

## General and Physical Chemistry.

**Spectrum Lines of Hydrogen.** By J. J. BALMER (*Ann. Phys. Chem.* [2], **25**, 80—87).—In this paper an attempt is made to trace out a mathematical ratio between the wave-lengths of the hydrogen lines. The general formula deduced is  $\lambda = \frac{m^2}{m^2 - n^2} \cdot h \frac{mm}{10^7}$ . The value for  $h$ , which may be called the basic number for hydrogen, is 3645·6; the values for  $m$  and  $n$  in the fraction are always integers. Thus, on comparing the wave-lengths of the three more common lines calculated according to the above equation with the wave-lengths observed by Ångström, the difference is found to be less than  $\frac{1}{40000}$  of a wave-length:—

	Observed.		
H <sub>α</sub> (E line) = $\frac{9}{8}h$ = 6562·08	6562·1	$m = 3$	$n = 2$
H <sub>β</sub> (F line) = $\frac{4}{3}h$ = 4860·8	4860·74	$m = 4$	$n = 2$
H <sub>γ</sub> (A line) = $\frac{8}{5}h$ = 4101·3	4101·2	$m = 6$	$n = 2$

The wave-lengths for the violet lines and ultra-violet lines of the fixed stars observed by Huggins are compared with those calculated in accordance with the above formula, and the difference is within the limits of experimental error.

V. H. V.

**Spectrum of Ammonia with a Reversed Induced Current.** By L. DE BOISBAUDRAN (*Compt. rend.*, **101**, 42—45).—When an induction spark falls upon an aqueous solution of ammonia, the liquid itself being the positive pole, a yellow globular or cup-shaped arc is formed between the two poles, and at the upper surface of the liquid pole there is a thin but very distinct greenish disc. This disc is not a true phosphorescence, but is due to the illumination of ammonia-vapour by the positive portion of the discharge; it gives a spectrum of one band in the green at 107·3, corresponding with wave-lengths 5681—5643 in the brightest portion. The interpolar yellow arc gives a spectrum consisting of several nebulous bands of various widths situated between wave-lengths 6325 and 5252. This spectrum, with the exception of the band in the green and a band at 6045—6008, is not given by pure and dry ammonia gas, but is only obtained in presence of water or oxygen; it appears to be identical with one of those observed by Mitscherlich (*Phil. Mag.*, **27**, 169), with a flame charged with ammonia. The green band at 5681—5643 is obtained with ammonia gas, and is more intense when the gas is moist.

C. H. B.

**Mutual Extinction of the Spectra of Yttrium and Samarium.** By W. CROOKES (*Compt. rend.*, **100**, 1495—1497).—The spectrum of a phosphorescent mixture of samaria 90 parts, and yttria 10 parts, in high vacua, shows none of the lines of yttrium, but is almost a

facsimile of the spectrum of pure samarium, except that the orange line at 2693 on the  $\frac{1}{\lambda^2}$  scale, which is scarcely visible in the spectrum of the pure substance, becomes sufficiently distinct to be measured. A complete change in the spectrum takes place between very narrow limits when the proportions of the two substances are varied. A mixture of samaria 44 parts, and yttria 56 parts, gives the spectrum of pure samarium (with the exception of the orange line already mentioned); a mixture of samaria 42 parts, and yttria 58 parts, gives bands peculiar to each of the constituents; whilst the spectrum of samaria 39 parts, and yttria 61 parts, is almost the spectrum of pure yttrium.

The orange line at 2693, which is so feeble in the spectrum of pure samarium, is the characteristic line in the spectra of samarium-yttrium mixtures. It attains its maximum intensity with a mixture of samaria 80 parts, yttria 20 parts. When the proportion of samaria is as low as 3 per cent., this line diminishes in intensity, and with pure yttrium it is no longer visible. So long as this line is visible the other lines in the spectra have less than their normal intensity, and several of the bands normally present in the spectra of yttrium and samarium respectively are entirely wanting. It is evident that since the presence of one body may so materially alter the spectrum of another, the indications of the spectroscope ought always to be controlled by chemical analysis.

With a mixture of samarium 1 part, and calcium 100 parts, the spectrum of samarium is very brilliant; with 1 part in 10,000 the bands become less brilliant; with 1 part in 100,000 the green and red bands are almost completely masked by the continuous spectrum of the calcium, but the double orange band and the black space in the yellowish-green are still very distinct. With 1 part in 1,000,000 the orange bands have almost disappeared, but the dark band is still apparent; whilst with 1 part in 2,500,000 the dark band is the only remaining trace of the samarium spectrum.

