

gaseous form, are subject to a disturbance of a tidal character as a matter of course. The author argued that a disturbing body would therefore raise a tide on the sun more than one hundred times greater than the same force would raise it if acting on a globe the size of the earth, the other circumstances being the same. Looking at the sun-spot numbers as a record of spring tides and as a first approximation, recognising only such tides as would be due to the conjunction and opposition of Venus and the earth, it remained to establish a relation between these tides and the tide due to Jupiter in the form of special tides varying in magnitude with the sun-spot numbers.

On a New Integrating Anemometer, by H. S. Hele Shaw and Dr. Wilson.—An ordinary Robinson's cup anemometer is used to drive a train of wheels and thus ultimately a serrated roller, which moves a board in the direction of, and with a velocity proportional to, that of the wind. On the board, which is horizontal and about two feet square, is placed a sheet of paper, upon which the roller presses, and in turning leaves the required trace, at the same time moving the paper underneath it. The board is prevented from having a rotary motion by means of a pair of frames, the upper moving by means of wheels on the lower, each of which can only move in one direction, and these directions are perpendicular to each other. By a clockwork adjustment the time element is able to be introduced, which, taken in connection with space, gives velocity. A method of performing this was shown, as also a proposed form of the instrument for observatories.

On a Universal Sunshine Recorder, by G. M. Whipple.—The author gave a description of a new form of card-supporter for the Campbell sunshine recorder. It consisted of a light frame capable of holding the slip of cardboard, to be burned by the sun in any position. It was arranged so as to receive ordinary parallel strips of card at all times of the year, and to allow of the instrument being employed on any part of the earth's surface without detriment to its efficiency. The card-holders themselves are movable, so as to permit of the cards being changed indoors or dried, if wet, before removal, in order to avoid mutilating the record of the observation. The instrument also has an appliance for placing the card correctly in position to receive the sun's image.

On the Calibration of Mercurial Thermometers by Bessel's Method, by Prof. Rucker.—The author stated that the late Mr. Welsh of Kew Observatory described to the British Association in 1853 the methods which he introduced of making and correcting mercurial thermometers. The correction with which the author dealt was that due to the variations in the bore of the tube. Mr. Welsh's method of making this correction, which is still employed at Kew, is less theoretically perfect than others, and has been unfavourably criticised abroad. The author, in conjunction with Prof. Thorpe, has recently corrected a number of thermometers with great care by Bessel's method, which is the most elaborate and perfect hitherto proposed. One set of three thermometers were made for them at Kew, and were calibrated according to Welsh's method. Afterwards the measurements necessary for the application of Bessel's method were made by the Kew authorities, the calculations being performed by the author and Prof. Thorpe. The Kew thermometers were thus subjected to the most rigorous possible test, and they were able to announce that in one instrument the errors left after the application of Welsh's method were not greater than four-thousandths of a degree Centigrade, and in no case did they exceed one-hundredth of a degree. As it is impossible to read on these thermometers less than a hundredth of a degree with certainty, Welsh's method, as applied at Kew, is practically perfect.

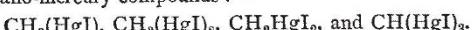
SECTION B—CHEMICAL SCIENCE

On a Process for Utilising Waste Products and Economising Fuel in the Extraction of Copper, by J. Dixon (Adelaide, South Australia).—This paper contains an account of a process for extracting copper from sulphurous ores, in which the heat generated by the combination of the oxygen of the air with the sulphur of the ore is utilised for the smelting of the ore. This process is based upon experiments, which, although the author regards as incomplete, show (1) that the charge grows visibly hotter by simply blowing air through it; (2) that the melting of the raw ore or regulus and its reduction can be carried on in the same furnace; (3) that if the ore is in lumps, and fed at the top whilst the air is admitted by the side, a prac-

tically clean slag can be obtained; but if added in a coarse powder, as it is generally found in the market, it either blows out again or chokes the furnace; (4) that a rough copper of about 96 per cent. pure metal can be obtained by the successful working of this process.

