1892	App. R.A. of Mars. h. m. s.	App. Decl. of Mars. ° ′ ″	Log. distance from Earth.
July 23 ...	21 18 47·4 ...	— 22 25 24 ...	9·59247
,, 25 ...	— 17 5·9 ...	22 38 27 ...	9·58837
,, 27 ...	— 15 16·0 ...	22 51 22 ...	9·58489
,, 29 ...	— 13 19·0 ...	23 4 0 ...	9·58201
,, 31 ...	— 11 16·4 ...	23 16 13 ...	9·57975
Aug. 2 ...	— 9 9·3 ...	23 27 51 ...	9·57812
,, 4 ...	— 6 59·4 ...	23 38 47 ...	9·57714
,, 6 ...	— 4 48·1 ...	23 48 55 ...	9·57678
,, 8 ...	— 2 36·8 ...	23 58 7 ...	9·57705
,, 10 ...	21 0 27·1 ...	24 6 18 ...	9·57796
,, 12 ...	20 58 20·4 ...	24 13 23 ...	9·57951
,, 14 ...	— 56 18·0 ...	24 19 18 ...	9·58166
,, 16 ...	20 54 21·4 ...	— 24 23 59 ...	9·58443

The opposition will take place on August 4, and Mars will be in perigee on August 6 at a distance of 0·3774. The distance in perigee in the present year will be 0·3767.

THE COMET 1873 II. (TEMPEL, JULY 3).—This very interesting comet of short period will return to perihelion in 1878. The elements which rest upon the widest extent of observation are those of Mr. W. E. Plummer; in his orbit the period of revolution is 1850·25 days, or 5·066 years, and the perihelion passage in 1873 having taken place June 25·38, G.M.T., the comet, neglecting the effect of perturbations which in the present revolution is not likely to be material, will be again due in perihelion about 1878, July 19·5. Probably geocentric places derived from Mr. Plummer's orbit, with this date for perihelion passage, will give a sufficient idea of the circumstances of the next appearance, and a few positions so derived are accordingly subjoined :—

At 12h.	R.A. °	N.P.D.	Distance from earth.
June 29 ...	322·5 ...	97·4 ...	0·437
July 9 ...	328·7 ...	100·7 ...	0·400
,, 19 ...	334·7 ...	104·9 ...	0·377
,, 29 ...	340·0 ...	109·8 ...	0·369
Aug. 8 ...	344·3 ...	114·6 ...	0·375
,, 18 ...	347·4 ...	118·8 ...	0·397

The comet, therefore, appears under conditions nearly as favourable as possible for observations, the least distance of its orbit from that of the earth being 0·33, at a greater radius-vector. In aphelion the comet is distant from the sun 4·555, and its distance from the orbit of the planet Jupiter at this point (which is that of nearest approach) is 0·736. Four days after perihelion passage the comet approaches the orbit of Mars within 0·05, all these distances being expressed in parts of the earth's mean distance from the sun.

There does not appear to have been any observation of this comet previous to 1873, notwithstanding its short period. It could neither have been the object seen on one morning only in October 1846 by Hind, nor that observed by Goldschmidt on May 16, 1855, which was at first mistaken for the short-period comet of De Vico (1844 I).

In addition to the comet in question, Tempel is also the discoverer of comet 1866 I, associated with the great November meteor-shower, and comet 1867 II, which was re-observed in 1873, after its orbit had undergone considerable change from a near encounter with Jupiter about the preceding aphelion passage.

NEW COMET.—Prof. Winnecke, the director of the Imperial Observatory at Strasburg, announces his discovery of "a fine bright comet, with nucleus and trace of a tail," early on the morning of April 6. The following position depends upon observations with an annular micrometer on a 3½ feet-telescope, the comet being inconveniently situated for the larger instrument.

April 5 at 15h. 53m. 39s. mean time at Strasburg, Right Ascension 22h. 7m. 49·44s., Declination + 14° 54′ 15·4″. The diurnal motion in R.A. is rather less than 1m., and that in Decl. about 1¼°, both increasing.

The dearth of comets which had prevailed since December 1874, appears to have terminated, and we must soon hear of the re-discovery of the one which bears the name of D'Arrest, and has been so elaborately calculated by M. Leveau.

[Since the above was in type the following elements, calculated by Herr Hartwig, have been received from Prof. Winnecke :—Perihelion passage, April 18·1741, Berlin time, longitude of perihelion, 251° 59′ 57″; ascending node, 317° 51′ 18″; inclination, 56° 42′ 42″; logarithm of perihelion distance, 9·96767, motion retrograde. By these elements the comet at midnight on April 25, in R.A. 22h. 39m. and N.P.D. 42°·7, will have twice the theoretical intensity of light that it had on the date of discovery.]

