

colour when treated with a stream of hydrogen sulphide, while a subsequent heating in oxygen resulted in the reappearance of the white sublimation product on the colder part of the vessel. An aqueous solution of these crystals gave no precipitate either with hydrogen sulphide or ammonium sulphide. As such behaviour was to be expected from the elements 43 and 75 and from none of the other known elements in the solution, it was presumed that this substance contained the missing elements. Further attempts at concentration resulted in a loss of the material.

Through lack of further supplies of the platinum ores, the authors turned their attention to columbite, resolving at the same time to carry out the final analysis by X-rays. From about 1 kgm. of the mineral the greater part of the iron, niobium and tantalum was removed by sodium hydroxide and sodium nitrate; the filtered solution was treated with hydrogen sulphide and concentrated to a volume of 50 c.c. By the use of mercurous nitrate, about one gram of precipitate was obtained from this solution. A repetition of the process gave about 50 mgm., estimated to contain about 5 per cent. of the elements 43 and 75. Heating in oxygen gave once more the white sublimate. The quantity available was too small for direct application to the anticathode of the X-ray tube. It was, therefore, mixed with niobic acid and examined spectroscopically in this form.

X-ray spectra probably provide the best method for the detection of a small quantity (say 0.1 per cent.) of an element in a mixture. These spectra are much simpler in nature than the optical spectra, and, unlike the latter, do not depend on the mode of excitation or on the state of chemical combination. The wave-lengths are determined by the atomic number alone. From Moseley's laws it is possible to predict the wave-lengths of the various lines with considerable accuracy. A further check is provided by an examination of the relative intensities of the lines. An X-ray investigation of the final products of the chemical processes was

carried out by Drs. Berg and Tacke, and a search made for the *K* series of the element 43 and for the *L* series of 75. The result was entirely successful. Three lines appeared on the plates corresponding to wave-lengths 0.601, 0.672 and 0.675 Å.U., whereas the calculated values of the $K\beta_1$, $K\alpha_1$ and $K\alpha_2$ lines for an element 43 are 0.600, 0.673 and 0.678 Å.U. These are the three strong lines in the *K* series, and their relative intensities agreed with the well-known ratios. In the spectral region 1.20 to 1.43 Å.U. there occurred five lines which were identified as the La_1 , La_2 , $L\beta_1$, $L\beta_2$ and $L\beta_3$ lines of an element of atomic number 75. The numerical agreement was excellent; thus, the observed and calculated wave-lengths of the La_1 line were 1.4299 and 1.4306 Å.U. There is always a chance that the lines may be wrongly identified, but the authors appear to have taken due precautions against any possible misinterpretation, and there seems no doubt that these lines are actually due to the presence in the columbite residue of the elements 43 and 75.

As a result of this careful research work, the existence on the earth of the elements of atomic number 43 and 75 appears to be definitely established, a fact which is all the more interesting because certain writers have put forward arguments suggesting that a search for the eka-manganeses must prove fruitless. The actual amount of the new elements in columbite is estimated as from 10^{-6} to 10^{-7} , or somewhat less than the proportion indicated by the calculations outlined above. The chemical and physical properties appear to be closely related to those predicted by an examination of their neighbours, but no doubt more details will soon be available when greater quantities of the new elements have been isolated.

The authors suggest that the two newly discovered elements should be named Masurium (Ma) and Rhenium (Re) after the district of Eastern Prussia and after the Rhine respectively. Whether these names will meet with such widespread approval as the research itself remains to be seen.

Current Topics and Events.

IN celebration of the 250th anniversary of the foundation of the Royal Observatory, Greenwich, their Majesties the King and Queen will pay a visit to the Observatory on July 23. We understand that they will be received in the Octagon Room, the original Observatory, by members of the Board of Admiralty and of the Board of Visitors of the Royal Observatory, and will then be conducted over the buildings and shown the principal instruments. On the evening of the same day a *conversazione* is being given by the president and council of the Royal Society to meet the delegates to the International Astronomical Union. On the following day an official luncheon is being given, presided over by the First Lord of the Admiralty.

