Britain does not have collective agreements as intensive in coverage as those existing in the United States: perhaps owing to the extensiveness of their scope (industry-wide as distinguished from plant-wide agreements). British agreements are less substantial than their counterparts in the United States, and, in particular, do not comprise anything like the American codes of job security and seniority or the grievance arbitration machinery through which these and other rights are enforced. On the other hand, Britain has nothing comparable with the German legislation on job security or the French principles on abusive or unfair dismissals. The Contract of Employment Act, 1963, is no more than a feeble and insignificant first step in this direction: it gives a right to a maximum of four weeks' notice after five years of continuous employment, and no power to award compensation for unfair deprivation of job. German workers and employees can claim up to one year's salary or wages by way of compensation for undue dismissal.

Similarly, Britain has neither the American pattern of grievance arbitration nor the Continental pattern of labour courts, consisting either (as in France) entirely of laymen, or (as in Germany) of a lawyer chairman, one employer and one employee with equal rights. These operate very rapidly and very cheaply, and settle many cases, and are far better adjusted to handling employer–employee cases than the existing machinery of justice in Britain.

To-day, British legislation on labour relations which, at one time, was in the van of progress, has fallen in arrears. The scrutiny of the fairness of dismissals, coupled with a power to award a right to be reinstated or to receive compensation and the creation of labour courts, are two measures necessary to promote social justice as well as the smooth operation of industrial relations.

The conference was also significant for a plea by Mr. G. R. Moxon (United Glass Ltd.), the president of the Institute, that the time had come for all bodies dealing with personnel management to re-examine their structure and organization and pool their resources in order to provide better services, particularly in projects overseas where British participation would be invaluable.

T. H. HAWKINS

SOLID-STATE CHEMISTRY

THE phenomenal growth of solid-state chemistry in the past fifteen years owes much to the joint research ventures of chemists, engineers and physicists, and the impetus for this stems largely from what has been aptly termed "the explosion in electronics", the invention of the transistor. In a paper by Dr. N. B. Hannay, chemical director, Bell Telephone Laboratories, for many years past concerned with semiconductor chemistry (*Science and Technology*, New York; October, 1963), the present position of this intriguing subject is ably summarized. The basis of this discipline is, he says, that "all solids are imperfect, fortunately, with atoms missing, misplaced, or of the wrong kind serving to bring the seemingly stolid solid to vibrant, useful, chemically reactive life". The high state of purity and crystalline perfection of some semiconductors, combined with their unique electrical properties, have facilitated the quantitative investigation of chemical processes in the solid state; they have made chemical reactions in such materials not only of great scientific interest but also to assume the importance of model systems as first principles in as yet a wide and largely unexplored field of chemical behaviour.

Many chemical interactions in semiconductors are analogous to those known and described in solution chemistry. The solvent is weakly ionized, like water, but in this case solid instead of liquid. "Just as ionization of water produces hydroxide and hydrogen ions ($H_2O \rightleftarrows H^+ + OH^-$) so ionization in semiconductors produces conduction electrons and holes (Si lattice $\rightleftarrows e^+ + e^-$) in a closely analogous way. Conduction electrons, which are not bound to any lattice atoms but wander freely through the lattice, are created when valence electrons are excited out of their normal atomic orbits by thermal agitation or by optical excitation. Holes, which simulate positively charged particles in their electrical behaviour, simply represent missing valence electrons". Several examples of reactions in semiconductors resembling those in aqueous solution are given in this paper and the analogies between them are striking. They result from the essential similarity between the hole (e^+)–electron (e^-) equilibrium in semiconductors and the hydrogen–hydroxyl equilibrium in water. It is indicated that both equilibria are governed by the familiar law of mass action, that is, any change in concentration of reactants which are in equilibrium shifts the equilibrium in a direction that tends to neutralize the change.

As Dr. Hannay points out, there remain, apart from the 'glamorous' materials and devices already discovered in the course of these researches in solid-state chemistry, innumerable problems of major theoretical and practical importance that are still unsolved. Among these may be cited the better understanding of controls on reaction rates; diffusion mechanisms; nucleation processes, for example, as applicable to catalysis.

H. B. MILNER

CENTENARY OF THE BIRTH OF W. H. YOUNG, F.R.S.

WILLIAM HENRY YOUNG was born on October 20, 1863. He entered Peterhouse, Cambridge, in 1881, was fourth Wrangler in 1884 and a Fellow of Peterhouse from 1886 until 1892. For thirteen years he coached for the Mathematical Tripos, a profitable but arduous occupation. He was an excellent coach, particularly with less than excellent pupils, but he gave, so far as mathematics was concerned, no sign during this period of the fertile originality that was to come.

In 1896 he married Grace Chisholm, a mathematician of no mean ability herself, a Wrangler of Girton and the first woman D.Phil. of Göttingen. Distinguished as her own work was, her greatest service to science was the influence she had on her husband, which, in the first instance, led him in 1897 to give up his Cambridge practice and devote most of his time to research. From then on, the family home was abroad, at first in Göttingen, later in Switzerland. Although Young spent some months in each year from 1901 until 1923 in some paid activity, mainly teaching mathematics in Britain, mathematical research (unpaid) dominated the rest of his life. In 30 years he published more than 200 papers: Young burst out in British pure mathematics like a supernova. He was elected a Fellow of the Royal Society in 1907.

