station, ρ, was visited [and, from a height of 1100 feet, the summits υ, τ, σ, ξ, and π were observed projected against the sky, and o against other mountains]. On the 21st, after having ridden out a heavy gale, they succeeded in climbing Mount Walrus [marked π], a mountain 1100 feet high, surrounded by glaciers, and laid down as an island on the existing charts. [From this mountain the station marked λ in Mr. Chydenius's map (Royal Society Proceedings, vol. xii. Plate IV.) was seen.]

"Proceeding in the boats they reached, on the 22nd, and ascended a mountain 2500 feet high, situated near the channel which joins the Storfjord with the southern opening of Hinlopen Straits. This was named White Mountain [and is marked ν on the Map]. From this summit they saw on a clear bright day the South Cape of North-east Land (μ), Mount Löven about the middle of Hinlopen Straits on the west shore, and the station marked κ on the eastern shore. Having thus ascertained satisfactory points in the Storfjord, they proceeded again to the west coast of Spitzbergen, with the intention of pushing to the northward as far as possible, but had not proceeded far when they fell in with several boats with the crews of wrecked sealing vessels. Of course they were obliged to take these men on board; and being short of provisions for the increased number of hands, and the season drawing towards its close, they put back to Tromsoe. The sealing vessels had been wrecked on the east side of North-East Land, having got there by the north of the island. The men had afterwards made their way in the boats through Hinlopen Straits, having thus circumnavigated North-East Land—a feat said never to have been accomplished before.

"The shores of the Storfjord are mountainous. The glens and valleys between the ridges are for the most part filled by glaciers, especially on the western shore. The mountains average from 1000 to 1500 feet in height, and belong in general to the Jura formation, which is here and there broken through by basaltic rocks (hyperite). In the Jura have been found skeletons, though not complete, of an Ichthyosaurus, closely resembling the species found in Arctic America by Sir Edward Belcher's Expedition. Mr. Malmgren, of the University of Helsingfors in Finland, accompanied the Expedition in the capacity of zoologist."

III. "On the Sextactic Points of a Plane Curve." By A. Cayley, F.R.S., Sadlerian Professor of Mathematics, Cambridge. Received November 5, 1864.

(Abstract.)

It is, in my memoir "On the Conic of Five-pointic Contact at any Point of a Plane Curve" (Phil. Trans. vol. cxlix. (1859) pp. 371–400), remarked that as in a plane curve there are certain singular points, viz. the points of inflexion, where three consecutive points lie in a line, so there are singular

points where six consecutive points of the curve lie in a conic; and such a singular point is there termed a "sextactic point." The memoir in question (here cited as "former memoir") contains the theory of the sextactic points of a cubic curve; but it is only recently that I have succeeded in establishing the theory for a curve of the order m. The result arrived at is that the number of sextactic points is $=m(12m-27)$, the points in question being the intersections of the curve m with a curve of the order $12m-27$, the equation of which is

$$\begin{aligned}&(12m^2-54m+57)\ \mathrm{H}\ \text{Jac.}\,(\mathrm{U},\mathrm{H},\Omega_{\overline{\mathrm{H}}})\\ +&(m-2)\,(12m-27)\ \mathrm{H}\ \text{Jac.}\,(\mathrm{U},\mathrm{H},\Omega_{\overline{\mathrm{U}}})\\ +&40\,(m-2)^2\ \text{Jac.}\,(\mathrm{U},\mathrm{H},\Psi)=0,\end{aligned}$$

where $\mathrm{U}=0$ is the equation of the given curve m, H is the Hessian or determinant formed with the second differential coefficients (a, b, c, f, g, h) of U, and, $(\mathfrak{A},\mathfrak{B},\mathfrak{C},\mathfrak{F},\mathfrak{G},\mathfrak{H})$ being the inverse coefficients ($\mathfrak{A}=bc-f^2$, &c.), then

$$\Omega=(\mathfrak{A},\mathfrak{B},\mathfrak{C},\mathfrak{F},\mathfrak{G},\mathfrak{H}\between\partial_x,\partial_y,\partial_z)^2\,\mathrm{H},$$
$$\Psi=(\mathfrak{A},\mathfrak{B},\mathfrak{C},\mathfrak{F},\mathfrak{G},\mathfrak{H}\between\partial_x\mathrm{H},\partial_y\mathrm{H},\partial_z\mathrm{H})^2;$$

and Jac. denotes the Jacobian or functional determinant, viz.

