May 22, 1856.

The LORD WROTTESLEY, President, in the Chair.

The following communications were read :—

I. "On the Application of Photography to the physiognomic and mental phenomena of Insanity." By HUGH W. DIAMOND, M.D. Communicated by Admiral SMYTH, For. Sec. R.S. Received April 23, 1856.

(Abstract.)

The position of the author, as Medical Superintendent of the Surrey Lunatic Asylum, has enabled him to make the peculiar application of Photography, of which he gives an account in the present communication. He points out the advantages to be derived from photographic portraits of the insane, as faithfully representing the features of the disease in its different forms, or its successive phases in the same patient, and as affording unerring records for study and comparison by the physician and psychologist. In the course of the paper frequent reference is made to the series of photographic portraits of lunatic patients with which it was accompanied.

II. "On the Problem of Three Bodies." By the Rev. J. CHALLIS, M.A., F.R.S., F.R.A.S., Plumian Professor of Astronomy and Experimental Philosophy in the University of Cambridge. Received May 15, 1856.

(Abstract.)

The object of the author is to give an approximate solution of the Problem of Three Bodies, equally applicable to the motion of the moon and to that of a planet, in which the forms of the developments of the radius-vector, longitude, and latitude in terms of the

time, are directly determined by the analysis. The solution to the first power of the disturbing force is effected by means of the following three equations, in which the letters have the significations usually given to them in the planetary theory:

$$\frac{dr^2}{dt^2}+\frac{h^2}{r^2}-\frac{2\mu}{r}+\mathrm{C}=2\int\left\{\frac{d^2\theta}{dt^2}\left(\int\frac{d\mathrm{R}}{d\theta}dt\right)-\frac{d\mathrm{R}}{dr}\frac{dr}{dt}\right\}dt$$

$$\frac{d\theta}{dt}=\frac{h}{r^2}-\frac{1}{r^2}\int\frac{d\mathrm{R}}{d\theta}dt$$

$$\frac{d^2z}{dt^2}+\frac{\mu z}{r^3}+\frac{d\mathrm{R}}{dz}=0.$$

After substituting in the right-hand side of the first equation, the values of r and θ given by a first approximation in which the disturbing force is neglected, that side becomes a known function of t. The equation can then be integrated approximately so as to give the development of r in terms of t to the first power of the disturbing force, and to any power of the eccentricity it may be thought proper to retain. By substituting in that term of the second equation which does not contain the disturbing force the value of r thus obtained, the integration of the equation gives the development of θ in terms of t, and lastly by substitution in the third equation z is similarly developed. The author has shown the practicability of this method by obtaining values of r and θ to terms of the order of the eccentricity multiplied by the disturbing force. The development of the latitude, and a more particular application of the method to the motion of the moon, are reserved for future consideration. The particular advantages of this mode of solution are, that being free from all assumption as to the forms of the developments, it gives those which are alone appropriate to the problem, and it evolves both the periodic and the secular inequalities by the same process. Terms containing *ent* as a factor, which are met with in other solutions of the same problem, do not occur in this method; but there are terms containing the factor $e^{\prime}nt$, which are shown to be convertible into periodic functions, and to have reference to secular variations of the eccentricity and of the motion of the apse. The paper concludes with some general remarks on the principle of this approximate solution of the problem of three bodies, and an explanation of the analytical circumstances which make it, in common with the

method of the variation of parameters, proper for determining directly the motion of the apses of an orbit.

III. "On some of the Products of the Distillation of Boghead Coal at low temperatures." By C. GREVILLE WILLIAMS, Esq., Assistant to Dr. ANDERSON, Professor of Chemistry in the University of Glasgow. Communicated by Dr. SHARPEY, Sec. R.S. Received May 14, 1856.

In presenting a brief preliminary notice of an investigation of the substances obtained by distilling boghead coal at low temperatures, I may observe that I was induced to undertake it from remarking the low density of the naphtha produced in the process; it being only ·750 at 60° F., although its boiling-point, previous to the rectifications, was as high as 290° F.

After fifteen complete fractionations of the portion distilling below 310° F., boiling-points were obtained as low as 170°, and it was found that the fluid could be separated, by careful treatment with fuming nitric, or a mixture of nitric and sulphuric acids, into two bodies, one forming a nitro-compound, the other being unacted on. The latter was washed several times with a strong alkaline solution, and, after being digested for a few days with sticks of potash to remove adherent moisture, rectified over sodium. In this manner I obtained a colourless and very mobile fluid with a pleasant odour, distantly resembling that of hawthorn blossoms. Its density at 60° was ·725.

I selected the fraction boiling in the fifteenth rectification at 240° F. to make a preliminary experiment upon, and, after purification in the manner described, it gave in three perfectly concordant analyses, exactly the per-centage of carbon and hydrogen required for butyl (valyl of Kolbe), the radical of the butylic alcohol. Two determinations of the vapour density, taken respectively at 80° and 107° above its boiling-point, gave numbers closely coinciding with theory.

When it is considered that 68° or more of difference of boiling-point only cause a variation of 0·3 in the per-centage of carbon and hydrogen of bodies of this class, it becomes evident that if I had