

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN FEBRUARY.

- Feb. 1. 19h. 10m. to 20h. 29m. Moon occults β^2 Scorpii (mag. 5.2).
 1. 19h. 10m. to 20h. 28m. Moon occults β^1 Scorpii (mag. 3.0).
 3. 0h. Mercury at greatest elongation ($18^\circ 17'$ E.).
 6. 17h. Jupiter in conjunction with moon. Jupiter $5^\circ 26'$ S.
 8. 17h. Venus in conjunction with moon. Venus $3^\circ 9'$ N.
 9. 9h. Mercury in conjunction with moon. Mercury $2^\circ 23'$ S.
 12. 7h. 40m. to 8h. 18m. Moon occults ϵ Piscium (mag. 4.5).
 14. 5h. 53m. to 6h. 45m. Moon occults σ Arietis (mag. 5.5).
 14. 11h. Venus in inferior conjunction with the sun.
 16. 6h. 24m. to 7h. 18m. Moon occults i Tauri (mag. 5.1).
 17. 11h. 41m. Minimum of Algol (β Persei).
 20. 8h. 30m. Minimum of Algol (β Persei).

VARIABILITY OF THE SATELLITES OF SATURN.—In the *Bulletin de la Société Astronomique de France* (January 1902), M. L. Rudaux directs attention to the probable variation in the brightness of the satellites Titan and Japetus, from evidence furnished by observations since 1892. He concludes that in the case of Titan the change is about half a magnitude, from 8.0 to 8.5, and, moreover, the variation appears to occur regularly at the same parts of the satellite's orbit. Maxima occur near and just after west elongation, and minima when the satellite is between superior conjunction and east elongation. A suggested explanation supposes the existence of fixed regions of different brightness and the rotation period equal to the time of revolution, as in the case of our own moon. There is a rapid passage from maximum to minimum.

The satellite Japetus is also thought to have equal periods for rotation and revolution, and the observation of Cassini is confirmed that the body almost becomes invisible in the eastern portion of its orbit. The variation is from the ninth to twelfth magnitude.

Prof. T. J. J. See refers to the variable visibility of Japetus in an article giving measures of the diameters of the satellites of Jupiter and Saturn in *Astronomische Nachrichten* (Bd. 157, No. 3764). He says, "The disc of Titan is rather obscure, but that of Japetus is even more so; in fact, only one side gives sufficient light to enable the observer to recognise a disc. This is visible when the satellite precedes the planet."

MAGNETIC OBSERVATIONS DURING TOTAL SOLAR ECLIPSE, MAY 18, 1901.—In a pamphlet reprinted from the *Overgedrukt uit het Natuurkundig Tijdschrift voor Ned-Indië* (vol. lxi., part iii, pp. 173-193), Dr. W. van Bemmelen presents the observations undertaken at Batavia and Karang Sago (Sumatra) during the last total eclipse of the sun on May 18, 1901. The determinations were made on behalf of the Batavia Observatory in response to the appeal of Dr. L. A. Bauer for accurate measures. The observations were made both visually and by means of self-recording photographic apparatus, reproductions from these latter being given. Although complicated by the presence of various common disturbances, the curves show decided irregularities about the time of eclipse which are thought to be due to the occurrence of that phenomenon. The observations at Batavia were only rendered possible by the courtesy of the Electric Car Company in stopping traffic over their lines from 11.30 a.m. to 2.30 p.m. on the day of eclipse.

SIMULTANEOUS VISIBILITY OF SUN AND TOTAL LUNAR ECLIPSE.—In the *Transactions* of the Vienna Academy of Sciences (Section of Mathematics and Natural Sciences) No. xxiv, pp. 263-271, Herr Dr. C. Hillebrand directs attention to the possible observation of both sun and total lunar eclipse at such times when the phenomenon occurs as the moon is rising or setting. As the refraction at the horizon is greater than the diameter of the lunar or solar disc, the sun will be visible after true sunset or before true sunrise; the conditions for the eclipsed moon to be thus seen may be fulfilled at certain localities during the lunar eclipses of April 22 and October 16 of the present year.