On the Chemical Action between Solids, by Prof. Thorpe, Ph.D., F.R.S.—The author drew attention to the extremely rare instances of such action hitherto observed, showing how many of these might be explained on the supposition that combination actually occurred between the bodies either in solution or in a state of gas. For example, the formation of cement steel, by the combination of carbon with iron, which had long been adduced as an example of such combination between solids, was now explained by the fact that iron at a high temperature was permeable to gases, and that in the actual process of cementation oxides of carbon were formed, which were in reality conveyors of carbon to the metal. He then illustrated by experiments the formation of several compounds by bringing together the components in solid form, choosing as examples such as would manifest their formation by characteristic colouring. Thus, as instances, potassium iodide and mercuric chloride, potassium iodide and lead nitrate, and silver nitrate and potassium chromate, were powdered together in a mortar, and in each case evidence of an action was exhibited by the production of characteristic colours of the product of the reaction of these compounds. The author referred to the memoir of the Belgian physicist, Prof. Spring, on the same subject, some of whose experiments he had repeated and in the main confirmed. One of the most remarkable results obtained by the Belgian professor was the formation of coal from peat by subjecting the latter material to a high pressure. Peat from Holland and Belgium, when exposed to a pressure of about 6000 atmospheres, was, according to Spring, changed into a mass which in all physical characters resembled ordinary coal. Experiments of the same nature made by Dr. Thorpe with various samples of British peat yielded, however, a very dissimilar result. These experiments were made with pressures which were considerably less and more than those employed by Spring. Although solid, compact masses, hard and very much changed in structure, were attained, in no case was any product obtained which could be confounded with bituminous coal. He said it was highly improbable, on purely chemical grounds, that mere pressure had been little more than an important factor in the transformation of woody matter into coal.

Metallic Compounds containing Bivalent Hydrocarbon Radicals, Part ii., by J. Sakurai.—This is a continuation of the work, an account of which was given at the last meeting (NATURE, vol. xxii, p. 448, or *British Association Report*, 1880). Dimercury methylene iodide, $\text{CH}_2(\text{HgI})_2$, is obtained by exposing methylene iodide with an excess of mercury to the action of light. It is a yellowish crystalline powder insoluble in ordinary solvents, but soluble in hot methylene iodide; it melts at 230° with partial decomposition. Iodine converts this compound into methylene iodine and mercuric iodide. This same compound is easily obtained by the exposure of the mono-mercuropound described last year (*loc. cit.*), mixed with mercury and mercuric iodide, to the sunlight. Hydric chloride reacts on dimercury methylene iodide, producing mercury iodomethide. The insoluble compound mentioned in the former publications (*loc. cit.*) the author regards $\text{CH}(\text{HgI})_3$, and therefore contains a trivalent hydrocarbon radical. We have thus the following series of organo-mercury compounds:—



On the Occlusion of Gaseous Matter by Fused Silicates at High Temperatures, and its Possible Connection with Volcanic Agency, by I. Lowthian Bell, F.R.S.

On the Siliceous and other Hot Springs in the Volcanic District of the North Island of New Zealand (with Photographic Illustrations), by W. Lant Carpenter, B.A., B.Sc., F.C.S. The author gives an account of his visit to this district in December, 1880; analyses of the water of many of the springs in the district are also given. The water of the springs in the neighbourhood of Lake Taupo were found to be chiefly siliceous; they are all more or less impregnated with free iodine, and possess a medicinal value. The water of one spring was found to be strongly impregnated with sulphates of iron and alumina. The water of the springs in the Hot Lake district of Rotona and Rotomahana contain large quantities of silica; the deposits from two of these form large siliceous terraces. The water of the springs in the White Island, which is the summit of an extinct volcano,

contains free hydrochloric acid in large quantities. The water of these springs deposits sulphur and sulphate of lime.

