

	5p $^3D_1$ 65876 200.2	5p $^3D_2$ 65676 2083.6	5p $^3D_3$ 63592	5p $^3P_0$ 64553 942.5	5p $^3P_1$ 63610 1079.6	5p $^3P_2$ 62530
5s $^3P_0$ 84059 397	18183.4 (10)				20449.4 (8)	
$^3P_1$ 83662 2381	17786.0 (5)	17986.0 (10)		19109.6 (8)	20052.1 (9)	21131.7 (10)
$^3P_2$ 81281	15406.0 (4)	15606.2 (4)	17689.3 (10)		17671.6 (8)	18751.3 (10)
5s $^1P_1$ 79972					16360.3 (10)	17441.2 (6)

has been studied using Lummer plates and etalons. Although it is found that the classification of the lines given by Tolonsky is not correct, the value of  $3/2$  for the nuclear spin moment is confirmed (Tolonsky, *Nature*, **129**, No. 3261, 652).

Details of the work will be published elsewhere.

A. S. RAO.

Solar Physics Observatory,  
Kodaikanal,  
July 22, 1932.

## Research Notes.

### Adsorption of Gases.

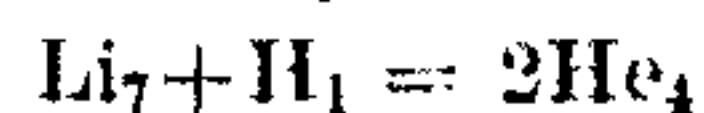
AT the general discussion on adsorption of gases held by the Faraday Society, emphasis was laid on two types of adsorption, activated adsorption and adsorption of the Van der Waals type. Activated adsorption or "Chemi-adsorption" takes place at high temperatures and the heat associated with it is roughly ten times that developed during the Van der Waals type adsorption which is a low temperature phenomenon.

The importance of the work of Volmer and his school on the mobility of adsorbed molecules, the promising use of thermionics in adsorption problems, the discontinuous nature of adsorption curves were other features brought out during the discussion. Special mention may also be made of the theory of Lennard Jones which satisfactorily explains a number of adsorption phenomena.

### Disintegration of Elements.

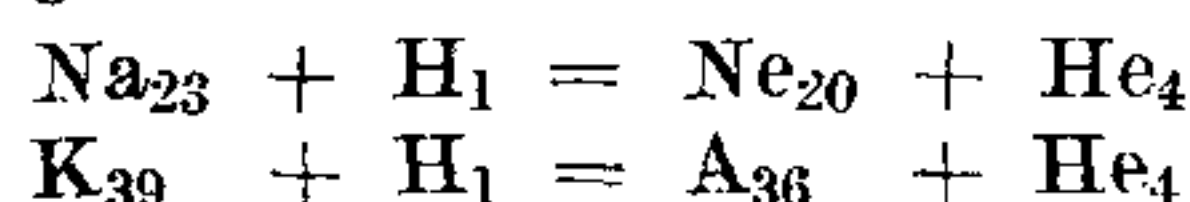
COCKCROFT and Walton have recently described their experiments (*P.R.S.*, **137**, 229, 1932) showing that protons of energy over 150,000 volts are capable of disintegrating many elements.

Positive ions from a hydrogen canal ray tube, falling through voltages upto 600 kilovolts, hit a target of the element to be investigated. The source of error due to the emission of the secondary electrons, which have energies below 20 volts, is eliminated by applying a magnetic field of about 700 gauss to the target. The secondary radiation for Lithium is shown to consist of particles with a range of about 8 cms. This range does not alter by varying the accelerating voltage between 250 and 500 kilovolts. By the use of the Shimizu expansion chamber and Williams-Ward ionization-chamber method, these particles have been identified as  $\alpha$ -particles, produced by the disintegration of  $Li_7$  into two  $\alpha$ -particles under proton bombardment:



The decrease of mass in the disintegration corresponds to an energy liberation of  $(14.3 \pm 2.7) \times 10^6$  volts, which is in agreement with the observed energies of the  $\alpha$ -particles. The probability of the proton penetrating a lithium nucleus according to Gamow's theory (*Zs. f. Phys.*, **52**, 510, 1928) is higher than their observed value. The authors are attempting to improve their experimental technique.