AFTER nearly two years' effort, the Australian National Research Council has succeeded in its project for establishing a Commonwealth School of Anthropology, to be attached to the University of Sydney. In December 1923 the Commonwealth Government expressed approval of a scheme sub-

mitted to it; in the following year, however, an officer selected by the British Government to advise Australia in the matter of administration of Territories, reported very strongly against the proposal to use such a school for the training of officials. In consequence, Government interest flagged. Renewed efforts, supported by the Australasian Association for the Advancement of Science and the universities, were made in September, and, largely as the result of a visit from Prof. Elliot Smith, who brought unofficial word of warm American sympathy, the Prime Minister promised to provide 1000*l.* per annum towards the expenses of a chair. The estimated yearly requirement being 2500*l.*, the respective States were then asked to contribute the balance of 1500*l.* between them on a population basis. New South Wales, Victoria, Queensland and Tasmania agreed to provide their shares, and South Australia is practically certain to fall into line; Western Australia remains uncertain. The Research Council, therefore, has now asked the Senate of the University of Sydney to consider the immediate appointment of a professor

and the general arrangements for the new school. In doing so, it has laid emphasis on the following points: (a) The main work of the chair both in teaching and research should be in the field of social anthropology rather than on the physical or anatomical side, though provision should be made for this also. (b) In view of the training of students for Government service in Papua and the Mandated Territories, and for specialised work in the Pacific, the professor chosen should have had actual field experience. (c) Though the routine work of the new chair will be under the control of the University of Sydney, it is urged that a permanent Advisory Committee, containing representatives of the Commonwealth, States and Research Council, should be appointed, to assist in the organisation of field research.

AN international conference is shortly to be held at The Hague on the subject of industrial property, that is to say, on patents, trade marks, and designs. It is a matter of considerable importance that Great Britain should be represented by delegates who have had wide experience in patent practice, but if the conference held in 1922 on the proposed Empire patent is to be taken as a precedent, it may be gravely doubted whether any such precaution will be taken. It will be remembered that at that conference the Comptroller was accompanied only by representatives of the clerical staff of the Patent Office, to the exclusion of representatives of the scientific staff who would have possessed both legal and technical training and experience. It is not surprising, in these circumstances, that the conference failed to produce any result, for the very delicate technical question arose of an Empire "search," or examination of all relevant British Empire patent specifications, before granting a patent, and none of the British representatives had that direct acquaintance with the "search" which might have enabled them to deal with this thorny problem in such a way as to satisfy the *amour propre* of the Dominion Governments. It would be far more serious, however, if Great Britain were to be unsuitably represented at an international conference, particularly if the Comptroller should be unable to attend in person. The effect of a given change in international patent practice cannot be instantly grasped by any one who lacks extensive experience of patents, and the interests of British manufacturers may inadvertently be prejudiced by negotiators who are not adequately qualified for their work. We trust that, on the occasion of the impending international conference, full use will be made of the technical knowledge and experience of the Patent Office staff.

THE Santa Barbara earthquakes at the end of last month prove to have been of less importance than the early accounts suggested. By the first, on June 29 at about 6.30 A.M. (2.30 P.M., G.M.T.), many buildings in Santa Barbara were destroyed or damaged (the loss being estimated at from three to six million pounds), twelve persons were killed, and water-mains were broken. The second, on June 30 at 1.22 A.M.,

is said to have equalled its predecessor in strength; while one of the after-shocks, on June 30 at 4.42 A.M., is described as severe. The area affected by the earthquakes was apparently small, and this seems to indicate that the depth of the foci was comparatively slight. In the neighbourhood of Santa Barbara there are several faults running east and west or parallel to the trend of the coast-line, and traversing longitudinally the Santa Inez and San Gabriel mountains. In the fault-map of California, issued by the Seismological Society of America, they are shown as inactive, but it would seem that they are rather in a state of moderate activity at long intervals. To one or more of these faults Dr. Bailey Willis attributes the group of strong earthquakes on November 27-30, 1852, and a local earthquake on July 30, 1902 (Bull. Seis. Soc. America, vol. 14, 1924, pp. 18-19). Between these shocks, on January 9, 1857, an earthquake, stronger than any of those mentioned above, was felt generally throughout southern California and severely in the Santa Barbara district. Dr. Willis assigns its origin to a movement along the extensive San Andreas fault, that with which the San Francisco earthquake of 1906 was connected.

A PRELIMINARY report on the Canadian earthquake of February 28 (NATURE, March 7, vol. 115, p. 347) has been issued by the seismologist of the Dominion Observatory (*Science*, vol. 61, 1925, p. 584). The epicentre of the earthquake is supposed to be in the mountainous region near the eastern boundary of the Laurentide Park. Its exact position is, however, at present unknown, the region being inaccessible when the first investigation of the central area was made. Many of the reports of the damage proved to be exaggerated or erroneous, but the amount was considerable at Quebec, Shawinigan Falls, Malbaie, St. Urbain, and the district near the Rivière Quelle. In every case of serious damage the ground was sand or clay, usually on the side of a hill, and the buildings were massive stone structures, without steel reinforcement, such as churches. A new seismograph station (the sixth in the Dominion) has been established by the Department of the Interior at Ste. Anne de la Pocatière, near the centre of the area affected by the earthquake of February 28.

