withstanding the fact that similar diagrams for the expansion considered in the paper have frequently occurred in text-books.

THE business of the *Electrician* Printing and Publishing Co., Ltd., having been acquired by Messrs. Benn Bros., Ltd., 8 Bouverie Street, E.C.4, the forthcoming books of the former company, announced in NATURE of September 20, will be published by Messrs. Benn.

OUR ASTRONOMICAL COLUMN.

SEPTEMBER METEORS.—Mr. Denning writes that a fair number of meteors, including several brilliant fireballs, were observed in September. There was a well-defined shower, not far from the Pole, at 314°+79° at the middle of the month, and at the period from September 19–24 the chief radiant points were at 4°+27°, 59°+35°, 271°+22°, 290°+52°, 343°+14°, and 352°+2°. A very brilliant meteor was observed on September 21 at 10h. 3m., from the radiant in Cygnus. As seen from Bristol it was brighter than Venus, and fell from a height of 67 to 28 miles. On September 23, at 7h. 42m., a fireball illuminated the sky as seen from Clevedon, and it had a long, slow, and nearly horizontal flight from a radiant at 322°−23° in Capricornus. Its path was about 166 miles from over the English Channel to Welshpool, and it descended from 64 to 32 miles. Though it had a very extended path, only two observations of it were received, viz. from Clevedon (Somerset) and Fowey (Cornwall), but the sky was cloudy at many places.

COMET 1916*b* (WOLF).—The following is a continuation of the ephemeris, for Greenwich midnight, given by Messrs. Crawford and Alter in Lick Observatory Bulletin No. 295:—

1917	R.A.	Decl.	Log Δ	Brightness
	h. m. s.	° ′ ″		
Oct. 4 ...	23 38 17	−1 8 2	0·0891	1·22
6 ...	38 22	1 45 27	0·0972	
8 ...	38 31	2 21 9	0·1055	1·10
10 ...	38 43	2 55 5	0·1141	
12 ...	38 58	3 27 14	0·1227	0·99
14 ...	39 18	3 57 37	0·1315	
16 ...	39 41	4 26 13	0·1404	0·89
18 ...	40 7	4 53 3	0·1495	
20 ...	40 38	5 18 9	0·1586	0·79
22 ...	41 13	5 41 33	0·1678	
24 ...	41 51	6 3 16	0·1770	0·71
26 ...	42 34	6 23 21	0·1863	
28 ...	43 20	6 41 51	0·1956	0·63
30 ...	44 10	6 58 49	0·2049	
Nov. 1 ...	45 3	7 14 17	0·2142	0·56
3 ...	23 46 0	−7 28 20	0·2235	

The comet is situated below the Square of Pegasus, and is well placed for observation. It is, however, much fainter than might have been expected from the fact that it was discovered more than a year before perihelion passage. Between August 13 and August 22, according to observations by Quénisset, the magnitude of the comet fell from 8 to 9.

A COLOUR SCALE FOR STARS.—An attempt to establish a scale of colours adapted to observations of stars and planets has been made by Prof. W. H. Pickering (*Popular Astronomy*, vol. xxv., p. 419). The numerical values assigned to the different colours are:—5, deep-blue; 6, sky-blue; 7, light-blue; 8 pale-blue; 9, bluish-white; 10, white; 11, yellow; 12, orange; 13, reddish-orange; 14, orange-red; 15, light-red; 16, deep-red. The typical colours are shown in circular patches on a coloured plate, which is to be viewed by one eye under carefully adjusted illumination, while the planet, or star out of focus, is viewed with the other eye at the telescope. To secure constant conditions of comparison, the illuminating source is to be slightly modified as required, so that certain standard stars of type K always register 11. The average results for stars of different types are compared with the colour indices (differences between photographic and visual magnitudes) in the following table:—

Type	Colour scale	Colour index
Oe ...	7·0 ...	—
B ...	6·7 ...	−0·3
A ...	7·4 ...	0·0
F ...	7·6 ...	+0·3
G ...	9·5 ...	+0·7
K ...	11·5 ...	+1·2
M ...	12·0 ...	+1·6
N ...	13·7 ...	+2·5

An extensive investigation of star colours has also been made by H. E. Lau (*Astronomische Nachrichten*, No. 4900). The scale in this case is white=0, yellow=5, and red=10. The influence of atmospheric absorption and the effect of magnitude have been examined, and a catalogue showing the colours of more than 700 of the brighter stars is given.

