Examinations and Ability.

IN an examination in any school subject, the maximum mark being 100, different distributions of the candidates among the hundred-and-one possible marks or percentiles are possible; different distributions are in fact found to result from two examinations of the same pupils in the same subject. The views expressed by Mr. B. C. Wallis in a privately printed pamphlet, "Mass Methods of Examining Children," a copy of which has reached us, may be stated as three propositions, of which the first two are: (1) an examination mark is not in general a measure of the ability of the candidate, but merely a symbol by means of which the candidate's rank in order of merit can be determined; (2) in order to obtain a mark that is a measure of the candidate's ability the examiner's marks must be adjusted to an appropriate standard distribution, the same for all cases.

Mr. Wallis reasons the matter cogently and with many illustrations of the effects of different distributions. He has in mind one of the school certificate examinations. If the one in question is that in which the percentage of passes varies throughout the range between 30 and 40, his complaint is thoroughly justified. When an examination deals with thousands of candidates, the constancy of the average candidate is assured and variation of the percentage of passes through such a range is inevitably due to variation in the standard of the questions and of the valuing.

Mr. Wallis's third proposition is that the standard distribution to which every examiner's marks are to be adjusted is the straight line distribution, on which there are the same number of candidates at every percentile. The only alternative with which he compares the straight line distribution is the cocked-hat distribution. The cocked-hat distribution, however, goes to infinity in both directions, and is unsuitable for a phenomenon that stops abruptly at both ends like examination marks. Suitable distribution curves for such phenomena are well known and may be found in Palin Elderton's "Frequency Curves." One type is the straight line; in another type the candidates are bunched at the two ends or at one end; in a third type they are bunched somewhere about the middle.

Mr. Wallis says truly that it has never been proved that marks on the cocked-hat distribution are measures of ability. It is equally true that it has never been proved that marks on the straight line distribution are measures of ability. The matter cannot be put to the test directly until precise information is available as to what the school aims at doing and as to what the examination aims at testing. But many investigations have been carried out in the Galton Eugenics Laboratory on physical, intellectual, and temperamental qualities, and the distribution is found in general to be bunched about the middle. Moreover, every examiner does his imperfect best to make his marks measure ability, and it can scarcely be a mere coincidence that in statistics kept for half a century the distributions have, with the rarest exceptions, been found to bunch about the middle.

Accordingly, while in complete agreement with Mr. Wallis in the view that examination marks ought to be adjusted to a chosen standard distribution, we are of opinion that a distribution bunched somewhat at the middle will furnish a truer measure of ability than the straight line distribution.

Potential Gradient at Great Heights.

IN June 1926, M. P. Idrac published in the *Comptes rendus* of the Paris Academy of Sciences a short description of the apparatus which had been devised for recording potential gradient at great heights and gave some account of the results which had been obtained.

Further details are now available in a paper which has been published by the Office National Météorologique de France. The system adopted was invented by M. l'Abbé P. Lejay, and depends on the use of a valve with four electrodes.

The whole apparatus is very compact. A balloon two metres in diameter can carry up the electrograph as well as a barothermograph. In practice two smaller balloons tied together are used instead of one large one. The apparatus hangs about twelve metres below the balloon, and there are at different levels two fuses, one of which is connected to the filament, the other to the grid of the valve. The difference of potential between these fuses determines the strength of the current flowing through the valve. This current passes through a recording milliammeter, the readings of which can be interpreted as giving the potential gradient. To allow for recording negative potential gradient, considerable grid bias is necessary, but to save weight the grid bias battery is frequently dispensed with and some of the records fail where they should show negative gradients. Between May 1926 and the end of 1927 there were 60 ascents, of which 44 have given useful results. These are all set out diagrammatically in the paper. The fluctuations in potential gradient in the various cases are remarkable, but some good records were obtained both for the ascent and the descent of the balloon, and the agreement in the curves inspires confidence in the system.

With so much variation from day to day it is not surprising that the averages given for the three groups, ascents made by night, in the morning, and in the afternoon are not very smooth. According to the averages for the afternoon, the potential gradient over Trappes at a height of 2 km. is 43 volts per metre. The gradient falls off to 11 volts per metre at 5 km., but at 7 km. it is 25 volts per metre, and at 9 km. it is 30 volts per metre. There is a sudden drop, presumably on entering the stratosphere, to 2 volts per metre, another rise begins at 12½ km. and a maximum of 16 volts per metre occurs at 14 km. The diminution to practically zero gradient at 20 km. seems to be based on one record only. If we may interpret the observations in the light of Coulomb's Law it appears that in the afternoon the air is positively charged up to 5 km., negatively charged between 5 km. and 9 km. There is a considerable positive charge just below the stratosphere. The stratification by night and in the morning is found to be somewhat simpler.

As M. Idrac emphasises, more observations are required before trustworthy generalisation can be made. It is to be hoped that the new line of research will be followed up in many parts of the world. It is only by learning about the conditions in the upper air that we can consolidate our knowledge of the processes of atmospheric electricity.