JUNE established a record for its dryness, and almost a record for its duration of bright sunshine in England. At the Royal Observatory, Greenwich, according to the weather records published by the Registrar-General in the Weekly Return of Births and Deaths, rain fell only on two days, the measurements being 0.11 in. on June 24, and 0.01 in. on June 26, making a total of 0.12 in. for the month. The previous minimum rainfall at Greenwich in June since 1815, in 110 years, was in 1895 and was 0.21 in. The normal for 100 years to 1915 is 1.99 in., the normal for 35 years, 1881 to 1915, is 2.02 in., and the normal days with rain, 11. The smallest rainfall in any month of the year was in February 1821 and was 0.04 in., and in comparatively recent years, since 1900, the smallest monthly total was in April 1912 (0.07 in.), and in February 1921 (0.12 in.). There

was a drought from June 1 until 23. According to the weather correspondent of the *Times* (July 1), June 1925 was the driest June at Kew since records started in 1871, and also the sunniest. The total rain at Kew was 0.04 in. Ross-on-Wye, Calshot (near Southampton), and Falmouth are reported to have had no rain. The duration of bright sunshine at Greenwich was 251 hours, which averages 8.36 hours per day. In June 1914 the sun shone for 267 hours, which is 16 hours more than in June this year. The average duration in June for the 35 years 1881 to 1915 is 201 hours, 6.70 hours per day. The mean maximum shade temperature at Greenwich was 73°.1 F., which is 3°.1 above the normal, and the mean minimum was 49°.7 F., which is in precise agreement with the normal; the excess of heat was clearly due to the intense sunshine in the early part of the month.

WE learn from *Science* that Dr. E. L. Thorndike, professor of educational psychology in Teachers College, Columbia University, has been awarded the Butler gold medal, given every five years by Columbia University for the most distinguished contribution to philosophy or to educational theory, practice or administration, for his contribution to the general problem of the measurement of human faculty and to the application of such measures to education.

THE third annual corporate meeting of the Institution of Chemical Engineering is to be held in the Philosophical Hall, Leeds, on July 17. Afterwards a joint meeting will be held with the American Institute of Chemical Engineers, at which addresses will be delivered by the presidents of the two bodies, Sir Arthur Duckham and Dr. Charles L. Reese, and a symposium on "Industrial Water Supply and Stream Pollution" will be presented. Visits to Messrs. Nobel Industries, Ltd., Messrs. Jos. Crosfield and Sons, Ltd., and the United Alkali Co., Ltd., and to various places of interest in Scotland and England, have been arranged to follow the meeting.

MR. T. R. FERENS, of Hull, is well known for his generous gifts for educational purposes, culminating in a gift of 250,000*l.* for a university college at Hull, referred to in our issue of February 14, p. 239. He has now presented a sum of 20,000*l.* to the Medical School of the Middlesex Hospital for the foundation of an Institute of Otolaryngology. The new institute, which will occupy for the present a part of the top floor of premises in Cleveland Street, to which patients from the Middlesex Hospital are being removed during rebuilding of the Hospital, will be devoted to research on the structure, functions, and diseases of the ear, nose, and throat, and it is intended to establish a laboratory, museum, and library.

PROF. R. RUGGLES GATES, professor of botany, University of London (King's College), is sailing from Liverpool on July 14, by the S.S. *Hildebrand*, on an expedition to the Amazon region. He will leave the ship at Manaus and spend a month collecting plant materials in that region and farther down the river. Returning from Para, he will reach England early in

October. Prof. Gates is taking Wardian cases to bring back living plants, and will also collect cytological and morphological material for research, as well as some dried specimens. He is also taking a photographic outfit, including a cinema camera and 3000 feet of film, and he expects to make some collections of plankton during the voyage and on the river.

THE control of the administration and the management of the Imperial Institute, South Kensington, has now been transferred, in accordance with the provisions of the Imperial Institute Act, 1925, from the Secretary of State for the Colonies to the Parliamentary Secretary, Department of Overseas Trade. The Imperial Mineral Resources Bureau was amalgamated with the Imperial Institute at the same time, and all correspondence relating to the work of the Bureau should be addressed to the Imperial Institute (Mineral Resources Department), South Kensington, London, S.W.7.

