On the theoretical side R. S. Mulliken suggested that it may soon be possible to make more reliable calculations of the energies of excited molecular states. He presented results for carbon monoxide, nitrogen and acetylene and for several molecules of the AB_2 type. The possibility of chlorine dioxide in the excited state being unsymmetrical was discussed, since the antisymmetric vibration appears to be excited on going to the upper state. J. W. Linnett discussed the electron distribution in the ground- and low-lying excited state of acetylene by transforming the molecular to equivalent orbitals. On this basis it was possible to understand why the carbon-carbon bond-length in the excited state is about the same as that in the ground-state of benzene and why the molecule is bent.

E. W. R. Steacie gave the introductory paper to the section on reactivity and pointed out that, while the evidence for excited species occurring in chemical processes had in the past often been very meagre, firmer knowledge of their participation in reactions is now being obtained. H. Eyring also gave a broad survey of the field and stressed the value of potential energy surfaces when considering chemical reactions theoretically.

There were several interesting theoretical contributions to this section. R. A. Marcus considered the case of electronically excited molecules reacting unimolecularly, the course of reaction being examined as motion on a potential energy surface. B. Stevens pointed out that while totally symmetric vibrations are excited when an electronic transition occurs, the excitation of non-totally symmetric vibrations are usually necessary for dissociation. A transfer of energy must therefore occur, and this will depend on the anharmonicity. Stevens suggested that the dissociation rate will consequently depend on the magnitude of optical energy taken up. E. K. Gill and K. J. Laidler discussed theoretically the reaction:

They reached the conclusion that both the theoretical and experimental evidence leads to the view that oxygen is produced in the $^3\Sigma_u^+$ state. This involves the minimum transfer of energy from one form to another. Potential energy surfaces were used by these authors also.

H. E. Gunning described experiments which made use of a mercury-vapour lamp charged with mercury-202. With this, mercury-202 could be excited in ordinary mercury vapour in the presence of gases with which the excited mercury could react. Isotopic enrichment in a solid product indicated that this

was formed in a primary process; no enrichment indicated that it was formed secondarily. No enrichment in mercuric oxide was obtained from nitrous oxide and oxygen but enrichment in mercurous chloride was found with hydrogen and methyl chlorides and with carbon tetrachloride.

J. D. McKinley and S. C. Polanyi had mixed atomic sodium with atomic and molecular hydrogen. They discussed the reactions that might lead to the chemiluminescence (sodium D lines) that is observed. J. C. Polanyi and also C. L. Arnot and C. A. McDowell discussed the results they had obtained for the rate of transfer of vibrational energy to translational when iodine is excited by the mercury green line to the twenty-sixth vibrational level of the excited state in the presence of inert gases. The competition between energy transfer and fluorescence is studied. Arnot and McDowell found that the ratio of rates was greater than expected from theory and suggested that the fluorescence lifetime may be less than has been supposed.

T. M. Sugden and E. M. Bulewicz and also F. Kaufman described work on the green emission that is obtained when nitric oxide is added to systems containing oxygen atoms. The former workers concluded that the intensity of the glow is determined by a more complicated process than the simple combination of atomic oxygen and nitric oxide.

G. J. Minkoff discussed the polymerization of acetylene and considered the possibility that a bent triplet diradical might be involved in the mechanism.

H. P. Broida and K. E. Shuler described the use of the reversal of iron lines in studying flame temperatures. This proves to be a sound method if equilibrium is established. Moreover, it is possible to discover when equilibrium is not established. P. Carrington had studied the emission by $^3\Sigma^+\text{OH}$ radicals in oxy-acetylene flames. It appears that the electronically excited radicals are deactivated at nearly every collision, so any departure from the equilibrium distribution that is observed must represent the situation prevailing on the production of the excited radicals.

J. Heicklen and W. A. Noyes described photochemical experiments that had been carried out with ketones and bi-acetyl. In the latter case they concluded that triplet excited molecules were involved. They discussed the decomposition, fluorescence and phosphorescence of these substances. H. Okabe described work on the fluorescence and photolysis of hexafluoroacetone. The effect of pressure and the addition of foreign gases was studied.

J. W. LINNETT

SUPPLY AND DEMAND

PROF. M. G. Say delivered his chairman's address before the Supply Section of the Institution of Electrical Engineers on October 23. The address, which was given under the title "Too Much and Too Little", was by no means confined to strictly technological considerations, and constituted, rather, a broad philosophical review of the persistent disparity between demand and supply, between needs and resources. Commenting on the use of the figure representing the power available per head of the population as an index of the standard of civilized life, Prof. Say remarked that in North America,

Western Europe, and the Soviet Union, energy resources were being developed as fast as practicable, while in the underdeveloped countries—representing three-quarters of the habitable world and two-thirds of the world's population—the demand for auxiliary energy was beginning. With the development of nuclear energy the production of electric power, which until now had been dependent upon coal, oil, or water-power, had become largely independent of geography or geology. It must, however, be remembered that a country might remain poor and underdeveloped because poverty put out of reach the

opportunity to build up the supply of power which would enable development to take place.