C. H. B.

**Spectrographic Investigations of Different Standards of Light: their Use in Measuring Photographic Sensitiveness.** By J. M. EDER (*Monatsh. Chem.*, 6, 363—368).—This paper contains an account of the investigations of the light produced by burning amyl acetate, which has been proposed by Abney (*Photographic News*, 1884, 787) as a standard in measuring the photographic sensitiveness of different substances, also of the light given out by Balmain's paint, which is used as source of light in Warnerke's "sensitometer." The first of these lights is less rich in chemically active rays than sunlight, and the second is still less active. Further, the sensitiveness of a substance varies with the quality of the light, and for the same substance the results obtained with either of the above lights is different from that obtained with sunlight.

P. P. B.

**Optical Properties of Thin Metallic Layers.** By W. VOIGT (*Ann. Phys. Chem.* [2], 25, 95—114).

**Reproduction of Siemens' Mercury Unit.** By K. STRECKER (*Ann. Phys. Chem.* [2], 25, 252—273 and 456—487).

**The Seat of the Electromotive Force in the Voltaic Cell.** By O. LODGE (*Phil. Mag.* [5], 19, 153—190; 254—280; 340—365).—The first paper gives an historical account of the chief experimental researches into the seat of the electromotive force in Volta's effect, and in the voltaic cell; the second discusses the various theoretical views already advanced, and explains those of the author; the third is occupied by the application of these last to certain cognate phenomena. The author maintains that there really is a contact force at every junction of dissimilar substances, whether solid, liquid, or gaseous, and that the electromotive force of a circuit is the sum of such contact forces. But the values ordinarily assigned to given contacts need not be admitted. It is certain, however, that the energy of the voltaic current of a cell is the equivalent of the chemical actions going on within it.

According to the author's views, a piece of clean zinc and one of clean copper, surrounded by air, are each at a lower potential than the air, because the electro-negative oxygen molecules are straining towards the metal, which thus rises in negative potential, not on account of any actual oxidation, but by the approximation of the oxygen molecules. This approximation being due to the chemical affinity between the elements, may be measured by their heat of combination. Calculated on this hypothesis, the potential of bright zinc is 1·8 volt below that of the surrounding air; clean copper 0·8 volt below the air. If the zinc and copper are put into contact, a rush of electricity takes place from the copper to the zinc, so that their potential is equalised (neglecting for the present an electromotive force of one-third of a millivolt developed at the junction, and driving positive electricity from copper to zinc). When the metals are separate, the oxygen-atoms, being all charged with negative electricity, are strained equally on all sides, and could not move in without giving the body an absolute charge. But when the metals are in contact, the oxygen-atoms are cleared away at the place, and the stress being no longer counterbalanced, they can move nearer to the zinc, their electricity finding a passage into the copper, whose surface will thereupon repel the oxygen-atoms to a greater than the normal distance. On comparing the figures to which this theory leads with those obtained by experiment, the author finds that whilst the agreement is not exact, it is, nevertheless, too close to be merely accidental. The effect of the contact is to throw the surrounding medium, if it be a dielectric such as air, into a state of strain; whilst if it be an electrolyte (for instance, dilute acid, in which the oxygen-atoms are subject to precisely the like attractions), a current is conveyed.

Besides this readjustment of the chemical forces, a physical action is brought into play by the contact of dissimilar bodies—an action arising, as the author conceives, from the dissymmetry to which the motions of the molecules are then subjected. This prevents the reduction of two pieces of metal in contact to *exactly* the same potential. Its intensity, which varies with the temperature, can be

measured by the Peltier effect only, and is probably independent of the surrounding media. This force is also related to the Seebeck effect, and in the contact of ordinary metals is very small, because it depends upon the specific resistance. With badly conducting metals, such as antimony and bismuth, and still more with selenium and tellurium, it is much greater. With non-conductors it becomes enormous, but necessarily it can then exhibit electrostatic phenomena only, not currents. Even in these cases mechanical actions, such as friction, may help the movement of the electricity.

The size of atoms, as deduced from electrical data by Sir W. Thomson, is discussed in connection with the author's views, chiefly in relation to the metallic union of mercury and tin, the result being an estimate of the linear molecular dimensions expressed by  $4 \times 10^{-9}$ , which is believed to be correct within narrower limits than those admitted by Thomson.