On the Two First Lines of Mendeleeff's Table of Atomic Weights, by W. Weldon, F.R.S.E.—The author draws attention to certain relations exhibited by the fourth and eighth powers of the atomic weights of the elements in these two lines of Mendeleeff's series. The atomic weights used to exhibit these relations differ but slightly from those generally accepted. The fourth powers of the atomic weights of the elements from lithium to fluorine, viz. lithium, beryllium, boron, carbon, nitrogen, oxygen, and fluorine, are, with the exception of carbon, related to one another as the whole numbers 1, 3, 6, 16, 27, and 54. In order to establish a similar relationship for the atomic weight of all these elements, it is necessary to raise their atomic weights to the eighth power; when the following relationship is found to exist :

$$\begin{array}{ll} \text{Li}^8 = 1\text{N}^8 = 2^8 \\ \text{G}^8 = 3^2 & \text{O}^8 = 3^6 \\ \text{B}^8 = 3^2 \times 2^2 & \text{F}^8 = 3^6 \times 2^2 \\ \text{C}^8 = 3^2 \times 2^3 & \end{array}$$

Similar relationships are established for the fourth powers of the atomic weights of the elements in the next line of Mendeleeff's table. The author concludes that, in the case of each of these fourteen elements some power of their atomic weight is a simple multiple of the corresponding power of the atomic weight of lithium; further, that this multiple is a function of 2 or 3, or of 2 and 3 combined.

Note on the Chrome Iron Ore of Japan, by E. Divers, M.D.—This paper contains a description and analysis of a specimen of chrome iron ore found in serpentine rocks, in the prefecture of Oita. Analysis shows it to contain magnesia, replacing ferrous oxide, and the formula $\text{MgO}_2\text{FeO}_2\text{Cr}_2\text{O}_8$ is attributed to it.

On the Oxides of Manganese, by V. H. Vely, B.A.—The author at the outset gives an historical sketch of the researches on this subject, in order to show how far it has been satisfactorily proved by them—(1) that manganese forms a series of definite oxides (apart from those present in manganic and permanganic acids); (2) that manganese dioxide forms a series of dioxides. An account is also given of the researches of Dittmar, Wright, and others on the conditions of formations of these oxides, and their behaviour when heated to various temperatures in certain gases. The author has studied the action of air, oxygen, nitrogen, and hydrogen at temperatures varying from 60°–200°, on an oxide having the formula Mn_4O_{11} . Hydrates of the following higher oxides, $\text{Mn}_{24}\text{O}_{32}$, $\text{Mn}_{24}\text{O}_{44}$, $\text{Mn}_{24}\text{O}_{45}$, $\text{Mn}_{24}\text{O}_{46}$, $\text{Mn}_{24}\text{O}_{47}$, have been prepared and analysed. When these oxides are heated in air or oxygen, at low temperatures, two changes are observed : (1) a loss of water of hydration; (2) an absorption of oxygen. When heated in nitrogen they are dehydrated, and at higher temperatures lose available oxygen. Heated in hydrogen, they are simultaneously dehydrated and reduced. The author regards these oxides as distinct chemical entities, and not mere combinations of molecules, or molecular compounds.

On the Inferences deducible from High Molecular Weights as exhibited by the Oxides of Manganese, by Prof. Odling, M.B., F.R.S.—In the course of his remarks Prof. Odling brought under the notice of the Section the various considerations which affected the determination of the relative weights of the reacting units of chemical substances. He contended that estimations of vapour-density had not had, and could not have, an absolutely determining influence, but thought these estimations always required to be checked by purely chemical considerations. In particular he referred to the cases of bodies which had two or more distinct vapour-densities—cases which were becoming added to daily. He expressed his entire concurrence with the views of the President of the Section as to the non-existence of two distinct forms of combination, atomic and molecular, and strongly opposed the notion that various metallic elements possessed a definite capacity of saturation. He brought forward various illustrations to show that the saturation capacity of both metallic and non-metallic elements was indefinite. He contended that the doctrine of atomicity furnished a very inadequate idea of the most important facts of chemical combination, and that the representation of atomicity notions by graphic formulae was highly misleading.

