

# CONTENTS

## CHAPTER I

PAGE  
I

### CALCULATION OF RESULTS AND ERRORS . . . . .

Number of figures to be employed. Calculations with approximate numbers. Methods of calculation. Logarithms. The slide rule. Errors. Influence of errors of observation on the final result. Determination of the error of observation.

## CHAPTER II

### DETERMINATIONS OF WEIGHT AND VOLUME . . . . . II

The Balance. Determination of the zero point. Rule. Sensitiveness of a balance. Weighing by oscillations. Calibration of weights. Correction for the buoyancy of the air. Calibration of volumetric apparatus. Calibration of measuring flasks. Marking a ring on the neck. Calibration of pipettes. Calibration of burettes. Parallax.

## CHAPTER III

### THERMOSTATS . . . . . 29

The bath. Constant level apparatus. Regulation of the temperature. Circulation of water. Electrically heated and controlled thermostats.

## CHAPTER IV

### DENSITY OF GASES AND VAPOURS . . . . . 41

Determination of the density of a gas. Degree of dissociation of a gas. Determination of vapour density. 1. *Victor Meyer's method.* 2. *Bleier and Kohn's method.* 3. *Apparatus of Mensies.* Analysis of binary mixtures.

# CONTENTS

## CHAPTER V

### VISCOSITY AND VAPOUR PRESSURE OF LIQUIDS . . . . .

A.—Density of liquids. Calculation of the density. B.—Vapour pressure of liquids. I.—Determination of the vapour pressure by the Ramsay-Young method. II.—Method of Smith and Menzies. III.—Determination of vapour pressure by the isotenoscope.

## CHAPTER VI

### VISCOSITY AND SURFACE TENSION . . . . . 72

A.—Viscosity. Viscosity of homogeneous mixtures. Falling-sphere viscometer. B.—Surface tension. Parachors. Apparatus. Drop method. Traube's stalagmometer. Surface tension of solutions. Torsion balance method.

## CHAPTER VII

### OPTICAL MEASUREMENTS . . . . . 89

A.—Refractometric measurements. Refractive index. Specific and molecular refractivity. Monochromatic light. Determination of the refractive index of a liquid by the Pulfrich refractometer. Regulation of the temperature. Pulfrich refractometer. Determination of the zero point. Correction for temperature. Determination of the refractive index by the Abbe refractometer. The Abbe refractometer. Adjustment of the refractometer. The immersion refractometer. Refractometric determination of the composition of solutions. B.—Polarimetric measurements. Apparatus. Source of illumination. Observation tubes. Adjustment of the polarimeter. C.—Spectrometry. Spectroscope. Adjustment of the spectroscope. The Hilger wave-length spectrometer (constant deviation type).

## CHAPTER VIII

### OSMOTIC PROPERTIES OF SOLUTIONS. CALCULATION OF MOLECULAR WEIGHTS AND ACTIVITIES . . . . . 118

I.—Freezing-point (cryoscopic) method. Apparatus. Precautions. The Beckmann thermometer. Setting the Beckmann thermometer. Activity of the solute. Abnormal molecular weights. Cryoscopic determinations by analysis of the equilibrium solution. II.—Boiling-point (ebullioscopic) method. Apparatus with electrical heating. Cottrell's Apparatus. Sakurai-Landsberger method. Apparatus of McCoy. III.—Lowering of the vapour pressure. Apparatus. Carrying out a determination.

# CONTENT

## CHAPTER IX

### DISTRIBUTION OF A SUBSTANCE BETWEEN TWO NON-MISCIBLE SOLVENTS . . . . .

I.—The solute has the same molecular weight in each of the solvents. II.—The molecular weight of the solute in the two solvents is different. Determination of the molecular weight of dissolved substances. Determination of the degree of hydrolysis of salts. The investigation of homogeneous equilibria. Preparation of water free from carbonic acid. Preparation of standard baryta solutions.

## CHAPTER X

### CONDUCTIVITY OF ELECTROLYTES . . . . . 151

Outline of method and apparatus. Platinizing the electrodes. The measuring bridge. Calibration of the bridge wire. Conductivity water. The cell constant. Degree of ionization and ionization constant. Strong electrolytes. Basicity of acids. Determination of the neutralization point by conductivity. Solubility of sparingly soluble salts. Hydrolysis of salts.

## CHAPTER XI

### TRANSPORT NUMBERS . . . . . 185

## CHAPTER XII

### MEASUREMENTS OF ELECTROMOTIVE FORCE . . . . . 191

Measurement of the e.m.f. of a cell—Outline of the method. Apparatus. Purification of mercury. More accurate measurement. Seat of electromotive force of a cell. Measurement of single electrode potentials. Electrode potentials. Influence of concentration. Concentration cells. Solubility measurements. Hydrogen electrode. Oxidation and reduction potentials. Potentiometric analysis. Use of electron tube or thermionic valve. Quinhydrone electrode. Titration without a potentiometer. Buffer solutions. Indicators. Hydrolysis of salts. The activity of hydrogen ion and the salt effect. Decomposition potential of salts. Overvoltage. Determination of transport numbers.

## CHAPTER XIII

### VELOCITY OF CHEMICAL REACTION IN HOMOGENEOUS SYSTEMS . . . 245

A.—Unimolecular and pseudo-unimolecular reactions. Hydrolysis of an ester in presence of an acid. Temperature coefficient of reaction velocity. Velocity of inversion of cane sugar. Application. Decomposition of diazonium salts. B.—Reactions of the second order—Saponification of esters by alkalis. Order of a reaction.

## CHAPTER XIV

## THERMO-CHEMISTRY . . . . .

Apparatus. Units. A.—Heat of neutralization of acids and bases in dilute solution. Calculation of the heat of neutralization. B.—Heat of solution. C.—Heat of combustion. The bomb. The calorimeter. Making a determination.

## CHAPTER XV

## HETEROGENEOUS EQUILIBRIA . . . . . 277

I.—Vapour pressure of salt hydrates. II.—Determination of solubility. Solubility of a gas in a liquid. Solubility of a liquid in a liquid. Solubility of solids in liquids. Determination of the solubility. III.—Determination of transition points. Determination of the transition point. 1. Solubility method. 2. Thermometric method. 3. Dilatometric method. 4. Tensimetric method. IV.—Freezing-points of binary mixtures.

## CHAPTER XVI

## COLLOIDS . . . . . 298

Electrical properties of suspensoids. *Preparation of colloidal ferric hydroxide. Preparation of arsenious sulphide sol.* Cataphoresis. Precipitation of suspensoid colloids. A.—*Mutual precipitation of colloids.* B.—*Precipitation of suspensoid colloids by electrolytes.* Protective action of emulsoids. Adsorption. The adsorption isotherm. Adsorption and catalysis.

## APPENDIX . . . . . 307

International atomic weights. Transition points of salt hydrates. Heating liquids. Viscosities of liquids. Surface tension of liquids. Ionic conductivities at infinite dilution. Solubilities of some sparingly soluble salts. Hydrogen ion concentrations and pH values. Activity coefficients of aqueous hydrochloric and sulphuric acid solutions at 25°. Reduction of barometric readings to 0° C. Reduction of barometric readings to latitude 45° and sea level. Temperature measurements—Correction for exposed stem. Logarithm tables.

## INDEX . . . . . 315