Letters to the Editor

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Possibility of Sedimentation Measurements in Intense Centrifugal Fields

THE ultracentrifugal technique worked out in this laboratory enables us to carry out measurements of sedimentation velocity and sedimentation equilibrium in very powerful centrifugal fields[1]. At the present time, routine work can be done at speeds up to 74,000 r.p.m. with a column of solution 12 mm. in height situated 65 mm. from the centre of rotation. The centrifugal force in this case corresponds to 400,000 times gravity. When it comes to the study of substances of comparatively low molecular weight, for example, 1,000 or 2,000, and when one wishes to make a sedimentation analysis of mixtures of low molecular weight, such as the decomposition products of the proteins, it is of importance to have at one's disposal centrifugal fields of still higher intensity. We have therefore tried to improve our technique in this direction.

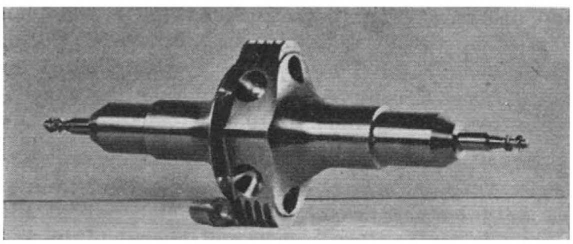

FIG. 1.

Rotor (weight 2,500 gm.) and cell (weight 12·5 gm.) for sedimentation measurements up to 900,000 times the force of gravity; the two twin-turbines at the ends of the shaft are fed with oil at a pressure of 15 kgm./cm.^{2}; the rotation takes place in hydrogen of 20 mm. pressure.

Last autumn a rotor was made for carrying a cell containing a column of solution 6 mm. in height at a distance of 36 mm. from the centre of rotation. It was successfully tested at 135,000 r.p.m. (750,000 times gravity) but exploded later, during a run at 125,000 r.p.m. (625,000 times gravity). The experiment showed, however, the possibility of regular sedimentation measurements at this speed. This spring, a new rotor of about the same dimensions, but of better material and improved construction, was therefore designed for a cell carrying a column of solution 8 mm. in height at 36 mm. from the centre of rotation (Fig. 1). It was tested at 160,000 r.p.m. (1,100,000 times gravity) and successful runs on hæmoglobin were carried out at a speed of about 145,000 r.p.m. (Fig. 2). The rotor finally exploded during one of these runs.

The fact that the cell with its windows of crystalline quartz withstood the strains and that convection-free sedimentation was obtained shows that accurate measurements may be performed in centrifugal fields of the order of one million times the force of gravity. We feel sure that it will be possible to improve further the mechanical design and to utilise to advantage the convection-free sedimentation which has been demonstrated to take place even in these very intense centrifugal fields under the experimental conditions realised in our ultracentrifuge.

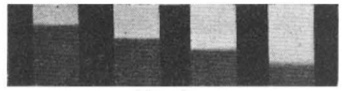

FIG. 2.

Sedimentation of dilute human hæmoglobin in the centrifugal field 900,000 times the force of gravity; time between exposures—3 minutes; the sharpness of the boundary between solvent and solution demonstrates the perfect homogeneity of this protein.

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[1] NATURE, **123**, 871, June 8, 1929. *Chem. Rev.*, **14**, 1; 1934. *Science*, **79**, 327; 1934. *Koll.-Z.*, **67**, 1; 1934. *Naturwiss.*, **22**, 225; 1934.

Fluorescent Yield of X-Ray Emission

ONE of the chief reasons for the low intensity of the X-ray lines emitted by light atoms is the low fluorescent yield of the X-ray emission by such atoms. As predicted by Rosseland and first shown by Auger, excited atoms when reorganising can dispose of their excess energy either by emitting X-ray quanta or by giving off photoelectrons. When the latter process prevails, the yield of X-ray emission is low, and vice versa. The magnitude of the yield can be determined by counting the number of photoelectrons[1] given off by the atoms when leaving the excited state, or by comparing the intensity of the exciting and the excited radiation.

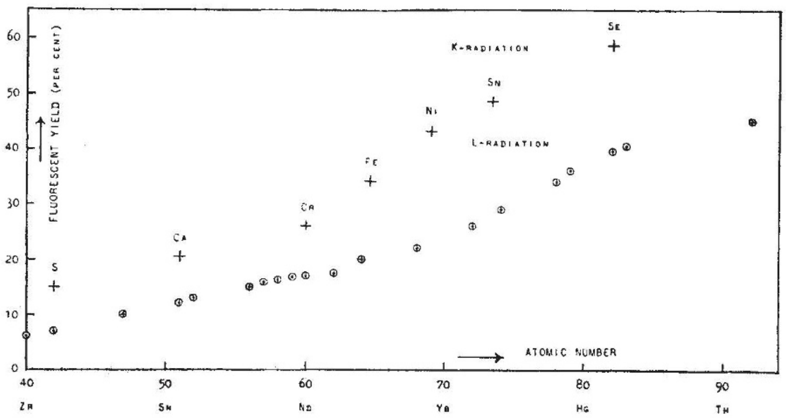

FIG. 1. *L*-radiation yield of the elements 40–92. The graph also shows the *K*-yield of the elements emitting a *K*-radiation of corresponding wave-length.