phorus is brought towards the lamp, the loops will diverge and strike the sides. Or if the displacement is only partial, the loops will swing back to their original place of rest directly the charged plate is removed to a distance. If, however, the metal disc of the electrophorus, positively charged, is brought towards the still lighted lamp, there is no movement of the loops. Equilibrium of potential is attained by emission of electrons from the filament. But as the disc with its positive charge is being moved away the loops diverge and may strike the glass.

What is most remarkable is this, that if the displacement of the loops is only partial, and not up to the glass, then when the disc is removed, the loops retain their displaced position and very slowly creep back to their original place of rest. It is this last phenomenon which clearly indicates the great difficulty of negative electricity returning to the glowing filament, or of positive ions leaving it.

The Beta rays from a few milligrams of radium near the lamp produce in it an ionisation current which accelerates the creep into a rapid motion, to the natural position of the filament.

These experiments with the electrophorus can all be carried out through a dry wooden drawing-board more than half an inch thick. When projected by a lens on a screen the motions of the filament afford interesting lecture-room illustrations of the thermionic current.

The valve action inside high vacuum lamps was explained by Fleming (Proc. Roy. Soc., 1890, vol. xlvii., p. 122). An account of his work is given in his well-known book on "Electric Wave Telegraphy" (second edition, p. 478).

So far as I know, the experiments described in this letter, with an electric force, produced outside the lamp, have not been previously published.

A. S. EVE.

McGill University, Montreal, January 29.

The Densities of the Planets.

THE prominence you give to M. F. Ollive's note in *Comptes rendus*, tome 157, No. 26, induces me to point out that M. Ollive's so-called empirical formula is really a simple statement about the densities of the planets. The formula is $r^3 = kRR'v'^2$, where r is the mean radius of any planet, R its mean distance from the Sun, R′ the mean distance of any satellite from its primary, and v' the mean orbital velocity of the satellite. v'^2R' for any satellite can be replaced by γM, where γ is the gravitation constant, and M is the mass of its primary, since we can ignore the mass of the planet as compared with its primary. We get then $r^3 = k'RM$, where k' is a new constant. But $M = \frac{4}{3}\pi\rho r^3$ where ρ is the mean density of a planet. Thus we get $R\rho$ = constant. This is what M. Ollive's formula amounts to. In other words, his formula does not derive any generality by the introduction of the satellites. The fact that his results for the various satellites of any given primary agree *inter se* is merely Kepler's third law.

The value of M. Ollive's "empirical" formula is thus to be measured by the extent to which the formula ρR = constant is true of the planets of the solar system. As it happens, this is at all approximately correct only for Earth, Mars, Jupiter, and Saturn. The densities as generally accepted are, taking the planets from Mercury outwards, 0·85, 0·89, 1·00, 0·71, 0·24, 0·13, 0·22, 0·20. The density of the earth is taken as the standard. M. Ollive's formula gives 2·58, 1·39, 1·00, 0·66, 0·19, 0·10, 0·05, 0·03. It is evident that M. Ollive's "empirical" formula is quite wrong for all but the four planets mentioned, and even for these the agreement is by no means encouraging.

It may be urged that the densities are not observed directly, but are inferred from the masses and the radii of the planets, so that a small inaccuracy in the observed radius of any planet may well account for a considerable error in the inferred density. But I very much doubt whether astronomers will be ready to admit possible errors of 50 per cent. in the radius of Uranus and 100 per cent. for Neptune. They will certainly decline to concede an error of 50 per cent. in the radius of Mercury and of 12 per cent. in the radius of Venus.

SELIG BRODETSKY.

University of Bristol, March 3.

An Optical Representation of Non-Euclidean Geometry.

LET us suppose Euclidean space to be filled with a medium of variable refractive index. Then to an observer in that medium the curved path of a ray of light will present all the appearances of a straight line, and, further, if the observer estimates the distance between two points by the time light takes to pass between them, this path will appear to be the shortest distance between the two points.

Suppose now that one or more such observers conduct an Ordnance Survey of the region occupied by the medium, using theodolites to measure angles, and imagine them to be equipped with instruments capable of measuring the time interval occupied by optical signals in transmission from one station to another, this interval being used as a measure of the distances between the stations. It is clear that these observers will obtain what to them must be a convincing proof that the sum of the three angles of a triangle cannot possibly be always equal to two right angles. And it would not be easy for an individual whose methods of observation of the geometrical properties of such a region were limited to those here assumed to believe that the space in which he lived could contain a Euclidean geometry.

G. H. BRYAN.

NATURE RESERVES.

