In many cases no electrometric check is feasible and the prevention of errors incident to the preparation and use of standard buffer and indicator solutions is of paramount importance. The purpose of this paper is to point out one of these errors, that is, the change of reaction of indicator solutions stored in glass bottles. It has been found that such a change will in many cases seriously affect the results obtained and that the use of the same indicator solution in both the standard and the unknown solutions does not remove this error.

In the course of some determinations of the pH of soil extracts it was found that the readings were in several cases too high (*i.e.*, alkaline) and change in the reaction of the indicator solutions used, probably due to alkali dissolved from the storage bottles, was found to be the cause. Forty-three soils were tested with indicators both unadjusted and corrected as to reaction, and, of these, twenty-two showed a difference in readings of from .3 to .9 between the adjusted and the unadjusted indicator solutions. The usual experimental error in determinations of this kind is less than .2. Buffer solutions tested under similar conditions showed no differences of color. The need for

such indicator adjustment has been noted by Karraker in his recent paper on soil reaction studies.¹

It is in some cases necessary to adjust the reaction of the indicator solutions quite frequently, and it has been found that a convenient means for doing this, when electrometric apparatus is not available, is by the "spot" method. An ordinary porcelain plate used for color reactions is suitable for this purpose. Twenty milliliters of the indicator to be adjusted are taken from the stock bottle and a drop placed in one of the depressions on the plate. A drop of N/20 hydrochloric acid is then added to the 20 ml. and another drop placed on the plate. This procedure is repeated until the acid color is reached. A spot is now selected which corresponds as nearly as possible to the color midway of the workable range of the indicator. A buffer solution of the desired pH plus the indicator being tested may be used for comparison or the colors in the excellent chart in Clark's book on hydrogen ion concentrations² may be referred to. The use of this chart provides a simple and efficient method of comparison as the flat colors more nearly approach the "spot" colors for comparative purposes than do the tubes of standard buffer solutions. The proper "spot" may also be approximated by selecting the one in which the two component colors of the indicator appear most nearly equal. Having decided on the proper color a quantity of the stock indicator solution is adjusted to this point by the addition of a calculated amount of N/20 hydrochloric acid. It will be found, after repeating this procedure once or twice, that the "midway" color can be readily determined without a preliminary 20 ml. test.

For highly buffered solutions this adjustment of the reaction of the indicator is apparently unnecessary, but for unknown solutions or those of known low buffer content it is essential, for if this source of error is disregarded there can be no assurance as to the accuracy of the results obtained.

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SPECIAL ARTICLES

OBSERVATIONS ON TAXONOMIC FACTORS USED IN THE GENUS *CERCOSPORA*

THE fungi which are included in the genus *Cercospora* have been and still are classified on the basis of spore size, host reaction to parasite and known host range of the causal organism. This taxonomic

¹ "A Note on Soil Reaction Studies," P. E. Karraker, *Soil Science*, Vol. 15, No. 6.

² "The Determination of Hydrogen Ion Concentrations." (1922 Edition.) W. Mansfield Clark.