AT the time of going to press (July 8), a reception is being held in the Pavilion of His Majesty's Government at the British Empire Exhibition, and invitations have been issued to view the Science Exhibition arranged by a committee of the Royal Society. The guests are being received by the president of the Royal Society, Sir Charles Sherrington, and the chairman of the Committee organising the exhibits, Mr. F. E. Smith. The Exhibition this year is a decided advance on that of last year, as will be seen from the account indicating some of its main features which appears elsewhere in this issue (p. 50). The Committee responsible for it is to be congratulated on the very representative collection of demonstrations and exhibits brought together. In connexion with the Science Exhibition, a volume entitled "Phases of Modern Science" has been prepared; this includes articles by leading authorities on various aspects of modern scientific research, and a descriptive catalogue of the exhibits. It constitutes a most valuable statement of the present position of physical and biological science. The section describing the exhibits is also being issued separately and is obtainable in the Government Pavilion at Wembley.

THE ninety-third annual meeting of the British Medical Association will be held at Bath on July 21-24, under the presidency of Dr. F. G. Thomson, physician at the Royal United Hospital, Bath. The annual representative meeting of the Association will be on July 17-20. The president will deliver his address and also open the annual exhibition of surgical appliances, foods, drugs, and books on July 21. Sir William Bragg is to deliver a popular lecture during the evening of July 24. The provisional sectional programmes include discussions on the following subjects, the opener's name appearing in brackets after the subject: Endocrine therapy (Dr. W. Langdon Brown and Prof. Swale Vincent), filter-passing viruses (Dr. W. E. Gye), pathological basis of treatment by radiation (Prof. S. Russ), pathology and bacteriology in Great Britain, with special reference to research (Prof. J. C. G. Ledingham), therapeutic value of light

(Prof. W. E. Dixon), food manipulation and health (Dr. W. G. Savage), influence of sunlight and artificial light on health (Prof. L. Hill), and the purity standard of milk (Dr. R. Stenhouse Williams, Dr. W. G. Savage, Dr. E. Pritchard, Mr. W. Buckley, Mr. G. P. Male and Mr. J. H. Maggs, each discussing a different aspect). The honorary local general secretary for the meeting is Mr. W. G. Mumford (British Medical Association Committee Rooms, Assembly Rooms, Bath); and the honorary assistant secretary is Dr. R. G. Gordon.

DR. ALÉS HRDLICKA, of Washington, is now travelling through India on the first stage of a survey of the field of early man and his predecessors in southern Asia, Australia, and Africa, on behalf of the Smithsonian Institution and the Buffalo Society of Natural Science. In the course of a letter to the former body, he has some interesting observations to make on what he had seen up to the time of writing. Of the physical character of the people he says that the main elements are unquestionably Mediterranean and Semitic, but there are also indications of a Hamitic mixture. He had intended to visit Karachi to investigate the curly-haired people there, but considered this unnecessary, as he was informed that they were known to be of African importation, and that if there were any such natives they must be somewhere at the head of the Persian Gulf, a region now impracticable to reach. At Simla he saw people from the Tibetan borders and some few even from Tibet. Among the latter was one woman who looked a typical American Indian; her dress also strongly suggested the Indian.

THE hundredth annual report of the Bath Royal Literary and Scientific Institution records an earnest effort on the part of the members to revive its interest and usefulness. The ceiling paintings by Andrea Casali have been cleaned, the valuable collection of birds put into good order and the various rooms re-decorated. The famous geological collection, containing 27 teeth of *Microlestes moorei* and 70,000 fish teeth from fissures of Rhætic age in the Carboniferous Limestone, is being re-arranged and relabelled as a memorial of the labours of Charles Moore, who did so much for the Museum and for geology. The winter series of lectures interrupted by the War were recommenced in 1921-2, and have steadily increased in number and interest until the accommodation is insufficient. A project for widening the adjoining roadway may result in the present building being taken down, in which case it is to be hoped that the Society may find itself provided with sufficient funds and vigour for the provision of a more suitable and better-placed museum in which the collections can be better displayed.