IT is only too true that man is slowly but surely destroying the beautiful wild animals and plants of the world, and is substituting for them queer domesticated races which suit his convenience and his greed, or else is blasting whole territories with the dirt and deadly refuse of his industries, and converting well-watered forest lands into lifeless deserts by the ravages of his axe. It is not too late to rescue here and there larger and smaller areas from this awful and ceaselessly spreading devastation. In remote lands there are large tracts which may be taken in charge by the local government and rescued from destruction, and to some extent this has been done. Even in our over-crowded European states there are still lovely bits of forest, marsh-land, and down which man has not yet irretrievably befouled, and from which he has not yet driven by assault nor removed by slaughter the beautiful living things which nature has guided and nurtured in their seclusion. There is yet time! Some of these little scattered fragments of our great mother's handiwork can still be preserved even in England, Wales, Scotland, and Ireland, so that future Britons may not utterly curse us, but enjoy, with gratitude to those who saved them, the precious living relics of the world as it was before man destroyed it.

There must be many who have in these days

learnt to know the difference between "the country" and the "wilderness," and have discovered the rare and over-powering charm of the latter. The "country," with its manured fields, its well-trimmed hedges, and artificial barriers, its parks planted with foreign trees and shrubs, its roadways stinking of tar and petrol, and its streams converted into chemical drains or else into over-stocked fish-stews, is only rendered less repulsive than the town by the survival here and there of a pond or a copse or a bit of ancient moor-land (happily too swampy for golfers) where nature is still allowed to pursue her own way without the arrogant interference of that prodigiously shameless barbarian, the "civilised" man.

Who does not know the charm of the real wilderness—far from the madding crowd—still accessible, even in southern England, to those in the secret? It is perhaps most directly to be found on a sea-shore bounded by sand dunes and marsh lands, or overhung by rocky cliffs on the untamed summits of which strange plants and legendary birds still linger. It is the real and effective absence of the marplot man which gives its vast beauty and fascination to that world protected by the great sea which is exposed as the tides withdraw from the rocks and pools. Here the passionate lover of nature seeks the unparalleled joy of contact with her, unsullied by human trail. And he finds it, too, in the desolate marshes, the remote sand-wastes of our coasts and estuaries, as well as in the still-surviving moorlands of the north. Plants of many kinds, the insects which depend on them, and timid birds—all of which perish in the presence of civilised man—are still to be seen in these precious and adorable sanctuaries. Even an old-time pond, undisturbed by man's improvements, is for the naturalist who can use the microscope a real "nature-reserve" full of the mystery and beauty of isolation.

It is proposed to secure by purchase or gift the right to preserve from destruction in this country as much and as many as possible of the invaluable surviving haunts of nature. A society has been formed for the promotion of nature reserves. It is in cooperation with societies and individuals having a like purpose in other European countries and in other continents, and has already sent representatives to an international conference recently held at Berne, which was attended by delegates from eighteen countries, and was the means of effecting an important exchange of views as to purposes and methods. The Speaker of the House of Commons is the president of the Society, Mr. Ogilvie Grant and the Hon. F. R. Henley are its secretaries. Its official address is "The Natural History Museum, Cromwell Road," and on its council we find such influential public men as Sir Edward Grey, and Mr. L. V. Harcourt, the two Secretaries of State, and many of our leading naturalists such as Profs. Bayley Balfour, J. B. Farmer, Edward Poulton, Sir David Prain, Sir Francis Darwin, and the Hon. Charles Rothschild.

The main objects of the Society for the Promotion of Nature Reserves, more explicitly stated, are "to collect and collate information as to areas of land in the United Kingdom which retain their primitive conditions; to obtain these areas, and to hand them over to the National Trust, and thus to preserve for posterity as a national possession some part, at least, of our native land, its fauna, flora, and geological features." It is hoped that naturalists and lovers of wild life in every district will keep a watchful eye on primitive and unspoilt tracts, and bring them to the notice of the society by writing to the secretary at Cromwell Road. Often such areas, if sought in good time, may be purchased at a low rate per acre; often local interest and public spirit as well as individual generosity, will facilitate the acquirement of the purchase-money, whilst "the National Trust" has proved itself a capable guardian, and will accept the trusteeship of such "reserves" with the necessary conditions imposed by the Society as to the absolute preservation of their natural conditions. No doubt there may be some care needed in arranging for the occasional admission of visitors to these reserved lands so as to avoid the access to them of too large a concourse, or of persons who are merely bent on holiday frolics—no less than of those who, actuated by the cupidity of the collector, would root out and destroy, under the false pretence of being naturalists and nature-lovers, all the rarer living things, as they have done in so many unprotected spots.

Already a beginning has been made in England. A part of Wicken Fen in Cambridgeshire has been acquired for the nation; also the shingle and salt-marshes of Blakeney in Norfolk. Near Oxford, too, there is a "Ruskin Reserve."

In foreign countries the government has long been active in the way of establishing "reserves," especially where, as in the United States, there are large tracts of uninhabited country. In Germany there is a department of State to control and assist in the preservation of nature, having a very large annual budget. There are already 100 reserves in that country. The yew and the holly are protected in the Government forests, and none may be cut: whilst the service tree is also protected. In this country we have no department of forestry, no knowledge or practice of forestry, and we shall very soon have no forests. The incapacity and want of authority in this subject which has been allowed to grow up in the British official world is lamentable, and was characteristically exhibited in the proceedings of the recent commission on Coast Erosion.

