this and other countries, to publishing-houses and mechanical workshops, with the wish that, through their hearty cooperation, the project may be furthered. We add the plan and more minute information, for the successful realisation of the exhibition.

The exhibition-lasts from September 1 to 30, 1893, inclusive, and comprises models, drawings, apparatus, and instruments used in pure and applied mathematics, either for purposes of instruction or investigation.[1]

The Deutsche Mathematiker-Vereinigung will take charge (free of cost) of the fitting of the rooms, the providing of tables, putting in of partitions, &c., as well as the unpacking and repacking of all articles intended for the exhibition. Moreover, the society will assume control of the articles while on exhibition, and will take particular care to preserve them, and will carry an insurance against fire. However, it can assume no responsibility against injury or loss.

Exhibitors who desire their various displays to be exhibited under closed cases must provide them at their own expense.

The expense of shipment to Munich, and, if desired, insurance, must be borne by the exhibitor. For the return the same inducements are held out as last year, viz. free freight over the chief German lines.

A comprehensive detailed catalogue of the mathematical exhibition, according to the announcement made last year, has appeared.[2]

The first part (142 pages) contains a number of essays, of general nature, having reference to problems, results, and methods of presenting geometrical concepts.

The second part (300 pages) contains, according to the suggestion given below, the enumeration and exact description of the articles intended for the Nürnberg exhibition, and gives, with numerous illustrations, a comprehensive view of the general plan of the undertaking, and a statement of what has already been accomplished.

The catalogue will also give the plan of the preparations of the present year; a detailed supplement will be added, in which we hope to perfect the non-completed parts of last year's catalogue.

As far as possible all technical explanations of the articles will be undertaken by the committee.

The committee will attend to all sales and buyings (which are in view by various mathematical institutes of our Hochschulen), and give all desired information.

During the exhibition the sold articles must not be removed from the exhibition rooms, except with special permission of the committee.

The intention to participate in the exhibition may be given by the use of the "Exhibition Announcement" until July 1.

Address: "Herrn Prof. Dr. Walther Dyck,
Münchon, Polytechnicum."

At the same time all papers and scientific notices for the catalogue respecting woodcuts (clichés) for illustration must be sent to the same address.

The editors reserve the right of all abbreviation and change in the notes of Part II. of the catalogue that uniformity may require.

All articles proposed for exhibition must be forwarded from August 15 to 31 under the address: "Mathematische Ausstellung in München (Polytechnicum) zu Handen Herrn Prof. Dr. W. Dyck."

The return of all articles will be effected within two weeks after the close of the exhibition.

In order to more minutely define the extent of the exhibition, we give, in accordance with the arrangement of the catalogue which has already appeared, the following division of groups:—

I.—ANALYSIS.

Calculating apparatus (calculating machines, slide rules); apparatus for the solution of equations and construction of functional relations; models and drawings in algebra and theory of functions; curvometers, planimeters; other instruments for mechanical integration.

[1] From the field of applied mathematics only those models, apparatus, &c., will be accepted whose chief interest lies in the field of pure mathematics.
[2] The catalogue can be obtained direct from Prof. W. Dyck (München, Polytechnicum) at the price of M. 9.80 (including postage).

II.—GEOMETRY.

Drawing apparatus; models for elementary instruction in plane and solid geometry, trigonometry, and descriptive geometry; polyhedra (division of surfaces and spaces in polygons and polyhedra); analysis situs; plane curves; algebraic surfaces; transcendental surfaces; curves in space and developable surfaces; models in line geometry; models to illustrate theory of curvature; singularities of curves and surfaces.

III.—APPLIED MATHEMATICS.

Mechanics.

Models used in elementary instruction; apparatus and models for the demonstration of the laws and principles of dynamics (equilibrium and movement of a material point; Poinsot motion of a rigid body; apparatus for representing precession and nutation; dynamical tops; gyroscopes; models and articles showing the effect of tension, compression, flexion and torsion of solids; representation of various phenomena in hydro-dynamics); models and apparatus in kinematics with regard to their application in practice.

Mathematical Physics.

Apparatus and models to illustrate the laws of the propagation of waves; models for the explanation of crystal structure; models to illustrate the optical, elastic, and electric properties of crystals; drawings and models in thermodynamics; models and apparatus for the mechanical illustration of electro-dynamic phenomena.

Various Technical Applications.

It is to be understood that exhibitors must declare their willingness to submit to the present rules and further dispositions ordered by the committee for the interest of the exhibition.