CHEMICAL NOTES

THE NEW METALS ILMENIUM AND NEPTUNIUM.—About thirty years ago R. Hermann announced the discovery of a new metal, ilmenium, accompanying tantalum and niobium in various minerals, and closely allied to them in its general characters. Several years later he relinquished his claims to the discovery, in consequence of researches by Marignac in the same field leading to entirely different results. Later investigations have, however, strengthened his belief in the existence of ilmenium, and in the February number of Kolbe's *Journal für praktische Chemie* he not only brings forward results tending to establish the individual character of ilmenium, but describes a new metal, *neptunium*, belonging to the same group, and occurring in tantalite from Haddam, Connecticut. As the quantities obtained are small, the characteristic reactions limited, and as the spectral properties cannot be made use of, chemists will naturally reserve their opinion till confirmatory observations have been made by some other well-known investigator. The following are the essential results obtained by Hermann. The mineral was found to consist of equal portions of columbite ($ROMe_2O_3$) and ferroilmenite ($RO2MeO_2$). By fusion with potassium bisulphate the hydrates of the metallic oxides were separated out in the following proportions :—

Ta_2O_3	32·39
Nb_4O_7	36·79
Il_4O_7	24·52
Np_4O_7	6·30
	100·00

The hydrates can be changed into double fluorides, and from the greater solubility of potassium-neptunium fluoride, it may be obtained free from tantalum and ilmenium salts but retaining a small quantity of the niobium salt; these, however, on being changed into niobate and neptunate of sodium may be separated on account of the greater solubility of the latter. By fusion of the neptunate of sodium with potassium bisulphate and treatment with water, the hydrate of neptunic acid was obtained in a pure condition. Neptunium may be distinguished from niobium and ilmenium by its having, along with tantalum, the property of forming an amorphous insoluble precipitate on the addition of caustic soda to the boiling solution of the fluoride; the other two form crystalline and easily soluble compounds. The very soluble character of neptunium-potassium fluoride as compared with the corresponding tantalum salt serves to distinguish it from that metal. The reactions with phosphorus salts in the inner part of the bunsen flame are the following :—tantalic acid, colourless; niobic acid, blue; ilmenic acid, brown; neptunic acid, wine yellow. Addition of tincture of galls to solutions of the sodium salts gives characteristically-coloured precipitates. The atomic weight of neptunium, determined from the double salt $4KFl + Np_2Fl_7.2H_2O$, was found to be 118. Hermann has also obtained ilmenium in the form of a black powder by heating potassium-ilmenium fluoride with potassium chloride and potassium.

ABSORPTION OF HYDROGEN BY ORGANIC SUBSTANCES UNDER THE INFLUENCE OF THE SILENT DISCHARGE.—M. Berthelot has recently found that under the effect of the dis-

charge, benzene absorbs about two atoms of hydrogen, yielding a polymeride of C_6H_8, a resinous substance with an irritating smell. On heating, benzene first distils over; then a liquid, soluble in strong nitric and sulphuric acid, finally leaving carbon containing a little hydrogen. Oil of turpentine absorbs about 2·5 atoms of hydrogen, yielding resinous products. Pure carbon does not combine with hydrogen under the influence of the discharge, and a mixture of hydrogen with acetylene behaves much in the same way as pure acetylene. A mixture of hydrogen and carbon monoxide yields the solid body observed by Brodie and Thénard, $5CO + 3H_2 = CO_2 + C_4H_6O_3$, a trace of acetylene being formed.

PHOSPHORUS PENTAFLUORIDE. — Professor Thorpe has lately described this body (Liebig, *Ann.* clxxxii.), which he prepares by the gradual addition of phosphorus pentachloride to arsenic trifluoride. Phosphorus pentafluoride is a colourless gas, with a pungent and extremely irritating odour; it reacts upon water, forming phosphoric and hydrofluoric acids. The density with regard to hydrogen was found to be 63·23 (theory requiring 63); under the pressure of twelve atmospheres at 7° it exhibits no marked deviation from Boyle's law; it does not seem to be affected by the passage through it of electric sparks either when pure or when mixed with hydrogen or oxygen. With dry ammonia it forms the compound $2PF_55(NH_3)$.

