

Thirty-four lines of the first spectrum of mercury have been examined; of these, many show Stark patterns of varying degrees of complexity. The patterns have been analysed and classified as "abnormal."

Several new combination lines have been observed, and term values corresponding to these lines have been calculated. In particular the mf levels are found to have a triplet structure.

The appearance of d lines which vanish when they pass under the zero field value of the corresponding p—p combination lines has been observed and discussed.

An approximate theory has been applied to calculate the displacement of lines of the group $2p - 2q$ in an electric field. Calculated values are found to agree with observations within the limits of experimental error.

PH. D.

BACTERIOLOGY

ERNEST HESS

EFFECTS OF SUB-OPTIMAL TEMPERATURES ON MARINE BACTERIA.

Pseudomonas fluorescens, *Flavobacterium decuduosum*, *Achromobacter x*, isolated from codfish slime, and *Bacillus vulgatus* from halibut intestine, studied at 37°, 20°, 5°, 0°, -3°, -6.5°, -10° and -16°C stimulated increase in cell-length (*B. vulgatus*) at cost of reproduction, for 13 days. Growth (aga slants) and pigment production observed at -6.5°C, in 100 days, motility persisting for over 37 days at -6.5°C. Sugar-fermentation, proteolytic activity and nitrate-reduction observed at -3°C. Growth curves show increasing length of lag and logarithmic periods with decreasing temperature, also increasing minimum generation times and temperature coefficients (Q_{10}) during logarithmic phase with decreasing temperature. Increasing total crops from 37° C to 5° C with increasing incubation time (Tammann principle), high total crops at 0°C and -3°C. Increased percentage reduction of cells with increasing length and decreasing freezing temperature, with repeated freezing, rapid freezing, young cultures, in unfavourable media (pH, salt concentration). Discussion of factors causing death by freezing and cold resistance.

PH. D.

CHEMISTRY

ROBERT KIRKWOOD HOLCOMB

THE APPLICATION OF DENSIMETRIC METHODS TO QUANTITATIVE ANALYSIS.

Consideration of the density changes or alterations of volume during reactions between liquids showed that the measurement of such changes should be of analytical importance. Alterations of volume in liquids have previously been used in the study of reaction velocity, but have not hitherto been used for following the titration of solutions.

Two methods are investigated experimentally. In the first the change of buoyancy of a submerged sinker is measured. It has been shown to be of value in following the reactions during neutralisation.

A dilatometer with which it is possible to measure the volume changes accompanying titration reactions has been devised. Its behaviour has been observed with respect to such extraneous factors as dissolved and other gases, temperature fluctuations, pressure differences inside the apparatus and leakage. Examples are given of titration curves of hydrochloric, acetic, sulphuric, oxalic and phosphoric acids with sodium hydroxide. These are compared with potentiometric titration curves. The volume change on dilution of aqueous sucrose solution has been measured and the results compared with those calculated.

PH. D.

CHEMISTRY

FRANCES HOWLAND

THE MECHANISM OF ORGANIC REACTIONS IN THE GASEOUS STATE: THE KINETICS OF THE OXIDATION OF GASEOUS ACETALDEHYDE.

The kinetics of the oxidation of gaseous acetaldehyde have been investigated from 60°C. to 120°C. by observing the rate of pressure decrease in a system at constant volume. A considerable induction period exists, during which the main products of the reaction are carbon dioxide, water, and formic acid. The main reaction in the subsequent stages involves the formation of peroxides and their oxidation products. The heat of activation of the reaction is 8,700 calories per gram molecule. The indications are that the reactions occurring during the induction period are heterogeneous. The subsequent reaction occurs by a chain mechanism. The chains are initiated at the walls of the reaction vessel, and are also largely broken at the walls.