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THE VALIDITY OF THE IONISATION THEORY.¹

Introduction.—The theory of electrolytic dissociation as advanced by Arrhenius in 1887 is based primarily upon the facts that the molecular conductivity of solutions increases with the dilution, that substances which, when dissolved, conduct electricity also have abnormally low molecular weights in such solutions when tested by osmotic or freezing- or boiling-point methods, and that the so-called degree of dissociation may be calculated from the electrical conductivity or the results of the molecular weight determinations. In his original article, Arrhenius states that the phenomena of electrolysis, when viewed from the standpoint of thermodynamics, require the assumption of free ions, as was pointed out by Clausius, and that the well-known additive properties of solutions support this hypothesis. Arrhenius sought to save van't Hoff's theory of solutions from having but a limited application, and to extend it.

Van't Hoff found it necessary to introduce the factor i in the case of electrolytic aqueous solutions in order to make them conform to the gas equation. This factor Arrhenius calculated from the electrical conductivity on the one hand and from molecular weight determinations on the other, the resulting figures showing an agreement to within 5 to 15 per cent. The agreement was not good, and the results were obtained exclusively from aqueous solutions. The non-aqueous solutions then known were practically non-conductors, and appeared to be fairly normal as regards van't Hoff's theory, so that non-aqueous solutions in general came to be regarded as having normal molecular weights and as being non-conductors.

Behaviour of Non-aqueous Electrolytic Solutions.—Previous work has already shown that non-aqueous electrolytic solutions are frequently abnormal in the light of the ionisation theory. Thus in many cases the molecular conductivity decreases with increased dilution, e.g. NaI and NaBr in benzonitrile, AgNO₃ in piperidine, FeCl₃ in pyridine and in benzaldehyde, and CoI₂ in POCl₃. In other cases the molecular conductivity at first increases and then decreases with dilution, e.g. FeCl₃ in paraldehyde, CBr₃COOH in POCl₃. Many solutions which, according to molecular weight determinations, are undissociated, conduct well. Thus AgNO₃ has a normal molecular weight in pyridine and benzonitrile, yet it conducts fairly well. According to Dutoit and Friderich, CdI₂, LiCl, NaI, HgCl₂ and NH₄CNS have normal molecular weights in acetone, and yet these solutions are conductors. Walden has found that KI, NaI, RbI, NH₄I and KCNS conduct well in liquid SO₂, and yet have abnormally large molecular weights in this solvent. Franklin and Kraus have found that while NH₄NO₃, NaNO₃ and KI dissolved in liquid ammonia are excellent conductors, the boiling points of the solutions are not nearly so high as they ought to be according to the ionisation theory. Nicolo Castoro found by means of the freezing-point method that AgNO₃, CdCl₂, HgCl₂ and ZnCl₂ have normal molecular weights in urethane; yet the author has found that the first three of these solutions are conductors. Recently, Innes found the molecular weights of succinic, salicylic and tartaric acids to be normal in pyridine according to the boiling-point method; preliminary tests by the author have shown that all three of these solutions are fairly good conductors.

In the case of non-aqueous solutions the various methods of observing ionisation do not always give the same indication with increasing dilution; it is sometimes in one direction and sometimes in the other. Occasionally simple substances in solution show abnormally low molecular weights, and yet are non-conductors. The author has found this to be so in the case of solutions of diphenylamine in methyl cyanide.

The abnormal behaviour, according to the theory, of non-aqueous solutions led the author to investigate aqueous solutions somewhat further.

Experimental Part.—The investigation consisted of four parts:—(1) Determination of boiling points of aqueous solutions of typical, common, chemical compounds from low to very high concentrations, to see how the molecular weight changes with the concentration. (2) Measurement of the conductivity of these solutions at or near their boiling points. These two parts of the work were carried out by Mr. A. A. Koch. (3) Measurement

¹ Abstract of a paper by Mr. Louis Kahlenberg in the *Journal of Physical Chemistry* (vol. v. pp. 339-392, June, 1901).