MOLECULAR VOLUMES OF SULPHATES AND SELENATES.— An account of investigations on this subject has lately been published by Otto Petterson (*Deut. chem. Ges. Ber.*, ix. 1559), in which he finds that, in the series of sulphates and selenates of potassium, ammonium, rhubidium, and cæsium the molecular volume of the compound is regularly increased by 6·6 when the group SO_4 is exchanged for the group SeO_4; also, that the substitution of a molecule of ammonium, rubidium, or cæsium for a molecule of potassium produces an increase in volume of 9, 8, and 23 respectively in the selenates as well as in the sulphates. He has also examined the double sulphates and selenates of cobalt, nickel, and copper with potassium, in which results are found tending to confirm the hypothesis that in double salts the components are unaltered; this is more marked in the case of the selenates, in which the volumes of the double salts are equal to the sums of the volumes of their components. The author disagrees with Favre and Valson in their conclusions that double salts cannot exist in solution, and are formed at the moment of crystallisation; he believes on the contrary that as no contraction takes place on crystallisation these salts may be held to exist in the same condition in solution as after crystallisation; the double salt of thallium is, however, an exception. In the case of the alums also when obtained in an anhydrous condition the volume of the salt exactly equals the volumes of its components.

CONTRIBUTIONS TO THE THEORY OF LUMINOUS FLAMES.— A continuation of experiments on the above subject is given by K. Heumann (*Liebig's Ann.*, clxxxiii.), in which he finds that carbonaceous matter will give luminous or non-luminous flames, according as the temperature of the flame is high or low; diluting the gaseous combustible with indifferent gases also requires a higher temperature to cause a separation of the carbon, and thus produce luminosity. Reduction of temperature in a flame prevents either partially or entirely the formation of carbon, consequently the author thinks that the deposition of carbon on cold surfaces in a flame is not the consequence of cooling, as a deposition may be formed on red-hot surfaces, but burns away in contact with air. In burners of different materials, those of iron were found to prevent the luminosity of the lower part of the flame to a greater extent than those of steatite, also when the burner is heated, a greater amount of light is produced, the consumption of the combustible remaining the same. Herr Heumann thinks that by heating the burner the luminosity is increased, and extends to a greater extent over the lower part of the flame.

NOTES

WE are informed that H.M. Government has just been pleased to sanction the necessary expenditure to replace the important deep-soil thermometers of the Royal Observatory, Edinburgh, which were so cruelly broken by a madman last September. The estimate has been prepared by Messrs. Adie and Son, Princes Street, Edinburgh, and is understood to include everything that can conduce to scientific accuracy.

PROF. J. DEWAR, F.R.S.E., Jacksonian Professor of Natural Experimental Philosophy in the University of Cambridge, has been elected Fullerian Professor of Chemistry to the Royal Institution in the room of Dr. Gladstone, resigned.

DR. COLAN, the senior medical officer of the recent Arctic Expedition, has been promoted to be Deputy Inspector-General of Hospitals.

DR. W. B. CARPENTER, C.B., commenced, on Monday evening, at the School of Mines, Jermyn Street, a free course of lectures on geology, which he is delivering as Swiney Professor.

AT the meeting of the French Geographical Society on April 4 it was announced that the great gold medal of the Society had been awarded to Commander Cameron in recognition of his services in the cause of geographical science.

THE estimate for "Education, science, and art in Great Britain amounted in 1853–4 to 578,000*l.*; this year the estimate was 3,546,000*l.*" "In 1835 the Government paid for public education a sum of 26,750*l.*, but in 1875–6 the amount had increased to 3,972,008*l.*"

AMONG the fifty-seven candidates for admission into the Royal Society are two clergymen of the Church of England, one Wesleyan minister, one peer, one foreign baron, one baronet, eleven M.D.s, &c.

THE late Mr. J. C. Tufnell has bequeathed to University College, Gower Street, 5,000*l.* to be used in establishing two scholarships, one in general chemistry and the other in analytical and practical chemistry.

THE Rev. E. Ledger, Gresham Professor of Astronomy, will deliver a course of Lectures on the Telescope, in the theatre of Gresham College, on the evenings of April 17, 18, 19, 20. The electric light will be used to illustrate the lectures.

LIEBIG is to have another monument. A few weeks ago we noted the "inauguration" of one at Darmstadt. Subscriptions are now being collected for the purpose of raising a statue to him in Munich. About 7,000*l.* has already been contributed.

MR. H. W. S. WORSLEY-BENISON, F.L.S., has been appointed Lecturer on Botany at Westminster Hospital.

THE services of Mr. W. Saville Kent, F.L.S., F.Z.S., have been engaged temporarily to superintend and place in thorough order the "Fish House" at the Zoological Society's Gardens, Regent's Park. A considerable number of marine fish and other specimens of interest have been imported to the tanks during the past week.

TWO views have been offered as to the mode of action of the gas in the radiometer. One attributes the motion to reaction of gas particles getting heated on the vanes, then dancing off; the other to air currents which are directed towards the plate in consequence of heated air rising from it. M. Neesen has endeavoured (*Pogg. Ann.*) to decide between these views. If the second view is correct, he argued, the wall of the vessel, by becoming also heated, must also acquire influence through rise of heated air from it as from the vanes. If the rotation be merely a phenomenon of reaction there is no reason to suppose such an influence of the fixed wall. Now by giving the radiometer an