AN AUSTRALIAN CHEMICAL INSTITUTE.

AN Australian Chemical Institute has been formed with its headquarters in Sydney, and branches in every State of the Commonwealth. The provincial committees include the professors and other teachers of chemistry in the universities and most of the professional chemists in the several States. The institute has been framed on much the same lines as the Institute of Chemistry for Great Britain and Ireland. The objects set forth are:—(1) To raise the status and advance the interests of the profession of chemistry; (2) to promote the usefulness and efficiency of persons practising the same; (3) to afford facilities for the better education and examination of persons desirous of qualifying as technical analysts and chemical advisers; (4) to obtain power to grant legally recognised certificates of competency. Persons eligible for membership must possess certain qualifications, such as the degree of a recognised British university where they have studied chemistry for not fewer than three years, or an approved diploma in some branch of chemistry granted by an approved technical college or school of mines (no mention is made of the length of study required from such), or be fellows or associates of the Institute of Chemistry of Great Britain and Ireland, or who have satisfied examiners appointed by the council that they have attained a necessary standard of chemical education; other persons may be admitted by the council without examination for special reasons on the recommendation of the committee of a branch.

The council does not intend to hold any examination for admission before January, 1918, but lecturers or teachers of chemistry at an Australian university, technical college, or school of mines, or approved secondary school, chemists who are in charge of a Government laboratory, or have been in charge of a laboratory attached to a commercial or industrial establishment for three years, chemists or analysts who have been in practice for three years, and certain others will be eligible for membership without examination before that date. Chemists who have been absent from Australia on war service may be admitted without examination after January 1, 1918, at the discretion of the council. One of the stated duties of the council is to take any steps that may appear to be advisable to improve the rate of remuneration of chemists in private practice or in the employment of

the Federal or State Governments or commercial establishments; another duty is to appoint committees for fixing standard methods of chemical analysis, for the publication of memoirs or bulletins, and for the standardisation of fees for professional work. It is intended to apply for a charter for the institute. A number of the professorial and professional chemists in Australia are fellows of the Institute of Chemistry of Great Britain and Ireland, and probably one of the principal reasons for forming a similar institute in Australia is in consequence of the difficulties connected with the holding of the former's examinations in Australia, due to the great distance and other causes now increased by the war.

CHILD-STUDY AND EDUCATION.[1]

THE special merit of the "Memorandum on the Educational Principles upon which should be based all Future School Reform" is that it dwells on the need for basing education upon a true theory of child-nature. It consists of an introduction by Prof. Adams, five sections written by "experts," and a series of "recommendations." All who are interested in educational progress should urge these "recommendations" on education authorities.

From the title one might suppose that these "principles" have been stated once for all by the council of the society. Fortunately this is not so. In the recommendations we find two "principles" only, viz. that reform must be based on knowledge, and that knowledge must be obtained through real investigation.

The suggestions as to how additional data are to be sought are both wise and practical, though there is much that is unscientific and altogether out of place in sections 3 and 4, which, as Prof. Adams puts it, "have the special merit of correlating age and advancement," and he adds that teachers will read with some eagerness what the experts have to say on this. But, in this memorandum, "merit" should be replaced by "*de*merit." If there were such a correlation, the only way to improve education would be to extend the period of pupil-age. The basis of the memorandum is that there is no such correlation—that with a truer psychology, intelligence and knowledge will be greater at a given age. Naturally, then, no trace of these excrescent sections appears in the "recommendations."