Lithium, Boron and Fluorine yield the largest emission of  $\alpha$ -particles and they are all of the  $(4n+3)$  type containing perhaps nuclei of  $\alpha$ -particles with the addition of three protons and two electrons. Certain other elements have been disintegrated and the results will be clear from the following reactions:—



#### The Relation of the Duodenal Mucosa to the Internal Secretion of the Pancreas.

LAUGHTON and Macallum (*P.R.S.*, Ser. B., **3**, No. 769, 1932) have succeeded in the separation of an active principle from the duodenal mucosa of rabbits, dogs, hogs and cattle which in its physiological properties differs from secretin and insulin. In the experiments conducted by them, they establish that this new substance has no effect on the external secretion of pancreas, but has a hypoglycæmic effect different, however, from insulin. It has practically no effect on the blood sugar when injected into the totally depancreatized dog, but manifests a decided influence in reducing the sugar of a partially depancreatized dog in which hypoglycæmia is experimentally induced, causing the blood to return rapidly to the normal level. It has no hypoglycæmic effect, like insulin in normal animals. It is assumed that this preparation stimulates the islets of Langerhans to secrete insulin. The paper discusses the probability that this substance is in the nature of an insular hormone whose physiological effect on the internal secretion of pancreas takes us a step forward in the control and treatment of diabetes mellitus.

#### The Absolute Measurement of High Electrical Pressures.

In a paper in the *Journal of the Inst. of Electrical Engineers*, Prof. W. M. Thornton and W. G. Thompson describe a method in which the polarization of a metallic Ellipsoid of Revolution, suspended by an insulating fibre between vertical circular pole plates is used to measure high electrical voltages up to 200,000 volts. The measurements of voltages by this method have been compared with sphere gap determination of voltage. Continuous measurements of voltages up to 200,000 volts can be made with the precautions indicated in the paper to an accuracy of at least 3 parts in 1,000.

#### Absorption of Water by Root System of Plants.

[Paul J. Kramer. *Amer. Jour. Bot.*, **39**, 148, 1932.]

FROM earliest days of Plant Physiology, workers have taxed their ingenuity to explain the absorption of water and of root pressure in Plants. The various theories put forth from 1832 to 1930 bearing on the problem vary widely in the importance attached to activity of the living cells of the root. However, they fall under two lines, either the living cells of the roots play the important part, or the physical forces concerned operate independent of the living cells. The experiments conducted and described by the author throw further light on the actual rôle of the living cells of the roots. Under conditions of reduced transpiration the water absorbed moves from the soil to the conducting vessels by osmosis across the differentially permeable multicellular membrane—the living cortex of the root—and accumulation of the water in the vessel developing a positive root pressure. Such positive pressures were manifested at the cut ends of stems, only when the roots were alive. Tips of plants with dead root system, remained alive for several days. Plants with root systems killed and suction applied at the cut end of the stem absorbed water for a few days as though the root system was alive. The rôle of the living cells of the roots in such



absorption processes is apparently a passive one. They are important as absorbing surfaces in preventing the entry of air into the vessels, and in extending the area of absorption by growth.

#### The Gondwana System.

THE recent memoir (Vol. LVIII) by Dr. C. S. Fox on "The Gondwana System and related formations" forms one of a series of four memoirs dealing with "Coal in India" proposed to be published by the Geological Survey of India. The present memoir is a summary of all the available information on the Gondwana system, brought up-to-date as far as possible, so as to include the results of the most recent work on some aspects of this subject by eminent palaeontologists like Dr. Cowper Reed and Prof. A. C. Seward. There is a thorough discussion of the problem of the classification of the Gondwana system, and a revised classification, which may be considered satisfactory in the present state of our knowledge, is suggested in a tabular form (Plate 9) accompanying the memoir. The author has also referred to the palaeo-geography and climate of the Gondwana land, and has endeavoured to depict the changes in the distribution of land and water in India during the Gondwana era by a series of four maps. The author is of opinion that considering the great lapse of time—150 million years—the geographical changes during the Gondwana era are remarkably small and that the general distribution of land and sea, according to present-day conceptions, was relatively constant throughout the period.

#### Neutrons in the Atmosphere.

IN a letter to *Nature* (130, 57, 1932) Moon, in an attempt at evaluating the neutronic concentration in the atmosphere shows that the presence of neutrons brings about an apparent decrease of the Newtonian gravitational constant with increase of temperature. Combining the experimental results of Shaw (*Phil. Trans.*, 216, 349, 1916) with his own approximate formula for the partial

pressure of neutrons in the atmosphere, he finds that with the neutronic data available at present the partial pressure is of the order of  $10^{-6}$  atm.

