

The eleven sections of the Division are: analytical chemistry, applied catalysis, applied physical chemistry, chemical engineering, colloid chemistry, corrosion, high polymer chemistry, metallurgical chemistry, physical organic chemistry, rubber and textiles. Much of the work falls under the general headings of petroleum or corrosion chemistry, in that several sections work on topics related to one of these fields.

A current project of both military and industrial significance is the use of lignin as a rubber reinforcing agent. Whereas carbon black had hitherto been regarded as the only suitable reinforcing agent, it has been shown that lignin is an extremely satisfactory, domestic, non-strategic alternative. In fact, enough lignin can be produced as a by-product of Canada's pulp industry to replace all the carbon black now used in North America—about 554,000 long tons annually.

**Pure Chemistry.**—The Division of Pure Chemistry is organized around a nucleus of outstanding Canadian chemists who direct about 50 young postdoctorate Fellows from all over the world. The work consists of long-term fundamental investigations in physical and organic chemistry.

The work in organic chemistry includes investigation of the structures of alkaloids, studies of the infrared spectra of steroids, the synthesis of porphyrins and of compounds labelled with isotopes. Other sections deal with chemical kinetics and photochemistry, the study of the ionization potentials of free radicals by mass spectrometry, Raman and infrared vibrational spectroscopy, and the application of high resolution proton magnetic resonance techniques to the study of hydrogen bonding and other molecular interactions. Still others study certain aspects of surface chemistry such as the thermal properties of simple solids and imperfections in the bulk and the surface of alkali halide crystals, the heats of micellization by microcalorimetry, and the thermodynamics and stress-strain relationships associated with the absorption of fluids by active carbons. There is also a small group interested in the chemistry of fats and oils, and one engaged in fibre research.

**Applied Physics.**—The work in Applied Physics is divided between research projects likely to be of practical value and the continual development of the fundamental standards on which measurements generally are based. All the fundamental physical standards for Canada are housed and serviced in this Division, which now has primary standards equal to any in the world in the fields of mass, length, time, electricity, temperature and radiation. New standards work will involve topics such as the temperature scale below the oxygen point, and the luminous intensity standards where inadequate knowledge has precluded international agreement.

An important addition to Canadian facilities was the cesium clock recently put into operation in the Division. This apparatus substitutes the natural and unchanging frequency of cesium atoms for conventional methods of time-keeping and frequency measurement—of great importance in scientific experiments where extremely small time intervals must be measured with the greatest possible accuracy, and also as a possible future substitute for the present astronomical basis for time. A similar apparatus using the transitions within thallium is now under construction.

The analytical plotter for making maps from aerial photographs has been licensed for production, and an important study has been carried out to determine the possible use of photogrammetry for legal surveys. Indications are that the photogrammetric techniques are more accurate than present field survey methods, and also provide permanent references, thus eliminating the present need for duplication of survey effort.

Work continues on several industrial noise problems, on the thermal properties of ceramics at high temperatures, and on the development of a remote-reading temperature, salinity and depth recorder for use in oceanographic research. The possible use of plasma motors to propel rockets in outer space is being investigated. A study of the gonadal dose received by adults in diagnostic radiography has been completed.