R. R.

**Electric Conductivity of Gases.** By F. STENGER (*Ann. Phys. Chem.* [2], **25**, 31—48).—In this paper it is shown that the difference between the phenomena of the spark and glow discharge is one of degree, not of kind. The various supposed characteristic differences alluded to by previous writers are discussed, and shown to have no real validity; these are—1st, the intermediate gas-layer possesses a lower resistance in the spark than in the glow discharge; 2nd, in the spark the anode is more strongly heated than the cathode, but conversely with the glow discharge; 3rd, the spectrum of the spark is that of the substance of the electrode, but in the glow discharge is seen only the spectrum of the intermediate gas-layer; 4th, in the spark both the electrodes are equally dissipated, but in the glow only the cathode. These conclusions, partly deduced from original and partly from previous experiments, are in accordance with the observations of Warren de la Rue and H. Müller that a change of pressure of the gas induces the conversion of the spark into the glow discharge. (*Phil. Trans.*, **171**, 65.)

V. H. V.

**Electric Conductivity and Temperature Coefficient of Solid Mercury.** By C. L. WEBER (*Ann. Phys. Chem.* [2], **25**, 245—252).—According to the researches of Matthiessen, the alloys of mercury seem to form a distinct class by themselves as regards their electric conductivity. Siemens explained their peculiar function on the hypothesis that their conductivity was equal to the mean conductivity of their constituents, assuming them to be in the liquid state. Experiments, however, did not confirm this hypothesis. In this paper, an account is given of experiments on the electric conductivity of mercury solidified by solid carbonic anhydride dissolved in ether. The principal results obtained were (i) the conductivity is increased four-fold on solidification; the value referred to,  $0^\circ$ , of the solid metal is  $3.5^\circ$ ; (ii) the temperature coefficient of the solid mercury, at points sufficiently removed from the point of fusion, is approximately equal to those of other solid metals.

This great difference of the solid and liquid metal probably influences the conductivity of amalgams, solid at ordinary temperatures.

V. H. V.

**Electric Conductivity of Aqueous Alcohol.** By E. PFEIFFER (*Ann. Phys. Chem.* [2], 25, 232—245).—The curve of the electric conductivity of mixtures of alcohol and water as a function of the percentage proportion of the two constituents shows an alternate rise and fall. Thus it rises with mixtures containing 0—5·24 per cent. alcohol, falls at 5·24 until it reaches a minimum at about 30 per cent., rises from this point until a maximum is attained at 83·4, and falls again. The minimum point corresponds with a mixture of 1 mol. of alcohol with 6 mols. of water, the maximum point, with a mixture of 1 mol. of water and 2 mols. alcohol. These mixtures correspond probably with the formation of definite chemical combinations, of which one possesses a higher, the other a lower, coefficient of conductivity than either of the constituents. V. H. V.

**Validity of Joule's Law for Electrolytes.** By H. JAHN (*Ann. Phys. Chem.* [2], 25, 49—71).

**Electro-pseudolysis.** By D. TOMASSI (*Bull. Soc. Chim.*, 43, 418—420).—Although it requires 69 cal. to decompose a molecule of water, yet electric currents of the feeblest strength are capable of separating oxygen and hydrogen from acidulated water; the author considers this result to be due not to electrolysis, but to the simple polarisation and collection of the atoms of oxygen and hydrogen in the free state in the water; their presence being due to slight dissociation taking place at low temperatures. This action is observable in many other cases, as in the action of a feeble electric current on a dilute solution of ammonium chloride, ammonia and hydrochloric acid being formed. This collection, by means of feeble electric currents of the free atoms formed in a solution by dissociation at low temperatures, the author proposes to call electro-pseudolysis. A. P.