For all further information please address the undersigned delegate of the committee.   PROF. DR. WALTHER DYCK.

RELATIONS BETWEEN THE SURFACE-TENSION AND RELATIVE CONTAMINATION OF WATER SURFACES.

IN a recent paper (NATURE, vol. xlvi., p. 419) I have suggested a method for measuring the relative contamination of an anomalous water-surface in my adjustable trough without fearing an error caused by incomplete separation of the surfaces by the partition. It consists in observing not the displacement of the partition itself, but that of a floating wire laid across the surface, which follows every motion of the superficial water particles.

By this method I have now tried to find a relation between the relative contamination and the decrease of tension which begins at that relative contamination, which we will call unit.

The surface-tension was measured by the separating weight of a ring of thin wire, which had a circumference of 114 mm. and was cleaned by ignition, so that it could be afterwards entirely moistened with water. The ring was attached to a balance with a sliding weight. In this manner the normal surface-tension of water was determined to be 80 mg. per cm. at a temperature of 15° C. The values obtained by experimenters on this subject differing considerably from each other, I shall express the tensions not in absolute measure, but in fractions of the normal surface-tension of water taken as unit. Thus, I found the surface-tension of a saturated solution of camphor 0·72, and that of a strong solution of soap 0·37.

On several occasions, when fast working was required, the tension was not observed directly with the wire-ring, but with the small balance used in my former experiments, the tension corresponding to each separating weight being previously determined by comparison with the large balance.

The observations were made as follows:—A slight trace of oil was communicated to the surface of the trough by

means of a wire previously heated to redness, the water-surface still remaining normal. If tallow was to be tried, I left several fragments floating on the water for a short time. When the anomalous surface had reached a sufficient length, the floating wire was put upon it about half-way between the partition and the end of the trough. Then the sliding weight of the balance was displaced successively along intervals of the scale, corresponding to equal differences of tension, and after each displacement one determined the length of surface, at which, under continued contraction, the disk or ring broke off. From these lengths the relative contaminations were afterwards calculated.

Thus I obtained the following results, T denoting relative surface tension and R relative contamination :—

Provence Oil.				Tallow.	
Interval of T. 0·05.		Interval of T. 0·06.			
T.	R.	T.	R.	T.	R.
1·00	0·1	1·00	0·1	1·00	0·1
0·95	1·11	0·94	1·13	0·95	1·12
0·90	1·20	0·88	1·24	0·90	1·22
0·85	1·29	0·82	1·32	0·85	1·31
0·80	4	0·76	10	0·80	1·39
0·75	13			0·75	6
				0·72	12

It did not influence the results if I used poppy-oil instead of olive-oil, or tallow of various provenience.

The decrease of tension was rapid, and nearly proportional to the increase of relative contamination, till the value 0·82 in the case of oil,[1] or 0·79 in the case of tallow, was attained. At this point a sudden change occurred, and the further sinking took place very slowly. At the same time the "solution current" of floating tallow fragments showed a sudden lessening.

Under continued contraction the water surface at last appeared turbid, and the lowest tension I could attain in this way was about 0·63 with oil and 0·68 with tallow.

The method described is still somewhat imperfect, inasmuch as the water particles in close proximity to the sides of the trough did not participate in the movement of the rest of the surface, indicated by the displacement of the wire-mark. Therefore the results were checked by another method.

The whole surface of the trough was rendered anomalous by means of weak solutions of oil or tallow in benzol, for which purpose 23 drops of the oil solution, or 13 of the stronger tallow solution were required. If the contamination be a little too great, the normal tension may be easily restored by immersing small strips of paper. Then part of the surface was cleansed by shifting the partition from the end towards the middle of the trough about 10 cm., and one drop of the solution being evaporated on the newly-formed surface, the partition was removed and the tension measured. The increase of relative contamination thus added by each drop was respectively $\frac{1}{23}$ and $\frac{1}{13}$. The means of all observations made in this manner were as follows :—

| Provence Oil.			Tallow.		
R.		T.		R.	T.
0·0000		1·000		0·000	1·000
1·0000		1·000		1·000	1·000
0·0434		0·973		1·077	0·963
1·0868		0·945		1·154	0·924
1·1321		0·916		1·231	0·870
1·1736		0·891		1·308	0·832
1·2170		0·860		1·385	0·790
1·2604		0·834		1·462	0·790
1·3038		0·815		...	...
1·3472		0·815		2	0·782
...		...		4	0·760
2		0·805			
4		0·795			
12		0·760			

[1] When ordinary olive-oil was used the value in question was 0·78.