#### Periodic Failures and the Punjab American Cotton Crop.

IN some years the Punjab American Cotton Crop has been afflicted with an unknown disease, the damage caused by which exceeded 5 million pounds sterling. It was fairly general over the Punjab Province in 1919, 1921, 1926, 1927 and 1928. Roger Thomas ("Periodic Failures of the Punjab American Cotton Crop," *Agriculture and Live Stock in India*, Vol. 2, Part 3, May 1932) from his investigations is of the opinion that the basic cause of these crop-failures in the Punjab is the cotton white fly (*Bemisia gossypiperda*).

The paper describes the distribution and life history of this pest. Comparisons of the damage done by this pest in cage experiments and the symptoms of the disease are outlined. The intensity of the white fly in any year is believed to be largely controlled by rainfall during the months of May to August and also by predators and parasites.

This explanation of the cause of the failure of cotton crop is not generally accepted by cotton research workers in India or by the Punjab Agricultural Department.

The author describes economic and practical methods of controlling the white fly, which he has applied on a commercial scale in the plantations of the British Cotton Growing Association. The method includes: (a) spraying the crop during the months of July and August with rosin-soda compound, (b) manuring the crop at flowering stage (end of August or early September) with a light dose of nitrogenous manure, (c) delay the sowing until late in May or early in June, and (d) breeding strains relatively immune to white fly attack.

#### Laboratory Lightning Doubled in Voltage.

(*Electrical World*, June 18, 1932.)

At the Pittsfield Works Laboratory of the General Electric Company 10,000,000 volts



have been artificially produced by the Lightning generator designed by Mr. F. W. Peek, Jr. This lightning forms a 60 ft. arc and has a capacity of 50,000,000 KW. discharged in one microsecond across a sphere gap. The maximum current delivered during discharge after the resistance of the air has been broken down is 50,000 Amps.

In 1929 artificial lightning discharges of 5,000,000 volts were attained at Pittsfield. Similarly 1,000,000 volt, 60 cycle, 3 phase arcs were produced.

#### Locomotor Organs of *Echinarechinus parma*.

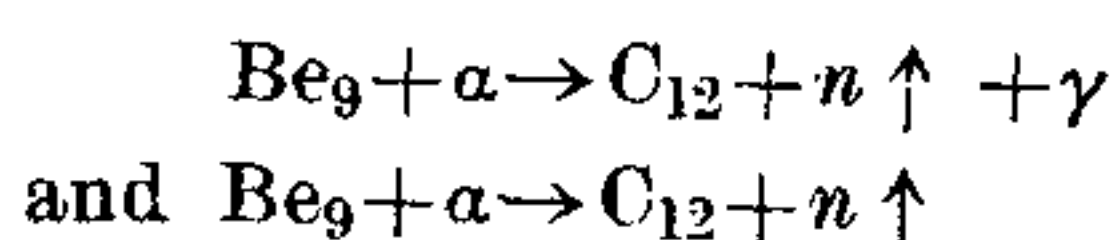
[Parker George H. and Margaret Van Alstyne. *Biol. Bull.*, 62, 195, 1932.]

THE method of locomotion in *Echinarechinus Parma* is described for the first time. Of the three classes of organs, integumentary cilia, tube-feet and spines suspected of having to do with locomotion, integumentary cilia do not play any significant part in the process as they cover only the tips of the short spines and the sides of the long ones. The tube feet which are provided with suckers are important in locomotion only to a limited extent in that they pile up sand on the aboral surface. Spines, which are of two types, short and long, are best developed over the anterior portion of the oral surface. Waves of co-ordinated spine movement enable the animal in forward locomotion, burrowing and righting.

#### Radiations Excited by $\alpha$ -Rays in Light Bodies.

IN *Comptes Rendus*, 194, 2208, 1932, Mme Irene Curie, M. F. Joliot and M. P. Savel describe experiments in which beryllium and lithium were bombarded with  $\alpha$ -rays and the properties of the emitted neutrons were studied. This was accomplished by making the neutrons pass through paraffin and determining the range of the H-rays produced. When the neutrons were emitted forwards, i.e., in the direction of the incident  $\alpha$ -rays two different groups

of H-rays were observed, having respectively the ranges 43 and 110 mg./cm.<sup>2</sup> of Al which correspond to 28 and 70 cm. in air. The more penetrating H-rays were not observed when paraffin was replaced by carbon. From the presence of the two groups of H-rays, the authors infer the production of two groups of neutrons having the velocities  $2.94 \times 10^9$  and  $3.84 \times 10^9$  cm./sec. i.e., having energy equal to  $4.52 \times 10^6$  and  $7.8 \times 10^6$  eV respectively. These results are represented by the reactions :