The total world consumption of power in the year 1950 was some 30,000 million kilowatt-hours. On a United Nations estimate of the annual rate of increase of power consumption at $3\frac{1}{4}$ per cent the year A.D. 2000 would see a three-fold increase on the present demand for power. This must be met very largely from nuclear energy, for by that time coal and oil outputs would be well past their peaks and hydro-electric power would be approaching its full development. It should be noted that the present methods of generating electric power, by means of a thermal cycle, were inherently wasteful, nearly four-fifths of the available heat being rejected. If this rate of loss should continue the world would in fifty years' time be wasting heat in the production of electricity at a level in excess of twice the present total world consumption of power.

Referring to engineering as a career and to the present shortage of engineering graduates, Prof. Say drew a comparison between the situation in the

U.S.S.R. and in Britain. It was worth noting that despite the scale of the Russian need for engineers and scientists there was no extreme specialization in science in the secondary schools. In the U.S.S.R. the three final years of school, to age seventeen, included the study of physics, chemistry and mathematics for about 40 per cent of the time, and this held for all pupils, arts as well as science. Thus potential arts men had to pass examinations in science subjects while potential engineers and scientists had to study literary subjects to a level quite beyond that of the average British technical student.

The concluding section of Prof. Say's address was concerned with the ultimate values in human life and the possible threat which was offered by the pressure and strain of a mechanistic age to the qualities of imagination and creation which were key elements in the human make-up. "We cannot deny," he said, "that the threat exists, nor on the other hand that industrialization has brought great benefits to mankind. It will bring more, but only if the mastery remains where it belongs—in the care of the human spirit." J. GREIG

NATURAL HISTORY OF THE FOX SQUIRREL

A FIELD study of the fox squirrel (*Sciurus niger*) in the south-eastern coastal area of the United States has been made by J. C. Moore (*Bull. Amer. Mus. Nat. Hist.*, 13, Art. 1). The fox squirrel has probably diminished greatly in numbers and range because of changes wrought by man. *Sciurus niger shermani* was investigated in the sand hills of north Florida in a fir-maintained plant community which is common over a wide area of the south-eastern coastal plain, the *Pinus australis-Quercus laevis* associates. This plant community was changed suddenly and radically from a tall but very open forest of primeval long-leaf pines with turkey oak indifferently represented as a secondary, lower level dominant, to a virtually pure stand of turkey oak, relatively close-ranked and low.

Moore's inquiry was designed to determine how this large tree squirrel, after presumably evolving in the open stands of large pines, lives now in the lowly oak forest which has succeeded the logged-off pine.

The principal predatory enemies of *Sciurus niger shermani* are apparently the bald eagle, the red-

tailed hawk, and man. There are few suitable refuges for so large a tree squirrel in this low, open forest of deciduous trees and this may have brought about the following developments in behaviour unusual for a tree squirrel: a fairly well-established tendency for it to take refuge, when hard pressed, in the burrows of gopher tortoises underground; the use by the fox squirrels of hollows that extend down through the tops of old stumps to nesting chambers underground; an escape behaviour, which may have developed since the removal of the old pines and which is presumed to be employed only against man, that involves hiding in the top of a second-growth long-leaf pine by ascending the plume-like apical twig so that the twig bends over horizontally under the squirrel, and the squirrel lies on top hidden from all below; there is, apparently, an excessive number of leaf-nests per individual squirrel, thus providing more refuge.

While these forms of behaviour have survival value, they do not enable the animal to prosper.

THE BRITISH COUNCIL

THE annual report of the British Council for 1956-57 refers briefly to the review of Overseas Information Services made by Dr. C. Hill. The decisions recorded in the White Paper accepted about nine-tenths of the Council's proposals for increased activities and the Council specially welcome the reference to co-operation with people and interests outside the Government. The Council's work depends largely on the help and advice of many educational, professional, scientific and industrial bodies as well as of thousands of individuals. About half the report deals with the Council and the sciences and an increasing proportion of the Council's work consists of making known British scientific achievement, assisting the dissemination of information to the appropriate specialists and in serving as a link between British experts and professional bodies and

their opposite numbers abroad. Allied to this is assistance in training. Since 1950, the number of overseas students in the United Kingdom has risen from 10,000 to nearly 35,000, about a third of whom are at universities or university colleges, while 60 per cent are concerned with the sciences. By far the largest increase in students is among those attending technical colleges, and the numbers might be greater still if their countries could find the necessary funds or Britain could offer scholarships and places on the scale of some of her competitors.

The report stresses Britain's advantage, shared with the Commonwealth and the United States, in the establishment of the English language among scientists as an essential means of communication, and the Council's work in furthering the study of English is thus of importance in this connexion. The