The results agree tolerably well with those obtained by the first method, and show still more clearly, that the tension in the beginning of the anomalous state may be approximately expressed by

$$T_0 - T = k (R - 1),$$

T_0 denoting the normal surface-tension and k a constant which is, in the case of oil, 0·60, and in the case of tallow, 0·54.

The course of the tension of a surface contaminated by oil may be more clearly seen from the following curve :
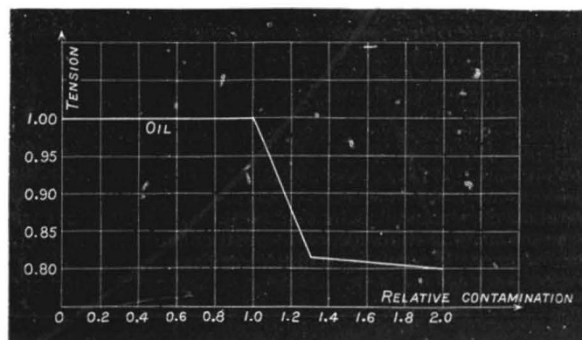

When the water-surface is not contaminated by pure grease, but by any other substance, as soap, resin, palmitic acid, the tension behaves quite differently.

If the justly anomalous surface be contracted, the tension at first sinks rapidly, but gradually begins to rise again, while the area of the surface remains constant; the latter being re-extended, the normal condition is attained at a shorter surface than before contraction. When the surface then is left for some time in the normal state, the length of the anomalous surface increases again.

Therefore the difference of tension produced by varying the area in a given ratio depends very much upon the time required for the contraction or extension.

The deeper the tension is lowered the stronger becomes its tendency to rise, till at last a further sinking
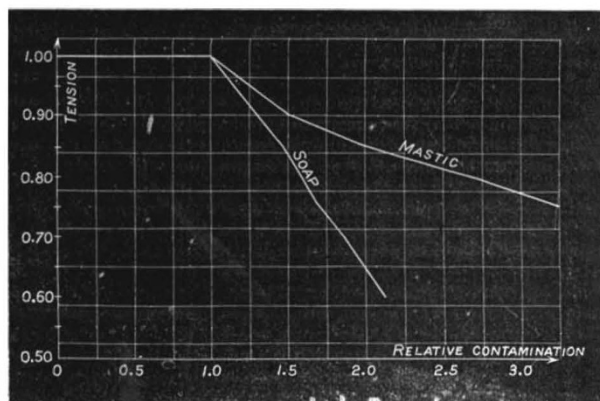
only can be observed during the motion of the partition, and this even is the case with grease at higher degrees of contamination. A sudden change of direction at a certain lowered tension I could perceive in no other curve than that of pure grease. As an example may be exhibited the curves of soap and mastic, when the contraction was as quick as possible. Mastic was introduced by means of benzol, soap directly by contact.

On strongly contracted surfaces, every substance gives

a stiff, visible pellicle, composed, as it appears, of small incoherent particles.

Certain peculiarities of some substances still must be mentioned.

(1) The contamination due to colophony and palmitic acid continually diminishes, and at last seems to disappear altogether on standing, which is not the case with mastic.

(2) On the other hand, if the surface has been for a moment in contact with a piece of soap, the contamination continues to increase after the removal of the soap.

(3) Stearic acid renders the water surface stiff as soon as the tension begins to sink.

(4) A surface made anomalous by olive-oil in the course of twenty-four hours undergoes a change, by which the curve of tension is totally altered.

On the whole the phenomena are rather complicated, the tension by no means being determined by the quantity of contaminating substance in the unit of area ; but depending considerably upon conditions that are still to be investigated. Especially in the experiments relative to the final tensions attainable by the various substances in the state of utmost concentration I could not succeed in getting definite results.

AGNES POCKELS.

NOTES.

A BRONZE statue of Arago, erected in the grounds behind the Paris Observatory, was unveiled by M. Poincaré on Sunday last in the presence of several members of the Institute, the observatory officials, and a few spectators. This is the third monument that has been erected to the memory of that renowned astronomer.

PROF. MAX MÜLLER has had the order of Medjidieh conferred on him by the Sultan of Turkey. This is a graceful recognition of Prof. Müller's scientific researches.

BARON VON NORDENSKJÖLD, of Stockholm, has been elected a Foreign Member of the Paris Academy of Sciences.