**Electro-chemical Studies.** By W. OSTWALD (*J. pr. Chem.* [2], 31, 433—462).—The enormous increase which the electrical conductivity of weak acids appears to undergo in proportion to their state of dilution has led the author to somewhat modify the opinions expressed in a former paper (this vol., p. 323). The influence exerted by the condition of dilution of any acid is the same in all cases, and may be defined as a function of a certain constant which is peculiar to each acid. The author compares in every case the molecular conductivity of the acid under investigation, the expression being obtained by multiplying the specific conductivity by the volume of the solution containing the molecular weight of the electrolyte in grams. The method recommended by Kohlrausch was employed in taking the measurements, and the different degrees of dilution varied as the whole powers of 2, and were obtained in every case by successive removal of half the volume of solution and its replacement by pure water. The conductivity of strong monobasic acids such as hydrochloric, hydrobromic, hydriodic, nitric, chloric, and perchloric acids varied from about 78 to 89·5 as the dilution increased from 2 to 1024 times that of the normal solution, and appeared to approach a

maximum of about 90; beyond this dilution, the numbers diminished, owing probably to the presence of minute quantities of impurity in the water, which of course made themselves felt in a more marked degree as the dilution increased. As a diminution is observed both in alkaline and acid liquids, the author infers the presence of traces of ammonium carbonate, which he shows has a disturbing influence on both. For the above acids, however, the law holds good that with increased dilution their molecular electric conductivity tends to a maximum which is independent of the nature of the acid.

The weaker acids such as butyric, acetic, formic, &c., begin at the same state of dilution with a much smaller conductivity, which increases, however, with the dilution, but does not arrive near the same maximum before the disturbing influences of the impurities come into play, hence it is impossible to say that they all tend to the same maximum, but they advance in strictly parallel lines, their conductivity at any given stage being the result of the dilution operating on a given constant peculiar to each acid; in other words, the increase of conductivity for each monobasic acid forms part of the same curve.

Polybasic acids appear to follow a different law, according as the different replaceable hydrogen-atoms have stronger or weaker acid qualities. Selenic acid, for instance, behaves like a monobasic acid, and especially like chloracetic; both this and phosphorous acid do not reach a conductivity of 80 at a dilution of 4096 litres. Strong dibasic acids, however, act quite differently; after reaching 90, the second hydrogen-atom comes into play, and the increase begins again to be rapid, reaching in the cases of sulphuric and methylenedisulphonic acids to nearly 180 at a dilution of 4096 litres, thus pointing to a limit which is double that attained by the strong monobasic acids.

Phosphoric acid, being a comparatively weak acid as regards its third replaceable hydrogen-atom, does not increase more rapidly than a monobasic acid. Other tribasic acids have not been brought within the scope of this investigation. In conclusion, the author draws attention to the great change in the electrical conductivity of any acid caused by the admixture of small quantities of other acids; and in opposition to Bouty's theory, is of opinion that the alterations of the general electric conductivity by dilution are not due to the successive formation of different hydrates.

J. K. C.

**Dielectric Constant of certain Gases and Vapours.** By I. KLEMENČIČ (*Phil. Mag.* [5], 19, 393—395).—The paper describes the author's mode of experiment in the determination of dielectric constants. The results in the case of seven gases and of carbon bisulphide agree well with Boltzmann's determinations, and with the electromagnetic theory of light. But the figures obtained for sulphurous acid, ether, ethyl chloride, and ethyl bromide, do not satisfy the conditions of that theory.

R. R.

**Electromagnetic Action of Dielectric Polarisation.** By W. C. RÖNTGEN (*Phil. Mag.* [5], 19, 385—388).—The paper describes an experiment with a rotating ebonite disc, confirming Faraday's theory as to a change of dielectric polarisation exerting



an electromagnetic force exactly like a current in the direction of the displacement of the positive electricity in the insulator.

R. R.

**Specific Heat of Aqueous Alcohol.** By A. BLÜMCKE (*Ann. Phys. Chem.* [2], **25**, 154—165).—In this paper, an account is given of determinations of the specific heat of various mixtures of alcohol and water as a function of the temperature. The results show that there is apparently no direct relation between the specific heat, concentration, and temperature. With mixtures containing 0 to 15·20 per cent. alcohol, the specific heat gradually increases, and from 20—99 per cent. gradually decreases. These results are in accordance with the observations of Dupré and Page (*Phil. Mag.* [4], **38**, 158), and of Schüllen.

V. H. V.

**Thermal Phenomena of Colloids.** By E. WIEDEMANN and C. LÜDEKING (*Ann. Phys. Chem.* [2], **25**, 145—153).—The dissolution of dry colloids, like that of salts rendered anhydrous, is separable into two distinct phenomena, the one, hydration, an exothermic change, the other, solution, an endothermic change. These successive phenomena can be illustrated in the case of anhydrous and hydrated gelatin.