On Peppermint Camphor (Menthol) and some of its Derivatives, by R. W. Atkinson, B.Sc. (Lond.), and H. Yoshida.—This paper contains an account of the determinations of the physical properties of menthol ($\text{C}_{10}\text{H}_{20}\text{O}$), menthone ($\text{C}_{10}\text{H}_{18}\text{O}$), mentene ($\text{C}_{10}\text{H}_{18}$), and those of a hydrocarbon, $\text{C}_{10}\text{H}_{16}$, which

latter compound is obtained by the action of hydric iodide upon menthol and subsequent treatment with caustic soda and metallic sodium. The authors also discuss the constitution of the above compounds.

Note on the Occurrence of Selenium and Tellurium in Japan, by E. Divers, M.D.—The author draws attention to the fact that the presence of these two elements has been observed in Japanese sulphuric acid, and considers it probable that these substances occur in material quantities in Japan.

Note on the Sodium Alum of Japan, by E. Divers, M.D.—An analysis is given of a specimen of this substance; it occurs as an efflorescence on decomposing sodium albite, which contains pyrites scattered through it. It is found in the province of Idzuno, in the prefecture of Shiniané, near the coast. It is said to occur in considerable quantities. It occurs in two forms, one massive, finely fibrous, greyish white and translucent, and the second in friable opaque tears, slightly coloured by iron oxide.

Brewing in Japan, by R. W. Atkinson, B.Sc. (Lond.).—The Japanese brewing process is divided into two parts comparable with the malting and brewing processes of beer-making. The mode of preparation and the properties of the diastatic materials are different in the two cases. The Japanese equivalent of malt or "köji" hydrates maltose in addition to cane-sugar, dextrin, and starch, and the ultimate products of its action on starch-paste are dextrose and dextrin, or perhaps dextrose alone. Köji differs from malt in being rendered inactive by heat at a much lower temperature than malt. Köji is prepared as follows: a mixture of steamed rice and water is allowed to remain in shallow tubs at a low temperature (0°–5° C.) until quite liquid; it is then heated, fermentation commences, and continues until nearly all the dextrine first formed is exhausted. This product is now used like yeast, and is added to fresh quantities of steamed rice and water, fermentation proceeding until the percentage of alcohol amounts to about 13 or 14 per cent. by weight. After the greater part of the rice added has been used up, the mash is filtered and clarified by standing. The "saké" so produced requires very careful watching, and when summer approaches, or it exhibits signs of putrefactive fermentation, it is then heated in iron vessels; this operation has frequently to be repeated. Analyses of various specimens, fresh and diseased, are given in the paper.

Observations on the Specific Refraction and Dispersion of Light by Liquids, by J. H. Gladstone, Ph.D., F.R.S.—The general conclusions arrived at from a large series of observations on different liquids are as follows :—

I. The confirmation of the statement made by the Rev. T. P. Dale and the author, viz., that the length of the spectrum (the difference between the refraction of the Fraunhofer lines A and H) decreases with elevation of temperature.

II. It would appear that the length of the spectrum divided by the density, i.e., $\frac{\mu\text{H} - \mu\text{A}}{d}$, is approximately, but not exactly, constant for different temperatures.

III. The specific dispersion appears to decrease with increase of temperature.

IV. The specific dispersion is influenced by the chemical constitution of a compound. In the case of hydrocarbons the change of the refractive equivalent of the carbon from 5.0 to 6.1 or 8 influences the specific dispersion to a far greater extent than the specific refraction.

V. Finally, the specific dispersion of a compound does not appear to be the means of the specific dispersions of its constituents.

On the Production of Crystals by the Action of Metals on Carbon Disulphide in Sealed Tubes, by P. Graham, F.C.S.—The author described a series of experiments which consisted in sealing up fifteen different metals in carbon disulphide. Some of these tubes were sealed up in 1879, and in those which contained gold, antimony, and bismuth, microscopic crystals were found. The composition of these crystals has not as yet been determined. The author also exhibited a micro-goniometer.