$$\text{Jac.}\,(\mathrm{U},\mathrm{H},\Psi)=\begin{vmatrix}\partial_x\mathrm{U}, & \partial_y\mathrm{U}, & \partial_z\mathrm{U}\\ \partial_x\mathrm{H}, & \partial_y\mathrm{H}, & \partial_z\mathrm{H}\\ \partial_x\Psi, & \partial_y\Psi, & \partial_z\Psi\end{vmatrix}$$

and Jac. $(\mathrm{U},\mathrm{H},\Omega)$ would of course denote the like derivative of $(\mathrm{U},\mathrm{H},\Omega)$; the subscripts $(\overline{\mathrm{H}},\overline{\mathrm{U}})$ of Ω denote restrictions in regard to the differentiation of this function, viz. treating Ω as a function of U and H,

$$\Omega=(\mathfrak{A},\mathfrak{B},\mathfrak{C},\mathfrak{F},\mathfrak{G},\mathfrak{H}\between a', b', c', 2f', 2g', 2h');$$

if (a', b', c', f', g', h') are the second differential coefficients of H, then we have

$$\begin{aligned}\partial_x\Omega=&(\partial_x\mathfrak{A},\ldots\between a',\ldots) && (=\partial_x\Omega_{\overline{\mathrm{H}}})\\ &+(\mathfrak{A},\ldots\between\partial_x a',\ldots) && (=\partial_x\Omega_{\overline{\mathrm{U}}});\end{aligned}$$

viz. in $\partial_x\Omega_{\overline{\mathrm{H}}}$ we consider as exempt from differentiation (a', b', c', f', g', h') which depend upon H, and in $\partial_x\Omega_{\overline{\mathrm{U}}}$ we consider as exempt from differentiation $(\mathfrak{A},\mathfrak{B},\mathfrak{C},\mathfrak{F},\mathfrak{G},\mathfrak{H})$ which depend upon U. We have similarly $\partial_y\Omega=\partial_y\Omega_{\overline{\mathrm{H}}}+\partial_y\Omega_{\overline{\mathrm{U}}}$, and $\partial_z\Omega=\partial_z\Omega_{\overline{\mathrm{H}}}+\partial_z\Omega_{\overline{\mathrm{U}}}$; and in like manner

$$\text{Jac.}\,(\mathrm{U},\mathrm{H},\Omega)=\text{Jac.}\,(\mathrm{U},\mathrm{H},\Omega_{\overline{\mathrm{H}}})+\text{Jac.}\,(\mathrm{U},\mathrm{H},\Omega_{\overline{\mathrm{U}}}),$$

which explains the signification of the notations Jac. $(\mathrm{U},\mathrm{H},\Omega_{\overline{\mathrm{H}}})$, Jac. $(\mathrm{U},\mathrm{H},\Omega_{\overline{\mathrm{U}}})$.

The condition for a sextactic point is in the first instance obtained in a form involving the arbitrary coefficients (λ, μ, ν); viz. we have an equation of the order 5 in (λ, μ, ν) and of the order $12m-22$ in the coordinates (x, y, z). But writing $\vartheta=\lambda x+\mu y+\nu z$, by successive transformations we

throw out the factors $\vartheta^2, \vartheta, \vartheta, \vartheta$, thus arriving at a result independent of (λ, μ, ν); viz. this is the before-mentioned equation of the order $12m-27$. The difficulty of the investigation consists in obtaining the transformations by means of which the equation in its original form is thus divested of these irrelevant factors.

IV. "On a Method of Meteorological Registration of the Chemical Action of Total Daylight." By Henry E. Roscoe, B.A., F.R.S. Received November 8, 1864.

(Abstract.)

The aim of the present communication is to describe a simple mode of measuring the chemical action of total daylight, adapted to the purpose of regular meteorological registration. This method is founded upon that described by Prof. Bunsen and the author in their last Memoir* on Photo-chemical Measurements, depending upon the law that equal products of the intensity of the acting light into the times of insolation correspond within very wide limits to equal shades of tints produced upon chloride-of-silver paper of uniform sensitiveness—light of the intensity 50, acting for the time 1, thus producing the same blackening effect as light of the intensity 1 acting for the time 50. For the purpose of exposing this paper to light for a known but very short length of time, a pendulum photometer was constructed; and by means of this instrument a strip of paper is so exposed that the different times of insolation for all points along the length of the strip can be calculated to within small fractions of a second, when the duration and amplitude of vibration of the pendulum are known. The strip of sensitive paper insolated during the oscillation of the pendulum exhibits throughout its length a regularly diminishing shade from dark to white; and by reference to a Table, the time needed to produce any one of these shades can be ascertained. The unit of photo-chemical action is assumed to be that intensity of light which produces in the unit of time (one second) a given but arbitrary degree of shade termed the standard tint. The reciprocals of the times during which the points on the strip have to be exposed in order to attain the standard tint, give the intensities of the acting light expressed in terms of the above unit.

By means of this method a regular series of daily observations can be kept up without difficulty; the whole apparatus needed can be packed up into small space; the observations can be carried on without regard to wind or weather; and no less than forty-five separate determinations can be made upon 36 square centimetres of sensitive paper. Strips of the standard chloride-of-silver paper tinted in the pendulum photometer remain as the basis of the new mode of measurement. Two strips of this paper are exposed as usual in the pendulum photometer: one of these strips is fixed

* Phil. Trans. 1863, p. 139.