In the first case the neutrons had a small velocity but at the same time secondary rays corresponding to  $\gamma$ rays of energy between 2 and  $4.5 \times 10^6$  eV were observed. Hence the conclusion that the liberated energy gives rise to neutrons of large velocity in the second case and to neutrons of smaller velocity together with  $\gamma$ -rays in the first case.

When the neutrons are shot backwards i.e., at angles of  $120^\circ$  to  $180^\circ$  with the direction of the incident  $\alpha$ -rays, two groups of H-rays of ranges 26-32 and 7-10 cm. are to be expected, but only one group having a range lying between these limits was observed. The range was 35 mg./cm.<sup>2</sup> of Al which corresponds to 23 cm. of air. This result is explained by the authors as possibly due to the low accuracy of the measurements in this case. They also think that the presence of a group having the maximum range 40 cm. as found by Chadwick (who obtained two groups corresponding to 22 and 40 cm. whether the neutrons were shot forward or backward) is doubtful in view of the proton absorption curves obtained by the present investigators.

Assuming the above reactions and taking the mass of the neutron as 1.006 (a value deduced from the reaction,  $\text{B}_{11} + \alpha \rightarrow \text{N}_{14} + n \uparrow$  assuming  $\text{He}=4$ ) the mass of  $\text{Be}_9$  has been found to be 9.006. From this they conclude that the energy of binding of the  $\alpha$ -particles and neutron forming the  $\text{Be}_9$  nucleus is very small.



### Anatomy and Micro-Chemistry of the Cotton Seed.

[R. G. Reeves and C. C. Valle. *Bot. Gaz.*, **93**, 259, 1932.]

THE Cotton seed once regarded as worthless has taken a prominent place among the agricultural commodities, since the recognition of the uses of cotton seed products. The previous investigators disagree as to the localization of certain chemicals and oils in the seeds, the extraction of which presents various types of problems. The present work was undertaken to get accurate knowledge of some of the debatable problems pertaining to the subject. Young ovules and mature ovules of American upland cotton were studied in addition to Pima and Sea Island cottons. The anatomy of the ovules, layer by layer, has been described and illustrated with sketches. The embryos, both young and old, are found to contain traces of starch in addition to oil. The commonly noticed pentosans occur in the resin glands which contain other substances also. At maturity endosperm cells contain small quantities of starch and an abundance of protein and oil; the perisperm is referred to by Winton as the remaining epidermis of the nucellus. The integuments are free from starch before maturity. The pigmentation of the cells of the palisade and epidermal layers is associated with a hardening protoplasm. The palisade layer is part of the inner integument and contains cellulose and lignocellulose.

### Urease Content of Leguminous Seeds.

SOYA bean and Jack bean have been extensively employed as sources of urease, but the possibility of the existence of richer sources of the enzyme has not so far been explored. With this object in view, Sundara Iyengar and Sastri have examined more than thirty commonly occurring leguminous seeds belonging to different suborders and have arrived at certain interesting conclusions. Among the seeds examined, *Pongamia glabra* showed the highest urease activity; *Dolichos biflorus* and *Cajanus indicus* came next. Narayana Menon and Narayana Rao (*Ind. J. Med. Res.*, **19**, 1077,

1932) have, independently of this work, shown that *Dolichos biflorus* is as rich a source of the enzyme as Soya bean. *Pongamia glabra* thus constitutes one of the richest sources of urease.

### Twinning in Plagioclase Felspars.

THE two papers on the application of Federov methods for the study of the twinning of Plagioclase Felspars, recently published by A. L. Coulson (*Rec. Geo. Sur. Ind.*, **65**, Pt. 1) are of considerable interest. In the first paper dealing with the zoning and difference in composition of twinned Plagioclase Felspars in certain rocks from Sirohi State, Rajputana, ten instances of the difference in composition of the individuals of twinned Plagioclase Felspars have been described, and it has been pointed out that "the difference in composition between individuals forming a twinning combination is not always evidenced by zoning and this leads one to doubt determinations of composition based solely on observations of the zone perpendicular to the twinning plane." In the second paper dealing with the Albite-Ala B twinning of Plagioclase Felspars in certain acidic rocks from the same area, the author points out, that out of ten twinning combinations measured in the Plagioclase phenocrysts of dellenites and porphyries from one locality, six contained the Albite-Ala B complex; and all the Albite-Ala B complexes had a composition of about 33 per cent An.—which composition appears to be peculiarly favourable for the formation of this complex.