On the Alleged Decomposition of the Elements, by Prof. Dewar, M.A., F.R.S.—In his remarks Prof. Dewar dealt chiefly with the spectroscopic work from which Mr. Norman Lockyer had drawn conclusions very different from those of Professors Livingstone and Dewar, especially concerning the value of evidence on the subject. Prof. Dewar argued that Mr. Lockyer's views regarding the existence of carbon vapour in the corona of the sun would not bear scientific investigation, and that his views regarding the modifica-

tion of the spectrum of magnesium were equally illusory, and gave no proof of the decomposition of elementary substances. Finally he discussed Mr. Lockyer's theory of "basis lines," and addressed himself to a refutation of the same. The results recorded, he said, strongly confirmed Young's observations, and left little doubt that the few as yet unresolved coincidences either would yield to a higher dispersion, or were merely accidental. It would indeed be strange if amongst all the variety of chemical elements and the still greater variety of vibrations which some of them were capable of taking up, there were no two which could take up vibrations of the same period. They certainly should have supposed that substances like iron and titanium, with such a large number of lines, must each consist of more than one kind of molecule, and that not single lines, but several lines of each, would be found repeated with the spectra of some other chemical elements. The fact that hardly a single coincidence could be established was a strong argument that the materials of iron and titanium, even if they be not homogeneous, were still different from those of other chemical elements. The supposition that the different elements might be resolved into simple constituents and even into a single substance had long been a favourite speculation with chemists; but however probable that hypothesis might appear *a priori*, it must be acknowledged, according to Prof. Dewar, that the facts derived from the most powerful method of analytical investigation yet devised, gave it but scant support.

On Manganese Nodules and their Occurrence on the Sea-Bottom, by J. Y. Buchanan.—The author exhibited specimens of the nodules obtained from the South Pacific, and also from Loch Fyne; an account of those obtained in Loch Fyne was given in NATURE, vol. xviii, p. 628. Some nodules containing cobalt were also exhibited; these the author had obtained from New Caledonia. An account is given of the author's method of dredging for mud. The nodules have been found to contain iron oxides, copper, cobalt, nickel, sand, &c. Further, in no case was the amount of oxygen found to be sufficient to form a peroxide with the manganese. The kernels of these nodules are usually richer in manganese oxides than the external portions. Concerning their mode of formation the author thinks that this takes place *in situ*, and that the nodules are not brought from a distance. Further, it would appear that living organisms assist in this formation, although indirectly, insomuch as the decomposing animal matter reduces the sulphates of the sea-water to sulphides, which in their turn react on the iron and manganese minerals (chiefly silicates) in the mud, and thus forming sulphides of these metals. When the organic matter is exhausted these sulphides are oxidised to oxides by the oxygen of the water, forming concretions or incrustations of the ochreous oxides, which naturally inclose the other and unaltered constituents of the mud.

On the Action of Zinc, Magnes'um, and Iron on Acidified Solutions of Ferric Sulphate, by Prof. T. E. Thorpe, Ph.D., F.R.S.—The extent of the reduction of the ferric salt may vary with the strength of the solution, with its temperature, with the amount of free acid present, and lastly with the specific nature of the metal employed. The author has studied the conditions under which the hydrogen does work as a reducing agent. Experiments were made on dilute solutions of ferric sulphate, containing known quantities of free acid. The author finds (1) that the extent of reduction, produced by a given weight of zinc in dissolving, increases with the temperature; (2) that it is also affected, although to a less degree, by the initial surface of the metal exposed. Whilst the extent of reduction, as also the rapidity of solution, increase with the temperature, at a given temperature the extent of reduction increases, although at a gradually diminishing rate, with the time of solution. The rapidity of solution and extent of reduction produced by a given quantity of zinc, of a given area and in a solution of a given temperature, and containing a definite weight of free acid, increase with the amount of reducible iron present. Experiments made by placing zinc in contact with platinum showed that, although the time of solution of zinc in contact with platinum is considerably diminished, as compared with that of zinc alone, little difference in the reducing effect is observed. Similar results were obtained with magnesium, although the amount of reduction is from one-fourth to one-third of that produced by zinc under similar conditions. The diminution of the rate of solution with decrease in the amount of free acid present, is far greater in the case of magnesium than in that of zinc. The author concludes that his experiments strongly sup-

port the view that the reducing power of nascent hydrogen is connected with the existence of this body in the atomic condition, since all conditions tending to prolong the duration of this atomic condition augment the reducing power.