The memorandum is called for. There is considerable evidence that, under the influence of traditional beliefs, we are to-day perpetuating mistakes in education no less serious than those in medicine before Pasteur's discoveries overthrew the traditional wisdom of physicians. One instance may here be given. The writer knows of a boy, three years eight months old, who, never having *lessons*, has been brought up in an environment providing as free and full opportunity for mental as for physical development. At two he did the Montessori exercises with ease and accuracy when presented to him, and did not care to repeat them more than once or twice. At two and a half his guardian wrote:—"He has a scrupulous sense of order, great carefulness, and a deft handling of everything he touches. He is allowed to explore and handle everything he wishes, even the most delicate articles, merely enjoining on him to be very careful," and more in the same strain, and he scarcely ever broke anything. Later, at three and a half:—"Whenever he sees anything new to him, he at once wants to know its name and all about it; he is quick to observe the different leaf buds on the trees, and can distinguish and name many trees by their buds alone; sometimes he will bring in a little branch, run to our 'Nature-book,' and compare it with the pictures, finding out which it is for himself. He is also full of interest in birds and knows twenty different kinds by name," and so on. This child has been remarkably free from ailments, as have been all the other children whom the writer can trace who have been brought up in this way, being allowed the free choice of mental as well as of physical occupations; treated always as intelligent, but never forced to mental exertion. And we find among the products of this method great *old* men such as Lord Kelvin.

This is the method indicated by Nature. The brain of the very young child is proportionately far more developed than any other part of his physical system; why should we assume that it is the part to be given the least opportunity for early growth and development through the exercise of the activities peculiar to it? As in such matters experience is the only guide, the writer would be very glad if those who have trustworthy data on the question of early education would communicate with him at Trinity College, Dublin.

E. P. CULVERWELL.

[1] Published by the Child-Study Society, 90 Buckingham Palace Road, London, S.W.1. Price 4*d*. post free.

THE HYDRAULIC RESOURCES OF FRANCE.

IN view of the partial dependence of France on other sources for her coal supplies, the question of utilising water-power becomes an increasingly vital factor in her economic development. Considerable interest therefore attaches to an article appearing in *La Nature* for June 23, which incidentally furnishes also a comparison with the resources of other countries in this respect. Various computations have been made as regards France; one made in 1911 places her resources at 9,200,000 horse-power of water-power available for a minimum of 180 days in the year. This is against Norway's 7,500,000 h.p., Sweden's 6,750,000 h.p., Austria-Hungary's 6,450,000 h.p., Italy's 5,500,000 h.p., Spain's 5,000,000 h.p., Switzerland's 1,500,000 h.p., Germany's 1,425,500 h.p., and Great Britain's 396,000 h.p. In this connection Norway's available supply is 36·60 h.p. per square kilometre of area, that of Sweden 20 h.p., of Austria-Hungary 19·46 h.p., Spain and Italy 10 h.p. each, England and Germany 2 to 3 h.p. each. France's resources, according to recent estimates, are about 25 h.p. for the same area. The quantity of water available in the Alpine regions alone of France represents about 4,000,000 h.p.

The value of the water-power resources of France has long been recognised, and while she has utilised them to a greater extent than certain other European countries have theirs, about nine-tenths are still unharnessed. Germany, on the other hand, though rich in coal, has utilised about 31 per cent. of her available supply of water-power.

Contrary to expectations, the war, instead of relaxing attempts to employ water for power-raising in France, has greatly stimulated activity in this direction, in spite of dearth of labour and materials. The article gives interesting details of plants already completed or in course of erection.

Much is hoped for by utilising barrage water at high pressures; especially is this the case in respect of the electrometallurgical and electrochemical industries, which are sure to develop when new works come into existence and more experience is gained.

France's annual requirements of coal are estimated in the near future to be thirty million tons per annum, and as prices are likely to increase considerably, the author's plea for the extended applications of water-power is justifiable. He asks what this 9,000,000 h.p. of available "white coal" represents in terms of