DR. E. B. TYLER, Curator of the Oxford University Museum, has been elected an Associate of the Brussels Academy of Sciences.

THE announcement that Mr. E. B. Poulton, F.R.S., has been appointed Hope Professor in succession to the late Prof. Westwood will be received with satisfaction by all naturalists who are familiar with this author's work. For more than ten years Mr. Poulton has displayed the greatest activity as an original investigator, more especially in connection with the subject of insect colouration, which he has advanced by many important discoveries. His contributions to insect morphology are sufficient guarantee that the purely systematic side of entomology will not be neglected at Oxford. All who are interested in the status of the University as a centre of biological research will recognise the wisdom of the electors in making their selection.

IN the House of Commons on June 8 Mr. Rentoul asked the Secretary of State for War whether he was aware that at the recent Staff College examination there was a striking change, of which no notice had been given, in the nature and scope of the mathematical examination ; and whether steps would be taken to prevent any of the officers who were candidates at the examination being disqualified in consequence of this unusual procedure. Mr. Campbell Bannerman replied that the change was due to the appointment of a new examiner, and said that, as the examination is competitive, the candidates would not be put to any disadvantage by the greater difficulty of the questions. This may be a sufficient explanation of the circumstance, but, in many cases, candidates for Government appointments

have found upon reading the question paper, that important changes have been made in the character of the examination without any intimation whatever having been given to them.

A *conversazione* of the Institution of Electrical Engineers will be held in the galleries of the Royal Institute of Painters in Water Colours on Friday evening, June 23.

THE Selborne Society have made arrangements for a visit to Selborne, the home of Gilbert White, on Saturday, June 24. Lord Selborne will occupy the chair at lunch, and be supported by Lord Northbrook, the Earl of Stamford, and Sir John Lubbock, Bart. Tickets for the excursion can be had from the Secretary, 9, Adam Street, Adelphi, W.C.

THE fourth annual meeting of the Museums' Association will be held in the rooms of the Zoological Society during the first week in July. The formal proceedings will commence on Monday, July 3, at 8.30 p.m., when Sir W. H. Flower, F.R.S., the President-Elect, will deliver an address. It is proposed to devote mornings to the reading and discussion of papers bearing upon the subject of museums, and in the afternoons and evenings visits will be made to various Metropolitan museums. The arrangements of the meeting will be greatly facilitated if those who propose to attend will give early notice to Mr. F. W. Rudler, 28, Jermyn Street, S.W.

THE fifth summer assembly of the National Home Reading Union will be held at Ilkley, Yorkshire, from July 1 to July 8. The inaugural address will be delivered by the Master of Trinity College, Cambridge, and there will be lectures by Mrs. Henry Fawcett, Prof. Michael Foster, Sir Robert Ball, Mr. W. G. Collingwood, Mr. Churton Collins, and others. Short lectures on archæology, botany, and geology will be given each day, and will be followed by excursions to places of interest in the neighbourhood. There could hardly be a more pleasant road to knowledge than that afforded by such a meeting as this.

VARIOUS learned and scientific bodies of Liverpool and the district, being desirous of inviting the British Association to meet at Liverpool in 1896, sent representatives to the Mayor on June 5 for the purpose of soliciting his aid in the furtherance of their object. The Mayor would not pledge himself to any course of action, but said he would consult the Corporation upon the matter.

THE Permanent Committee of the International Congress of Zoology propose, as the subject for the S. A. I. le Tsarévitch prize, the study of the fauna of one of the great regions of the globe and the relations between this fauna and that of neighbouring regions. The award will be made at the Leyden Congress in 1895. By the rules of the Congress this prize cannot be given to a Dutch man of science. The jury will accept works bearing upon a branch or a class of the animal kingdom. Manuscripts or printed papers should be written in French and sent, before May 1, 1895, to M. le Président du Comité permanent, Société Zoologique de France, 7 Rue des Grands-Augustins, Paris.

WITH the exception of heavy thunderstorms which occurred in the central part of Ireland during the night of Friday, the 9th inst., in which 1·2 inch of rain fell, and in Merioneth the next day, the weather, as represented by the stations reporting to the Meteorological Office, has been practically rainless over nearly the whole of the British Islands. These conditions were owing to the persistence of an anticyclone over Scandinavia, the North Sea and our own area. The temperature has been somewhat high for the time of year, the highest daily maxima in the south and west having at times exceeded 75° ; but in the north, and especially on the east coast,