

CONTENTS

Chapter 1. GENERAL SURVEY OF THE ERRORS OF CHEMICAL ANALYSES	7
1.1 The significance of determining the errors of results of chemical analyses	7
1.2 Errors to which the results of chemical analyses are subject	7
1.3 Precision and accuracy of the results of chemical analyses	9
1.4 Absolute and relative errors	10
1.5 The general theory of errors	11
1.6 Relative error of the final result of a chemical analysis	12
1.7 Errors of procedure and errors of measurement	14
1.8 Influence of the precision of measurement and of the absolute value of the quantity measured, on the relative error	15
1.9 The influence of the constant k on the error of the result	17
1.10 The origin of random, systematic and gross errors	18
1.11 The reliability and reproducibility of the results of chemical analyses	19
1.12 Elimination of the influence of errors of chemical analyses	20
Chapter 2. MEASUREMENTS USED IN CHEMICAL ANALYSES	22
2.1 Weighing	22
2.2 Calibration of analytical weights	24
2.3 The relative error of weighing	25
2.4 Influence of humidity and temperature on the accuracy of weighing	27
2.5 Measuring solutions	27
2.6 Calibration of glassware	28
2.7 Errors in measuring and making up solutions	30
2.8 Sample weighing	33
2.9 Titre of the volumetric solution	34
2.10 Physical measurements in practical analysis	35
2.11 Indirect two-component analysis	40
2.12 Checking the accuracy of instruments; calibration and setting	41
Chapter 3. SPECIFIC ERRORS OF INDIVIDUAL METHODS	42
3.1 Introduction	42
3.2 The Guldberg-Waage law	42
3.3 Errors in neutralization titrations	44
3.4 The titration error of complexometric titrations	49
3.5 Solubility of precipitates; titration error of precipitation titrations	52
3.6 Titration error of oxidation-reduction titrations	56

3.7	Errors of electrometric titrations	59
3.8	Purity of precipitates	60
3.9	The temperature of drying and igniting precipitates	65
3.10	Errors of photometric determinations	66
3.11	Errors of emission spectrography	68
3.12	Errors of flame photometry and atomic absorption photometry	70
3.13	Errors of electroanalytical determinations	70
3.14	Errors of polarographic analyses	71
3.15	Errors of extraction methods	72
3.16	Errors of some special separation methods	74
Chapter 4. THE APPLICATION OF MATHEMATICAL STATISTICS		76
4.1	Application to assessing analytical results	76
4.2	Probability	77
4.3	Positive and negative deviations from accurate results; the binomial distribution	78
4.4	The Gaussian distribution; the law of normal distribution of random errors	81
4.5	Parameters of the normal distribution of errors	82
4.6	Estimate of the mean value	83
4.7	The estimate of the standard deviation	86
4.8	The standard deviation of the mean value	90
4.9	The Gaussian law and the probability of occurrence of an error of given magnitude	94
4.10	The reliability interval	97
4.11	The amount of information obtainable	101
4.12	Deviations from the Gaussian law of error distribution	103
4.13	Student's t-distribution	107
4.14	Comparison of the mean with the expected value	110
4.15	Comparison of the results of two different methods	111
4.16	The most suitable number of parallel determinations	116
4.17	Comparison of the precision of two methods by means of the F-test	118
4.18	Determining the influence on the final result, of errors of individual operations	124
4.19	Gross errors and the elimination of outlying results	127
4.20	The permitted difference of two parallel determinations	129
4.21	The limit of detection	129
4.22	Non-parametric methods	130
4.23	Sequential analysis	133

Chapter 5. GRAPHICAL AND NUMERICAL METHODS	137
5.1 Calibration graphs	137
5.2 Numerical and graphical interpolation	139
5.3 Numerical and graphical determination of the point of inflexion	140
5.4 Linear regression	142
5.5 The final result of chemical analysis	146
5.6 Expression of the results of chemical analyses	147
LITERATURE	149
INDEX	153