For the successive intervals of two days the second differences are: +7, 4, 7, 4, 6, and 3 seconds.

Declination, −3 12·3, add for April 8, −41·1′. Successive second differences: +1·2′, 1·2′, 1·4′, 1·3′, 0·9′, and 1·5′.

The comet will pass near the "bright" nebula, N.G.C. 2974, on April 7, and N.G.C. 3115 on April 20. At the Hill Observatory on April 3 the comet was seen near the calculated position. With the 10-in. refractor, it showed a faint, diffuse, somewhat oval, coma, with a condensation north-preceding.

SOLAR VARIATION.—The annual report of the Smithsonian Astrophysical Observatory for the year 1915 contains some interesting statements regarding the variation of solar radiation. The Smithsonian measures of the solar constant have brought to light a long-period variation synchronising with sun-spot activity, and also rapid irregular fluctuations. Both types of variability are correlated with a variation of the contrast between the centre and limb of the sun's disc, but in opposite directions. In the first type of variation high solar constant values and increased contrast are associated with increased spot activity; in the second case the higher solar constant values are associated with diminished contrast. Correspondingly, two distinct causes are suggested. the long-period variation may result from changes of the sun's effective temperature, whilst changes in the transparency of the outer solar envelopes may account for the rapid fluctuations.

THE TRANSLATIONAL MOTION OF BINARY STARS.—M. C. Luplau-Janssen has investigated the distribution of the proper-motion vectors, freed from the effect of the solar movement, of a number of double stars, with reference to their orbital planes (*Astronomische Nachrichten*, No. 4828). After rejecting five pairs of small inclination ($i<30°$), data for twenty-nine well-established orbits remain. The proper motions were taken from Boss, and reduced uniformly to their equivalents at a distance of 1 parsec. At this distance the adopted solar motion is represented by an angular displacement of 4·11″ per year. The resultant proper motions and the node-lines lie in a common plane. It is found that the included angle shows no tendency to take a value about 90°, as it would if the proper motion showed any general parallelism to the normals to the orbits. Further, on resolving the proper motions along rectangular axes, one coincident with the line of nodes, the sums of the components are found to be equal; thus there is no tendency apparent for the proper motions to be parallel to the plane of the orbits. A chance distribution is indicated.

The investigation depends on the assumption that the real parallaxes are on the average equal to twice the hypothetical minima; measured parallaxes have not been used. M. Luplau-Janssen is convinced of the substantial accuracy of the fundamental assumption by the result obtained in a determination of the solar motion from the proper motions of 180 double stars by the method of Bravais. The deduced solar velocity is given as 17·1 km./sec. This value is in good accord with that generally accepted, and also with the value (14·9 km./sec.) obtained by Weersma by the same method but from quite different data.

EDUCATION AND INDUSTRY IN FRANCE.

AN extremely interesting account of the rise and growth of industrial education in France appears in the *Revue Générale des Sciences*, March 15, contributed by Prof. M. E. Bertrand, of the Ecole d'Arts-et-Métiers d'Angers. Whilst full of confidence in a military triumph he is deeply concerned with the position of French industry, especially from the point of view of the adequate scientific and technical training of all who are engaged in it, whether apprentices and workmen or foremen and directors, and urges that it is the imperative duty of the nation to ensure also a victory in the economic sphere. Much space is given to the measures taken from the earliest times for the satisfactory training of those engaged in industry, and the rise and progress of the craft guilds down to their decay on the birth of the factory system is interestingly portrayed. The advent of the Third Republic resulted in active measures for the establishment and support of different types of schools designed to secure the effective training of those destined for industry and commerce, and many excellent mono-technic schools were established, the fine work of which made a magnificent display at the Centennial Exhibition of 1900. Yet with all the variety of effort made for the due training of French youth, it would appear that out of 600,000 young people employed in industry and commerce from thirteen to eighteen years of age, only 30,000 frequent technical schools; whilst 65,000 beyond that age give a more or less assiduous attendance at evening adult courses, as compared with 500,000 under the same conditions in Germany; and where France spends seven million francs on this form of technical education, Germany spends thirty millions from Imperial sources alone. The grave moral danger attending this neglect of training is emphasised by the fact that there are 1,600,000 unemployed young people in France wandering about the public places exposed to serious temptations. Even though Germany is engaged in a devastating war, she is still thinking of the future, and is even now taking energetic measures to conserve her industries so as to secure and advance her economic interests on its conclusion. The article calls upon France to be up and doing, since delay is dangerous, and the economic industrial position of the nation is put in grave peril. A highly appreciative account is given of the educational provision made throughout Germany for the due training of all ranks engaged in productive industry, and much emphasis is laid upon the great value of the continuation schools, which ensure compulsorily the attendance, within the usual hours of employment, until eighteen years of age of all those who have left the day schools. The article contains much of the highest interest to English readers in the present crisis, since the conditions and the aims to be accomplished are much the same in the two allied nations.

THE CORROSION OF CONDENSER TUBES.

THE annual meeting of the Institute of Metals was held on March 29, when the society took leave of its retiring president, Sir Henry Oram, and listened to the address of his successor, Dr. G. T. Beilby. The latter reviewed briefly the unsatisfactory position of certain non-ferrous metal industries in this country, and then indulged in some interesting speculations as to the possibility of preparing lighter alloys, especially for aircraft, than have hitherto been produced. This address has not as yet been printed. When it has been published it will be found to repay very careful study.

The Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research has made a substantial grant to the institute for the purpose of aiding its Corrosion Committee in their investigation of the corrosion of condenser tubes. The publication of the third report to this committee by three investigators, Messrs. Gibbs, Smith, and Ben-

gough, was therefore very timely, and the discussion of this paper occupied the greater part of the proceedings of the meeting. It was followed by a paper by Mr. Elliott Cumberland, who gave a demonstration of his method of minimising the corrosion of condenser tubes, which created considerable interest.

The ground covered in the report to the Corrosion Committee is very extensive, and it is only possible within the limits of this article to give a brief summary of its most salient features. Five alloys have been subjected to corrosion tests under a great variety of conditions. Of these one was ordinary condenser tube metal (70 : 30 brass), another was Admiralty brass, containing 1 per cent. of tin, and another a special lead brass (2 per cent. of lead). The fourth was a bronze, containing 3·5 per cent. of tin and a trace of phosphorus, and the fifth a copper-aluminium alloy containing 8 per cent. of aluminium. These have been tested in (*a*) stagnant sea-water over the temperature range 15°–60° C.; (*b*) in diluted sea-water of various degrees of dilution and with both gentle and violent aeration. The influence of their surface condition has been carefully examined, the effect of air bubbles adhering to the metal, and that of the E.M.F. due to unequal temperature distribution. Two main types of corrosion have to be considered :—(*a*) *Complete,* in which all the constituents of the alloy dissolve simultaneously at approximately the same rate and uniformly over its surface; (*b*) *selective,* in which one constituent dissolves preferentially. In brass alloys it is usually zinc, and the process is called dezincification. This type of corrosion, however, may conveniently be subdivided into "*general,*" which occurs over the whole surface uniformly, and "*localised,*" which occurs in spots. Selective localised corrosion is the type which is responsible for the chief failures in practice, giving rise as it does to "pitting," which is the most frequent cause of failure.

The authors have come to the conclusion that it is the formation of oxy-salts and their adherence to the surface of the alloy which is the prime cause of pitting, and in spite of the fact that the bronze came worst out of the majority of the tests, when the results were expressed in the form of loss of weight per unit of area, they have concluded that it would be the most likely to give the best results in practice, because its corrosion is of the "complete" type, and no oxy-salt is formed until a temperature of 60° C. is exceeded. No one alloy was found to be satisfactory under all conditions, but much the most resistant alloy under the majority of conditions was that composed of copper and aluminium.

The authors' recommendations as to the minimising of corrosion in condenser tubes are :—(1) The temperature of the water should be kept as low as possible; (2) its flow should be made smooth, foaming and churning being avoided; (3) oxy-salts should be removed as soon as possible after formation.

H. C. H. CARPENTER.

CIVIL SERVICE ESTIMATES FOR SCIENCE AND EDUCATION.

THE Estimates for Civil Services for the year ending March 31, 1917, are being issued as Parliamentary Papers. Under Class IV. are included the estimates of expenditure on Education, Science, and Art; and we record below the main points of these estimates, with details of those relating to scientific investigation and higher education.

It will be noticed that the grant in aid of scientific and industrial research has been increased from 25,000*l.* to 40,000*l.*

United Kingdom and England.

BOARD OF EDUCATION.

	1916–17	1915–16
Administration	203,667	209,551
Inspection and examination	222,578	252,458
Public elementary schools etc.	12,640,528	12,696,815
Training of teachers ...	408,282	577,000
Secondary schools and pupil teachers and bursars, etc.	919,800	863,050
Technical schools, etc. ...	576,000	638,000
Scholarships, exhibitions, and other allowances to students, prizes, etc. ...	19,110	30,160
University institutions in respect of technological work...	60,000	59,000
Assistance in choice of employment	4,000	4,500
Imperial College of Science and Technology	30,000	30,000
Chelsea Physic Garden ...	150	150
Royal College of Art ...	8,494	10,300
Victoria and Albert Museum	63,375	70,459
Science Museum	13,943	18,892
Geological Museum	3,212	3,805
Geological Survey of Great Britain	14,718	16,820
Bethnal Green Museum ...	2,735	5,433
Deduct—		
Appropriations in aid ...	3,860	5,015
Net total	£15,186,732	£15,481,378

BRITISH MUSEUM.

British Museum[1]	93,263	110,102
Natural History Museum ...	43,631	51,943
Gross total	136,894	162,045
Deduct—		
Appropriations in aid ...	8,295	13,400
Net total	£128,599	£148,645

SCIENTIFIC INVESTIGATION, ETC.

Royal Society :		
(i) (*a*) Scientific investigations undertaken with the sanction of a committee appointed for the purpose (4,000*l.*), and (*b*) scientific publications (1,000*l.*)	5,000	5,000
(ii) Magnetic Observatory at Eskdalemuir	1,000	1,000
(iii) National Physical Laboratory	7,000	7,000
(iv) Aeronautical Section of of the National Physical Laboratory	10,400	9,425
Total for Royal Society	£23,400	£22,425
Meteorological Office ...	22,500	22,500
Royal Geographical Society[2]	1,250	1,250
Royal Academy of Music ...	—	500
Royal College of Music ...	—	500
Marine Biological Association of the United Kingdom	500	500

[1] The British Museum (Bloomsbury) (except the Reading Room, etc.) and part of the Natural History Museum, South Kensington, are closed during the war.

[2] A condition of the Grant is that the Society exhibits to the public, free of charge, its collection of maps.