On the Reducing Action of Zinc and Magnesium on Vanadium Solutions, by Prof. Roscoe, LL.D., F.R.S.—From his original experiments on this subject the author had drawn the conclusion that, whilst the reduction in the case of zinc and sodium took place from V_2O_5 to V_2O_4 , in the case of magnesium it only proceeded to V_2O_3 . Later experiments have, however, shown that each of these reducing agents acts in the same manner, but that the reduction from V_2O_5 to V_2O_2 takes place very slowly when magnesium is used.

Note on a New Method of Measuring Certain Chemical Affinities, by A. Tribe.—The author points out that when a metal is immersed in an electrolytic field, *i.e.*, in an electrolyte in the act of electrolysis, and the electromotive force set up on any part of its surface is sufficient to decompose the medium, then the positive ion separates out on that part of the surface which has received negative electrification, and the negative ion on the portion which is positively electrified. If such a plate be of a rectangular form, and it be so placed that the lines of force are perpendicular to its surface, then the maximum electromotive force is set up in the central part of the plate, and at the edges it becomes so weak as to be unable to initiate any electro-chemical action. If the sheet be placed in the electrolytic field, so that the lines of force are parallel with its sides and with two of its edges, then the maximum electromotive force is at the end of the plate and is the weakest at the centre, where it is unable to bring about electro-chemical changes. That this is the case is shown by the boundaries of the deposits, which in many cases are very sharply defined. From the intimate connection between electromotive force and chemical affinity, the author supposed that if, in a series of trials, the chemical affinities were altered, other circumstances remaining the same, the magnitude of the inter-medial space between the boundaries of the electro deposits would increase with the force required to overcome the affinities of the ions of the electrolytes. This supposition has been confirmed by several experiments, *e.g.*, with sheets or analysers of silver immersed in solutions of chloride, bromide, and iodide of zinc, it was found that the inter-medial space was the greatest in the case of the chloride, and in the case of the bromide it was greater than in the case of the iodide.

On some Phenomena of the Nature of Chemico-Magnetic Action, by W. Thomson, F.R.S.E.—The author had observed that the colour from a piece of cloth dyed with Prussian blue was discharged in the neighbourhood of a piece of iron which had been lying upon it for some weeks. The ash of the portions of cloth from which the colour had been discharged was found to contain but a trace of iron. Experiments were made in which no iron was used, and the blue colour was bleached but slightly, showing that the action could not be attributed to light alone. Further experiments, in which small pieces of iron or magnets were used, showed not only that the colour was discharged, but that the colour so discharged appeared to be rearranged in semi-circles on each side of the bar of iron. When magnets were used, the colour assumed more or less of circular forms, which were developed not only from the poles, but from all parts of the magnets. These phenomena the author does not regard as due to magnetic action, for when a piece of gutta percha tissue was placed between the wet cloth and the magnet, no action took place, even after several weeks. Similar observations have been made with cloth dyed with aniline colours, and with a like result.

On the Double Iodide of Copper and Mercury, by Prof. Silvanus P. Thompson, D.Sc.—After describing the preparation of this compound, which is cuproso-mercuric iodide, Cu_2HgI_4 , the author draws attention to one property, viz., its change of colour by a comparatively small change of temperature. At the ordinary temperature this substance possesses a brilliant red colour, and when heated, it becomes black, changing back to red on cooling. In thin layers this substance transmits light, but becomes opaque on heating. Now according to the electro-magnetic theory of light, opaque bodies are the best conductors of electricity; therefore this double iodide of copper and mercury should conduct heat better at a high than at a low temperature. Experiment has shown this to be true to a certain extent only, as beyond a certain temperature its conductivity becomes less; this is probably due to its decomposition when heat *d* beyond a given temperature. In conclusion, the author pointed out several ways in which this change of colour of this

compound could be used in lecture experiments. For instance, it may be used to show the conduction of heat along a copper rod; for this purpose the rod is coated with the red compound, which is gradually blackened as the heat travels along the rod. It may also be substituted for wax in Tyndall's experiment for showing how crystals conduct heat. There are also a variety of other ways in which it may be applied.