THE May issue of the *Scientific American* inaugurates a discussion as to whether street accidents due to careless driving would be diminished by the substitution of a regulation as to the distance in which a vehicle should be able to stop for the present speed limit. Mr. H. W. Slauson, who opens the discussion, is of opinion that they would, and points out that the object of the speed limit is to ensure that

the driver shall have his vehicle under such control that he can stop quickly when called upon to do so. He may be under the speed limit, but his physical and mental condition and the state of his brakes may be such that he cannot stop quickly enough to avert an accident: under the speed limit regulation he is blameless. The fault lies with the regulating authority. Under a stopping-distance regulation, the duty of adjusting the speed to the condition of the driver and his vehicle would rest on the driver. Roads would be specified as "twenty feet," "fifty feet," etc., and the tests of vehicles would be simpler than the present speed tests.

THE Report of the Castle Museum, Norwich, for 1924, records a large number of gifts, and among them a fine series of mounted heads and horns of big game bequeathed by the late Mr. E. N. Buxton. To accommodate these, as well as the many previously in the Museum, it is proposed to extend the building over a portion of the inner garden. It has also proved necessary to extend the Skin-Room over a vacant space enclosed by the outer wall of the Castle. A large collection of flint implements from various local sites, presented by Mr. H. H. Halls, has been drawn upon, with others, to provide a case illustrating neolithic culture in Norfolk and Suffolk. In many other directions, not so directly within our scope, this Report bears witness to a progress and activity of which Norwich should be proud.

SOCIETIES and Institutions in Great Britain, desiring to get into touch with similar bodies in Russia for the purpose of exchange or purchase of recent scientific publications, should address correspondence on the subject to one of the following organisations, in the hands of which the government of the U.S.S.R. has placed the responsibility for all arrangements of the kind. For all societies and institutions in Leningrad: The Publications Exchange Department, The Academy of Sciences, Leningrad. For all those in the whole of the rest of Russia, and for those in other constituent territories of the Union of Socialist Soviet Republics: The Book Exchange Bureau, The U.S.S.R. Society for Cultural Relations with Foreign Countries, Sverdlov Place, Moscow.

DR. C. A. CROMMELIN has published the inaugural lecture delivered by him on May 12 on the occasion of his taking up the post of lecturer in physics at the University of Leyden (Leyden: Edward Ijdo). As is well known, Dr. Crommelin has collaborated with Prof. Kamerlingh Onnes for many years in the conduct of the experimental researches carried out at the famous Physics Laboratory of Leyden. In all that relates to the science and art of measuring pressures, temperatures and volumes, he is one of the most experienced physicists in Europe, and now that Prof. Kamerlingh Onnes has retired, there is perhaps no one in the world who possesses the same knowledge of the intricate technique required in the measurements at low temperatures and high pressures which characterises so much of the work done at Leyden. In his address Dr. Crommelin has given a most interesting historical sketch of the development in the

making and using of instruments and apparatus in connexion with experimental research in physics. It is illustrated with portraits of three members of the celebrated van Musschenbroek family and is fully documented with literature references. For many years the laboratory of Kamerlingh Onnes has been a famous training school for young instrument makers and glass-blowers. Perhaps nowhere else in the world has so much attention been given to the development of this side of the work which is required in a great laboratory of experimental research in physics. It is therefore particularly appropriate that Dr. Crommelin should deal with this subject in his inaugural address, which can be heartily recommended to all who take an interest in the history of physical experimentation.

IN the Report of the Rhodesia Museum, Bulawayo, for 1924, the curator, Dr. G. Arnold, records the finding of several palæoliths from an ancient land surface now covered by 15-20 feet of flood-silt from the Umgusa River. He believes "that these implements, mostly of a Chellean and Acheulian facies, were fashioned by the predecessors and contemporaries of Broken Hill Man."

APPLICATIONS are invited for the following appointments, on or before the dates mentioned: A part-time research demonstrator in mathematics at Uni-

versity College, Swansea—The Registrar, University College, Singleton Park, Swansea (July 15). Museum assistant and demonstrator in zoology at Birkbeck College—The Secretary, Birkbeck College, Fetter Lane, E.C.4 (July 21). Professor of electrotechnics in University of the Witwatersrand, Johannesburg—Secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2 (July 31). Five appointments in the School of Dental Surgery, Cairo, namely, superintendent and lecturer in metallurgy and materia medica, lecturer in surgery and pathology, assistant lecturer in surgery and pathology, lecturer in mechanics and orthodontia, and a mechanic—The Under-Secretary of State, Ministry of Education, Cairo (August 14). Professor of organic chemistry and director of the chemistry department, Armstrong College, Newcastle-upon-Tyne—The Registrar (August 15). Director of the Rubber Research Institute in the Malay States—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, Westminster, S.W.1 (August 31). A reader in biology in the University of Hongkong—The Chief Medical Officer, Ministry of Health, Whitehall, S.W.1 (September 1). Professor of public health in the University of Edinburgh—The Secretary (September 15). Laboratory assistant for the Mobile Unit, Government Laboratory, Gold Coast—Crown Agents for the Colonies, 4 Millbank, Westminster, S.W.1.