Composition of sample.	Water added.	Heat-change in gram-calories.
2 grams gelatin .....	10 grams.	+ 3·1
„ „ + 100 p. c. H <sub>2</sub> O	8 „	— 1·0

Similar results were obtained with gum arabic, tragacanth gum, dextrin, starch, and tannin. The difference between the thermic phenomena of the solution of a crystalline and amorphous form of the same substance is well illustrated in the case of tartaric acid; thus the solution of crystalline dextrotartaric acid is an endothermic change (— 23·37 cal.), of amorphous inactive tartaric acid an endothermic change (+ 5·92 cal.). A similar relationship exists between crystalline and barley sugar. The coagulation of colloid silicic acid is accompanied by an evolution of heat (11·8 cal.); this result is in opposition to Thomsen's observations, that there is no heat-change; but the discrepancy is to be explained by the length of time taken by Thomsen in his experiments.

The statement of Guthrie that the tension of aqueous vapour of solutions of colloids is equal to that of water is incorrect, inasmuch as the boiling point of a solution of gelatin is higher than that of water, and secondly, at low temperatures the admixture of gelatin and water is accompanied by development of heat; and direct experiments with solutions of gum arabic showed that the tension of its solution is less than that of water.

V. H. V.

**Sodium Methoxide.** By DE FORCRAND (*Compt. rend.*, **100**, 1500—1502).—When metallic sodium is added to anhydrous methyl alcohol, the action is more energetic than with ethyl alcohol, and in presence of a large excess of alcohol solution is very rapid. The heat developed at 16° is + 48·2 cal. for Na = 23 grams. Anhydrous sodium meth-

oxide, NaOMe, was prepared by heating the solution at 180—200° in a current of dry hydrogen for several hours. It is a white nacreous highly deliquescent solid; heat of dissolution at 16° = + 11·89 cal. The compound NaOMe.HOMe, is obtained in colourless nacreous deliquescent crystals by drying, on biscuit-porcelain, the crystalline mass resulting from the dissolution of sodium in 5—6 equivalents of methyl alcohol; heat of dissolution at 17° = - 5·05 cal. From these results, it follows that—

CH <sub>4</sub> O liquid + Na solid = CH <sub>3</sub> NaO solid + H gas .....	develops + 33·19 cal.
NaOMe solid + <i>n</i> CH <sub>4</sub> O liquid = NaOMe, diss. in <i>n</i> CH <sub>4</sub> O.....	„ + 15·01 „
NaOMe solid + CH <sub>4</sub> O liquid = NaOMe, CH <sub>4</sub> O solid.....	„ + 8·84 „
2CH <sub>4</sub> O liquid + Na solid = NaOMe, CH <sub>4</sub> O solid + H gas.....	„ + 42·03 „
2CH <sub>4</sub> O liquid + Na <sub>2</sub> O solid = 2NaOMe solid + H <sub>2</sub> O solid.....	dev. + 2 × 18·32 „
CH <sub>4</sub> O liquid + NaHO solid = NaOMe solid + H <sub>2</sub> O solid.....	develops + 1·32 „

These numbers are very similar to those obtained with ethyl alcohol, and almost identical with those obtained by the action of sodium on water. It would seem, therefore, that the molecule of water contained in these alcohols acts on sodium as if it were in the free state. In presence of a large excess of the solvent the numbers obtained are higher with alcohol than with water, a fact which indicates that the dissociation of the alcoholates in presence of alcohol is less than the dissociation of the hydroxide in presence of water. C. H. B.

**Heat of Neutralisation of Hydroxybenzoic Acids.**—By BERTHELOT and WERNER (*Compt. rend.*, **100**, 1568—1570).—*Hydroxybenzoic Acid* (1 : 2).—Heat of dissolution - 6·35 cal.

HO·C <sub>6</sub> H <sub>4</sub> ·COOH diss. + $\frac{1}{2}$ Na <sub>2</sub> O	develops + 12·91 cal.
„ + Na <sub>2</sub> O	„ + 0·81 „
	<hr/> + 13·72 „

*Hydroxybenzoic Acid* (1 : 3).—Heat of dissolution - 6·18 cal.