The Effect of the Spectrum on Silver Chloride, by Capt. Abney, R.E., F.R.S.

Alterations in the Properties of Nitric Ferments by Cultivation, by R. Warington.—The author, after giving an account of his experiments on the cultivation of these ferments, which consist of organisms resembling bacteria, states that these nitrifying ferment are capable of existing in three forms—(1) the nitric ferment of soil, which converts both ammonium salts and nitrites into nitrates; (2) the altered ferment, which converts ammonium salts into nitrites, but fails to convert nitrites into nitrates; (3) a surface organism which converts nitrites into nitrates.

On the Fluid Density of Certain Metals, by Prof. W. Chandler Roberts, F.R.S., and T. Wrightson, C.E.—This is an account of a continuation of experiments upon this subject, some of which were submitted to the Section at Swansea (*vide NATURE*, vol. xxii. p. 448). The authors also exhibited the *oncosimeter* described in the *Journal of the Iron and Steel Institute* (ii. 1879, p. 418), by the aid of which these results were obtained. The following table contains the results obtained:—

	Sp. gr. solid.	Sp. gr. liquid.	Percentage of change in volume.
Bismuth	9.82	10.055	Decrease 2.3
Copper	8.8	8.217	Increase 7.1
Lead	11.4	10.37	" 9.93
Tin	7.5	7.025	" 6.76
Zinc	7.2	6.48	" 11.10
Silver	10.57	9.51	" 11.2
Iron	6.95	6.88	" 1.02

On Molecular Attraction, by F. D. Brown, B.Sc.—The author points out that, if we regard chemical affinity as neutralised by the union of two elements, we are then unable to account for the reactions taking place between molecules, and involving an interaction of the atoms composing different molecules. If, however, the act of combination be regarded as producing no change in the chemical forces, and it be supposed that the same attraction is exerted between any given pair of atoms without regard to the state of combination of one or both of the atoms, then a reasonable account can be given of chemical reactions, and the existence of molecular combinations does not appear very remarkable. Further, we are provided with a more or less effective explanation of the relative volatility of substances. Reasoning from this point of view, and considering the carbon compounds specially, the author concludes that intermolecular attraction should be greater in an acid than in a corresponding alcohol; greater in an alcohol of high molecular weight than in a homologue of which the molecule is less complex; greater in a primary alcohol than in the secondary or tertiary isomeride; and finally, greater in a chlorinated compound than in the corresponding substance containing hydrogen. If the volatility of a substance be a measure of the forces of attraction between the molecules, then it must be admitted that the boiling points of organic compounds show with some reason that the above expression represents the value of intermolecular attraction. From this point of view the study of the latent heat of many carbon compounds would materially aid us in the solution of the problem of chemical affinity.

On the Relative Atomic Weights of Silver, Manganese, and Oxygen, by Prof. Dewar, M.A., F.R.S., and A. Scott, B.A., B.Sc.—The authors have determined the atomic weight of manganese, in relation to silver and oxygen, by a complete analysis of silver permanganate. Taking the atomic weight of silver to be 108, that of oxygen to be 16, the following values have been obtained for the atomic weight of manganese, 55.51, 54.04, 54.45. These numbers do not agree very well amongst themselves, nor with the numbers obtained from the analysis of pure manganese peroxide, made from manganese nitrate. By this latter method the following values were obtained, viz., Mn = 53.6 and 53.3.

Note on the Phosphates of Lime and Ammonia, by J. Alfred Wanklyn.—When ammonia is added to a soluble calcic phosphate a precipitate is obtained, which dissolves on heating, forming a viscous solution which solidifies on cooling. The soluble salt formed the author regards as having the composition

$\text{P}_2\text{O}_5 \text{CaO}(\text{NH}_4)_2\text{OH}_2\text{O}$. The author confirms Morfit's observation, that bone earth dissolved in acid is reprecipitated by alkalies in the form of a hydrated tribasic phosphate; a fact which he considers of great importance to agriculture.