### The Structure of *Vertebraria*.

*Vertebraria*, like *Glossopteris*, is one of the commonest and most characteristic plant-fossils of the Lower Gondwana (Upper Carboniferous and Permian) rocks of India and the Southern hemisphere. But its structure and affinities have long been a problem. Originally regarded as one of the Equisetales, it was later suspected to be the stem of a fern. The latter view was influenced by the discovery of specimens bearing leaves of the *Glossopteris* type, which were then believed to be fern fronds. More recently the view has gained ground that *Glossopteris*,



and therefore *Vertebraria*, belong to seed-bearing plants. Prof. Walton of Glasgow and Miss J. R. Wilson have recently thrown some light on the structure of *Vertebraria* (*Proc. Roy. Soc. Edin.*, 52 (ii), 8, 200, 1932). With the help of Walton's cellulose peel method it has been shown that the greater part of the axis consisted of secondary wood of the gymnospermous type. The tracheids are provided with multiseriate bordered pits, which may be either opposite or alternate; the medullary rays are narrow, and in the area common to a medullary ray cell and a tracheid several bordered pits are present. The primary wood and pith (if one was present) appear to have been very poorly developed. In specimens preserved at right angles to the planes of bedding the thin plates of tissue radiating from the centre represent the much-compressed wedges of secondary wood. In the living plant these wedges must have nearly filled the large triangular spaces between them, leaving room only for the medullary rays. The present work thus supports the view that *Vertebraria* belongs to a seed-plant.

#### A Fossil Dicotyledonous Wood, Devoid of Vessels, from the Rajmahal Hills.

Sahni describes under the name *Homoxylon rajmahalense* gen. et sp. nov. (*Mem. Geol. Surv. Ind., Palaeont. Indica*, N.S. 20 (2), 1, 1932) what is no doubt an angiosperm wood of an archaic type. It resembles *Drimys*, *Trochodendron* and other members of the

primitive Ranalean plexus in the absence of true vessels, the pitting of the tracheids, the structure of the medullary rays and in other features. The age of the fossil is believed to be Jurassic, but is not known with certainty.

#### A Comparative Study of the Phosphagens with some Remarks on the Origin of Vertebrates.

[O. M. Needham, J. Needham, E. Baldwin and J. Yudkin, *P.R.S.*, Ser. B. 110, No. 767, 1932.]

SUBSEQUENT to the discovery of labile phosphorus in muscular tissue by Eggleton and Eggleton (1927), it has been practically assumed that arginine phosphate is characteristic of invertebrates while creatine phosphate is characteristic of *Cephalochorda* and *Vertebrates*. The usual Fiske and Subbason (1929) method with the various modifications thereon have been followed. Practically examples of every group have been experimented upon and it should be noted, however, that *Balanoglossus* and *Echinoderma* contain both the kinds of phosphates, thus affirming Bateson's (1886) view of the affinity between *Echinoderma* and Chordata. Curiously the *Ctenophora* alone exhibit the presence of arginine phosphate in the phylum *Cœlenterata*. Further evidences are put forward to show that the arginine phosphate may be somehow associated with the ciliary movement.

### The Industrial Outlook.

#### Tea Fermentation.

THE essential characteristics of black tea are developed during the fermentation process. The exact nature of the chemical changes involved or even the agency responsible for fermentation is still obscure and until scientific research clarifies the situation, rigid control of the process cannot be hoped for or replace the existing arbitrary standards based on visual and sensory judgments.

A certain degree of insight has, however, been obtained by the work done in several

countries. Thus it is known that fermenting leaf requires oxygen, indicating that some component of the leaf is oxidised. The absorption is rapid at first but gradually slows down and the time-oxygen consumption curve is similar to curves representing enzyme action. At the same time carbon dioxide is evolved but the course of respiration is not normal. The free tannin content of the leaf decreases as also the total soluble constituents and starch. Nitrogenous compounds do not appear to take part during the fermentation. Tea tannin is capable of forming red derivatives called phlobaphenes