HO·C <sub>6</sub> H <sub>4</sub> ·COOH diss. + $\frac{1}{2}$ Na <sub>2</sub> O	develops + 13·18 cal.
„ + Na <sub>2</sub> O	„ + 8·52 „
	<hr/> 21·70 „

*Hydroxybenzoic Acid* (1 : 4).—Heat of dissolution - 5·58 cal.; heat of hydration, C<sub>7</sub>H<sub>5</sub>O<sub>3</sub> + H<sub>2</sub>O liquid develops + 2·14 cal.; H<sub>2</sub>O solid + 0·71 cal.

HO·C <sub>6</sub> H <sub>4</sub> ·COOH diss. + $\frac{1}{2}$ Na <sub>2</sub> O	develops + 12·97 cal.
„ + Na <sub>2</sub> O	„ + 9·33 „
	<hr/> 22·30 „



The heat of dissolution, and the heat of neutralisation by the first equivalent of alkali, are practically the same for all three acids, but the meta- and para- differ from the ortho-derivative in that with a second equivalent of alkali they develop an amount of heat practically equal to the heat of neutralisation of phenol, and hence show a marked phenolic as well as acid character. This difference in the behaviour of the three compounds, depending on the different orientation of the substituted radicles, is strictly analogous to that already observed in the case of the ortho-, meta-, and para-di- and tri-hydroxybenzenes (this vol., p. 628). C. H. B.

**Spontaneous Change of Form of Homogeneous Solid Substances, induced by Internal Energy.** By O. LEHMANN (*Ann. Phys. Chem.* [2], 25, 173—189).

**Physico-chemical Experiments.** By V. MEYER and G. G. POND (*Ber.*, 18, 1623—1628).—According to the experiments of Menschutkin and Konowaloff (*Abstr.*, 1884, 1119), tertiary amyl acetate and chloride, when heated to a temperature at which, under ordinary conditions, decomposition does not occur, are to a large extent dissociated in the presence of rough substances, such as sand, asbestos, or particles of glass. In order to test the accuracy of this result, the authors have repeated the experiments with a slight modification. The apparatus is so arranged that as soon as the substance has been volatilised and a constant volume obtained, sand may be dropped in without opening the apparatus. The experiments described do not confirm Menschutkin and Konowaloff's results, as the introduction of the sand did not produce the smallest effect. A. K. M.

**Influence of Temperature on the Capillary Meniscus Angle.** By J. TRAUBE (*J. pr. Chem.* [2], 31, 514—527).—This paper consists of some observations relating to Volkmann's remarks on Schiff's work on the constants of capillarity of liquids at their boiling points (*Abstr.*, 1884, 808). Schiff shows that the meniscus becomes flatter with rise of temperature, and at the critical point becomes convex; the angle of the meniscus with the walls of the tube increases therefore at the same time; the same results were obtained by him with different preparations of the same substance, and at various times. Volkmann assumes that owing to the extreme difficulty of making accurate observations, the values obtained by Schiff are merely accidental. This statement the author opposes, on the ground that he has repeated Schiff's experiments, and obtained in every case confirmatory results, showing that the form of the meniscus undergoes invariably a gradual change with rise of temperature, and that in no case did it present the form of a hemisphere. From his own experiments, he concludes that there exists a certain temperature for every substance at which the meniscus assumes a hemispherical form, but above which it flattens, and its edge-angle increases.

On repeating Link's experiments, the author found that the capillary elevation of a liquid was independent of the substance of the tube, thus obtaining an opposite result to that of Link. J. K. C.

**Application of Various Substances as Halogen Carriers.**

By C. WILLGERODT (*J. pr. Chem* [2], **31**, 539—540).—The author has found that the presence of those elements whose chlorides easily give up their chlorine assists greatly in the chlorination of organic substances. Metallic iron or any of its oxides behave as excellent carriers in this respect; also antimony and tin, their oxides, and to a much less degree bismuth, arsenic, amorphous phosphorus, and sulphur. Sodium, magnesium, zinc, copper, mercury, nickel, and lead, have, however, the opposite effect.

J. K. C.

**Velocity of Saponification.** By L. REICHER (*Annalen*, **228**, 257—287).—Schwab has recently pointed out (*Bydrage tot de kennis der estervorming*, Inaug. Dissert., Amsterdam, 1883) the objections to Menschutkin's mode of determining the initial rate of etherification of alcohols and acids, namely, the influence which the products of the reaction, ether and water, exert on the velocity. He attempted to minimise this influence by using a large excess of alcohol instead of working with a mixture of acid and alcohol in their molecular proportions. He also proposed to substitute the constant of the velocity of saponification for the initial rate of etherification. He endeavoured to determine the value of this constant by decomposing ethereal salts with water. Better results were obtained by the author and also by Warder (*Ber.*, **14**, 1361), who substituted alkalis for water in the reaction.