In Germany military exercising grounds and rifle ranges are made into nature reserves so far as is possible and consistent with their military use. The same thing might be, and should be, done in this country. There is no Government department in this country which can either advise or control in such matters. Commons, when taken over by public authority for preservation, should not be utterly drained of water and converted into

London parks, as has been the case at Hampstead, where the small bog above the Leg of Mutton Pond, in which grew the Sun-Dew (Drosera) and the Bog-bean (I used to visit them there!) might well have been left as a bog for the delighted contemplation of London naturalists. There was plenty of dry ground on Hampstead Heath without destroying the bog. There is danger of all such open spaces being converted into a common-place garden or a football field or a golf course unless the new society can extend its protection to them.

The purpose of this article is to invite all lovers of the wilderness, all worshippers of uncontaminated nature, to enter into communication with the Society for the Promotion of Nature Reserves, and see how far they can help in promoting its most worthy national objects.

E. RAY LANKESTER.

P.S.—The following series of inquiries issued by the Society for the Promotion of Nature Reserves will enable the reader to appreciate its purposes and mode of going to work.

Answers will be treated as strictly confidential, and will be at the disposal of the executive committee only. Name of Place. District and county where area is situated. Name and address of society or person giving information. (A) Is the suggested area worthy of permanent preservation as:—(1) A piece of typical primeval country? (2) A breeding-place of one or more scarce creatures? (3) A locality for one or more scarce plants? (4) Showing some section or feature of special geological interest? (B) Is the place recommended primarily for birds, insects, or plants? (1) To whom does it belong? (2) Would the owner be willing to sell, or could the area be leased? (3) Could you get local financial aid should it be considered desirable to acquire the area? (4) Is the place or site locally popular as a pleasure resort? This form should be filled up and returned to the secretary, Society for Promotion of Nature Reserves, c/o Natural History Museum, Cromwell Road, London, S.W.

GOVERNMENT LABORATORY REPORT.[1]

FROM the report of the Government Chemist,[1] issued a short time ago, it appears that the work of the Department increased considerably during the year 1912–13. The total number of samples examined was 209,502, as compared with 195,170 in the previous year.

It is noted that many questions of a consultative and advisory nature, apart from those connected with the examination of samples, are referred to the laboratory by various Government departments. Above 600 such references were dealt with during the year. They included such diverse matters as the causes of the deficiency in the non-fatty solids of milk; the relation between the citric acid solubility and the availability of the phosphates in slags; the selection of suitable denaturants for growing tobacco; stamps for National Health Insurance; and the supply of lime juice to the mercantile marine.

In connection with the attempts to cultivate tobacco and sugar in this country, it is interesting to note that 224 samples of home-grown leaf tobacco were examined, and also specimens of beet-juice, sugar, and molasses from the recently erected beet sugar factory at North Cantley.

Imported dairy produce was generally satisfactory as regards freedom from adulteration. Thus fresh (pasteurised) milk was not below the statutory regulations for quality, and contained no preservatives or artificial colouring substances. Imported butter, of which 1223 specimens were analysed, occasionally contained a small excess of water, but gave no evidence of the presence of fat other than butter fat.

In connection with the supervision of dangerous trades, a large number of lead glazes, dust, and other articles were analysed. From works where lead poisoning had occurred, fifty-eight specimens of lead glaze were taken; in most of these nearly the whole of the lead was in a soluble form, and therefore readily dissolved by the acids of the gastric juice. The principal chemist notes also that important investigations were conducted during the year for the Home Office Committees appointed to consider questions concerning (1) celluloid, and (2) the use of lead compounds in the painting of buildings and coaches.

A large part of the report is devoted to an account of the work done by the laboratory in exercising chemical control over the production and sale of dutiable articles. The account is accompanied by brief outlines of the reasons for this control, and shows how it is exercised. For example, it is explained that the duty on beer brewed in this country is charged on the wort or unfermented saccharine liquid from which the beer is brewed; that the basis of the charge is a statement made by the brewer as to the quantity of materials used and unfermented wort produced, and that the accuracy of this statement can be checked at any time subsequently by analysing the fermented wort. That there is some need for such control is shown by the fact that out of 11,641 samples examined, 1628 were found to have been "declared" at less than their true value. In this and numerous similar ways the laboratory has become an indispensable ancillary of the fiscal departments.

The report shows steady progress of the laboratory, and records a useful year's work.

[1] The Report of the Government Chemist upon the work of the Government Laboratory for the year ended March 31, 1913. (Cd. 7001). Price 3d.

NOTES.

THE meeting of the Royal Society on March 19 will be a meeting for discussion, the subject being "The Constitution of the Atom." The discussion will be opened by Sir Ernest Rutherford.

MR. LAURENCE BINYON, assistant-keeper in the British Museum in charge of the sub-department of Oriental Prints and Drawings; Dr. R. M. Burrows, principal of King's College, London; and Mr. A. G. Lyster, president of the Institution of Civil Engineers, have been elected members of the Athenæum Club under the provisions of the rule which empowers the