Our Astronomical Column.

DISCOVERY OF A TENTH MAGNITUDE OBJECT.—A telegram from the International Astronomical Union Bureau, Copenhagen, announces the discovery of an object of the tenth magnitude. Its position on June 28 at 1^h 37^m 0^s G.M.T. (new) was R.A. 0^h 23^m 28^s, N. Decl. 0° 41'. Daily motion +1^m 48^s, N. 14'. The motion is rather large for a minor planet, unless it should be of the Eros type.

M. Delporte apparently took the plate in the search for Tempel-Swift's periodic comet, using the ephemeris in the British Astronomical Association Handbook. However, as a later examination makes the probable date of perihelion March 1926 (see B.A.A. Journ., vol. 35, p. 159), the object is not likely to be identical with that comet. No further observations are to hand at the time of writing.

THE ROYAL OBSERVATORY, GREENWICH.—Dr. J. L. E. Dreyer contributes an article to the *Nineteenth Century* for July, which summarises the work done at Greenwich during the 250 years of its existence, and emphasises the vagueness of the knowledge of the heavens that existed at the time of its foundation. Tycho Brahe's star catalogue was then the best available, and the best lunar tables differed a quarter of a degree or more from the heavens. Flamsteed's observations of the moon were of great assistance to Newton for comparison with his gravitational theory. Dr. Dreyer vindicates Flamsteed against the charge of withholding these observations from Newton.

The splendid work of Bradley is given due prominence, credit being also given to Bessel and Auwers, who brought the results into a form that later astronomers could utilise. The development of the work of the Observatory under Airy and the further extensions made since his time are also described.

Dr. Dreyer is well known as an astronomical historian, and he has a congenial subject in dealing with the remarkable advance in knowledge since

1675, in which Greenwich has played a considerable part.

THE PHYSICAL STATE OF THE STARS.—While insisting on the incompleteness of the available observational material, Dr. A. Brill, in the *Zeitschrift für Physik* of March 21, attempts to deduce, on the basis of the Eddington theory, general regularities in the connexion between spectral type, surface temperature as deduced from colour and from energy distribution in the spectrum, absolute brightness, mass and other physical magnitudes for a very large number of dwarf and giant stars. It was found that the logarithm of K , Eddington's constant, which determines the mass absorption coefficient k in the interior of a star, only varies from 27.41 to 27.69 between the different spectral classes. $k\sqrt{\epsilon}$ is nearly constant for all stars, where ϵ is the energy radiated in unit time per gram. The following table, abridged from that in the original paper, gives some of the results obtained. Super giants are not considered.

DWARFS.						
Spectral Class.	Temp. °C	M(vis).	R. cm.	Mass. gm.	g cm./sec. ²	ρ gm./cm. ³
O	28.7 × 10 ⁸	- 4.00	711 × 10 ⁸	738 × 10 ³²	9.70 × 10 ⁸	4.9 × 10 ⁻³
B ₉	21.4 "	- 1.30	241 "	154 "	17.7 "	2.6 × 10 ⁻¹
A ₉	11.8 "	+ 0.90	170 "	54.7 "	12.6 "	2.7 × 10 ⁻¹
F ₉	7.76 "	+ 2.65	143 "	32.2 "	10.5 "	2.7 × 10 ⁻¹
G ₉	6.32 "	+ 4.50	90.8 "	21.3 "	17.2 "	6.8 × 10 ⁻¹
K ₉	5.23 "	+ 6.35	59.7 "	15.1 "	28.1 "	1.7
M ₉	3.79 "	+ 11.00	19.2 "	6.89 "	124 "	23
GIANTS						
G ₅	4.98 "	+ 0.25	1150 "	79.1 "	0.399 "	1.2 × 10 ⁻³
K ₅	4.57 "	+ 1.55	824 "	56.0 "	0.548 "	2.4 × 10 ⁻³
K ₄	3.62 "	+ 0.75	2550 "	99.5 "	0.102 "	1.4 × 10 ⁻⁴
M ₅	3.52 "	+ 0.25	3150 "	112 "	0.0757 "	8.7 × 10 ⁻⁵

M(vis) is the visual absolute brightness in magnitudes, R the radius, g the gravitational acceleration at the surface, and ρ the density.