The author decomposes the ethereal salts with alkaline solutions of known strength in a specially constructed apparatus, in which the temperature is accurately controlled and measured. After a given time, a portion of the mixture is poured into excess of standard sulphuric acid, and the excess of acid determined by titration with baryta-water. In this way, the amount of alkali used and of ether saponified is ascertained. One advantage of the process is that the ethereal salts need not be in a state of absolute purity; they must be free from acids or other impurities which would interfere with the titration, but the presence of alcohol would not interfere with the results.

The constant of the velocity of saponification has been determined for the following ethers and bases:—

With ethyl acetate at 9.4.°		With soda at 9.4.°		With soda at 14.4.°	
Soda .....	2.307	Methyl acetate ..	3.493	Ethyl acetate....	3.204
Potash.....	2.298	Ethyl „ ..	2.307	„ propionate ..	2.816
Lime .....	2.285	Propyl „ ..	1.920	„ butyrate ..	1.702
Strontia .....	2.204	Isobutyl „ ..	1.618	„ isobutyrate ..	1.731
Baryta.....	2.144	Isoamyl „ ..	1.645	„ isovalerate. ..	0.614
Ammonia .....	0.011			„ benzoate ..	0.830

W. C. W.

**Formation of a Stalactite by Vapour.** By J. BROWN (*Phil. Mag.* [5], **19**, 395).—The vapour of anhydrous aluminium chloride

issuing from a crucible, formed by contact with the moisture of the air, a white stalactitic tube of hydrated chloride, about  $1\frac{1}{2}$  inch long and one-tenth inch diameter. The formation seemed quite analogous to that of the ordinary calcium carbonate stalactite. R. R.

**Lecture Experiments on the Occlusion of Hydrogen by Palladium.** By H. SCHIFF (*Ber.*, 18, 1727—1729).—This is a description of experiments for demonstrating the occlusion of hydrogen by palladium, the increase of volume of the metal, and the reducing action of the occluded gas. A. P.

**Lecture Experiments on Spectrum Analyses.** By E. CLEMINSHAW (*Phil. Mag.* [5], 19, 365—368).—The oxy-hydrogen flame supplies a ready and simple means of projecting spectra on the screen. The hydrogen is rapidly generated from zinc and hydrochloric acid in a bottle, into which strong solutions of any of the alkaline or alkaline-earth chlorides can be introduced. Or the flame may be used to ignite a lime cylinder upon different portions of which the chlorides have been melted. The reversal of the D line may be readily shown by the limelight when the sodium is burnt in a Bunsen burner, the flame of which is cooled down by a properly regulated supply of carbonic anhydride. Other arrangements for this purpose are also described. R. R.

**Useful Apparatus.** By R. ANSCHÜTZ and A. KEKULÉ (*Annalen*, 228, 301—308).—1. *A modified Glaser's Combustion Furnace.*—When platinum-black is used in the combustion of organic bodies, it is impossible to effect the complete oxidation of difficultly combustible bodies by means of the simple furnace described by Kopfer (this Journal, 1876, i, 660). Good results are obtained by the platinum-black process if a Glaser's combustion furnace is used, but in order to watch the process it is desirable to replace a portion of the earthenware tiles by sheets of mica.

2. *Air-baths for drying Substances in a Current of Air.*—Air- or water-baths are specially constructed to contain Liebig's drying tubes. Perforations in the side and top of the bath allow the drying tube to be connected with an aspirator.

3. *Apparatus for drying in a Vacuum at Higher Temperatures than that of the Atmosphere.*—The caoutchouc stopper which closes the mouth of the bell-jar has three perforations. A glass tube passes through one hole and is connected with the water-pump. The two ends of a thin leaden pipe, which is coiled in a spiral, pass through the other two holes. The substance to be dried or evaporated is placed on this spiral, and a stream of hot water is allowed to circulate through the pipe.

4. *Lecture Experiment on Flame.*—An experiment to show that the flame from an oil lamp is due to burning vapour. W. C. W.

**Apparatus for Chemical Laboratories.** By D. J. WALTER (*J. pr. Chem.* [2], 31, 527—538).