His productivity is the more astounding in that it started so late and that his first work failed to bring him the credit it deserved. About this time, Lebesgue arrived at his definition of an integral. Young, working independently, arrived at a definition differing in form from Lebesgue's, but essentially equivalent. Lebesgue, however, was first, and it is called the Lebesgue integral. Fortunately, Young's name is attached not only to recondite theorems in the theory of Fourier series and the theory of surfaces, but to more than one result in undergraduate analysis, where the clarity of his mind created a new simplicity and a new elegance.

He raised a large and talented family. He died in 1942, alone in Lausanne, separated by the accidents of war from his wife and family. At a seminar on November 5, at Imperial College, Sir Graham Sutton (one of Young's pupils), Dr. J. C. Burkill and Prof. J. Proudman spoke on Young and his mathematical work, including his methods of teaching, and the centenary was commemorated in the evening by a small dinner at his old club, the Athenaeum. (See also *Nature*, 150, 227; 1942.)

H. D. URSELL

SHIFTING SAND BANKS OFF LOWESTOFT

LITTLE is known about the origin or stability of sand banks although some are serious hazards to navigation around the southern half of the British Isles. Accordingly, publication of a detailed account of 6 square miles of sand banks off Lowestoft * is a most welcome addition to knowledge, for both practical and academic reasons. It is fitting that this study was carried out by a member of staff of the department of the Admiralty which surveys the sea-floor and draws up navigational charts.

The method of approach adopted by Mr. Cloet was to compare the 44 detailed surveys made between 1835 and 1962, using a standard datum. From these surveys he prepared figures showing the maximum and minimum depths detected at any place and then derived a further figure showing the maximum known changes in thickness which can be expected. Such changes may reach even as much as 80 ft. It is suggested that the channelled surface of maximum depth is made of bedrock or relatively immovable material such as pebbles.

* Admiralty: Hydrographic Department. Admiralty Marine Science Publications. No. 6: *Hydrographic Analysis of the Sandbanks in the Approaches to Lowestoft Harbour*. By R. L. Cloet. Pp. iii+15+22 illustrations+12 graphs. (London: Admiralty, Hydrographic Department, 1963.)

Much of the analysis is concerned with a demonstration of the stability or motion of channels and sand banks and the smaller features associated with them. It is shown that the rate of movement of a feature need not be uniform and can vary with depth. Their direction of growth is particularly interesting since it is apparent that they approach Lowestoft both from north-north-west and south-south-west, and interfere off the harbour entrance. There are indications that their direction of growth corresponds to the direction of sand transport by tidal currents though the occasions of transport, and the relative importance of sea-waves cannot be revealed by such a study.

Diagrams are numerous, but it is a pity that so few are self-explanatory. It is rather unfair that only some of the localities mentioned in the text are shown on the figures, for not everyone has ready access to detailed Admiralty charts, or knows the region as well as Mr. Cloet. A much more serious criticism concerns the difficulty of identifying the ornament and of matching it with that in the key on figures, such as 3–5. Such a style of reproduction is false economy.

A. H. STRIDE

LONG-RANGE WEATHER FORECASTS

THE present state of knowledge does not permit a satisfactory theoretical solution to the problem of the general circulation of the atmosphere, nor to the associated problem of forecasting for long periods ahead. Because of the practical importance of long-range forecasts, many national meteorological services attempt to deal with the problem empirically, mostly on a regional basis and, of course, avoiding over-precision. No country depends entirely on one method of prediction, but makes the most of a variety of aids towards a solution. In any country, however, there tends to be a concentration of effort along particular lines because of the work involved. A short description of the methods adopted by different meteorological services has recently been published[1] by the German Weather Service, following the report[2] published in 1962 by a working group of the Commission for Aerology (World Meteorological Organization).

Some methods used are statistical and objective, and can treat a wide range of observational material in attempts to find correlations between future weather and available measurements. Regression equations have been used, for example, in forecasting the Indian Monsoon, but simple and multiple correlation tables also have their uses. The French, German and Russian weather services make great use of statistical methods. The various chosen predictors may be values of anomalies of pressure, temperature or rainfall, or may be concerned with weather types, solar influences, or with the interactions of atmosphere and ocean. Climatological probabilities and persistence tendencies must also be taken into account.

Another of the favoured methods makes use of analogous situations from the past, and assumes that an existing weather situation will develop in the manner followed by a similar previous situation found in weather records. The finding of analogues is essentially the basis of the British method, which compares present and past patterns of temperature anomalies over a large part of the northern hemisphere, and also examines the sequence of weather charts during the month over the British Isles as well as the monthly mean pressure chart over the northern hemisphere. A forecast can then be made when a number of analogous situations lead to similar sequels. If their sequels are different, then the most likely sequel is chosen in the light of additional arguments which may be based on the limits of the polar ice-cap, sea temperatures, snow cover or some marked anomaly of the general circulation.

Other methods depend on extrapolation. For example, the United States Weather Bureau examines mean circulation patterns and extrapolates these by normal forecasting methods, thus obtaining an indication of the most likely main paths of depressions and anticyclones during a period. From this indication can be produced charts showing anomalies of temperature and rainfall. Other extrapolation methods make use of periodogram analysis and extrapolate any regular variations found in a chosen predictor, though some methods used in the United States make use of a theoretical formula for obtaining the speed of movement of a wave pattern.

Many of the methods are adaptable to the electronic computer, and the enormous possibilities of modern computing are causing some reconsideration of previous ideas on the use of statistical data. The computer also makes possible various researches on the use of dynamical theory to obtain a numerical prediction.