On the Separation of Hydrocarbon Oil from Fat Oils, by A. H. Allen, F.C.S.—The author pointed out that the extensive production of hydrocarbon oils and their cheapness had led to their being employed for the purpose of adulterating animal and vegetable oils. Indications of their presence are afforded by the determination of the density of the oil, by the lowering of its flashing point and boiling point, further by its taste and the odour produced on heating. An oil so adulterated is not completely saponified, and the hydrocarbon oil may be removed from the product of saponification by extraction with ether. Fluorescence is also to some extent a useful indication of the presence of such a mineral oil; the fluorescence of some mineral oils may, however, be destroyed by chemical means, and as some mineral oils are not fluorescent the absence of fluorescence in an oil does not therefore indicate the absence of a mineral oil.

On Boukett's New Thermograph, by W. Lant Carpenter, B.A., B.Sc., F.C.S.—This is an instrument for recording changes of temperature, which are measured by the action of heat upon a hollow circular metallic ring connected with a circular vessel, the whole being filled with fluid and hermetically sealed. One end of the ring is fixed, the other is free to move, and its motion is magnified by a series of levers, to the end of which is attached a recording pen. Increments of heat cause increments of pressure in the ring, which moves at its free end. The instrument has hitherto been used for clinical purposes only, but the author thinks it might with advantage be used in chemical and physical researches.

The Blowing Wells near Northallerton, by T. Fairley, F.R.S.E.—The author gave an account of a series of observations on these wells, of which there are three in the neighbourhood of Northallerton. The gas issuing from the fissures in these wells has been analysed, and is apparently nothing more than common air.

On the New Metal Actinium, by J. L. Phipson.—The author stated that he had been able to separate a new element from the pigment zinc-white. The oxide of the new element is said to be slightly soluble in caustic soda, and is soluble in ammonia and ammoniacal salts. Its colour is uninfluenced by exposure to light. The sulphide of actinium is described as a pale yellow canary-coloured substance; it is insoluble in ammonium sulphide, is soluble in acetic acid, and becomes darker on exposure to the air.

On some Vapour-Density Determinations, by Prof. Dewar, M.A., F.R.S., and A. Scott, B.A., B.Sc.—The authors described the apparatus they employed for the determination of the vapour-densities at high temperatures, and the means adopted for examining the vapours to ascertain whether or not decomposition had taken place. The vapour-densities of the halogen compounds of several metals have been determined, and it is interesting to note that the authors find, according to its vapour-density, the molecular formula for ferrous chloride is FeCl_2 .

Some Remarks on Crystallogeny, by Prof. J. P. Cooke (Harvard University, U.S.A.).

On a New System of Blow-pipe Analysis, by Lieut.-Col. Ross.—The author described his system of blow-pipe analysis, and exhibited a compact form of blow-pipe and other necessary apparatus for use when travelling.

On Experiments with Manures on Barley Crops, Season 1881, by Ivison Macadam, F.C.S.—The author gave a detailed account of his experiments on two fields sown with barley in April of this year. The previous rotation of crops was as follows:—in 1878 potatoes with 20 tons of farmyard manure per acre, and 4 to 5 cwt. of dissolved manure; in 1879 wheat, no manure; in 1880 turnips, 20 tons per acre of town ashes and 5 to 6 cwt. of dissolved manure. The only difference between the two fields was that in one case the turnips were carted away, whilst in the other they were eaten on the ground by sheep. From the time when the barley appeared to the time of cutting, determinations of the following points were made every week: (1) the weight of the plant; (2) length of straw; (3) rate of storage of saline matter by the plant; (4) amount of water, nitrogen (given as ammonia), organic and vegetal matter; (5) the amount of the various saline ingredients present in the ash. The results appear to show that, in the case of the field where the turnips had been eaten on the ground, the barley crop grew more rapidly and was more healthy than that on the other field.