

## General and Physical Chemistry.

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**Sensitiveness of Silver Bromide Dry Plates for Different Portions of the Solar Spectrum.** By H. W. VOGEL (*Ber.*, **14**, 1024—1028).—After referring to his previous researches on the action of light on the haloïd silver salts (this Journal, 1874, 217, 424, and 736), the author points out that silver bromide gelatin plates are most sensitive to pale blue rays (450 wave-lengths). The sensitiveness gradually diminishes in the direction of the violet and rapidly in the direction of the red rays; whereas silver bromide collodion plates are most sensitive to indigo rays (430 wave-lengths), the action decreasing rapidly towards the green, and gradually towards the ultra-violet rays. The difference in the sensibility of collodion and gelatin plates is due to the fact that they contain two different modifications of silver bromide.

Collodion-gelatin plates, prepared by mixing a solution of gelatin containing finely-divided silver bromide in glacial acetic acid with a solution of pyroxylin in glacial acetic acid and alcohol, are as sensitive as gelatin plates. They resemble the gelatin plates in their maximum of sensibility and in their behaviour to the violet end of the spectrum, but are much more sensitive to the rays of lesser refrangibility. The conversion of a negative into a positive image, by over exposure to strong light, takes place much less readily with collodion-gelatin than with gelatin plates.

W. C. W.

**Action of the Air in Rendering the Flame of the Bunsen Lamp Non-luminous.** By K. HEUMANN (*Ber.*, **14**, 1250—1253).—In reply to Blochmann's remarks (*Annalen*, **207**, 167), the author points out that the non-luminosity of the flame of a Bunsen's burner to which air is admitted is due to several different causes, some of which act in opposite directions; *e.g.*, the dilution of the gas with the inert nitrogen of the air tends to diminish the luminosity of the flame by lowering its temperature, but this action is not directly perceptible, since it is more than counterbalanced by the increase of temperature due to the admission of oxygen. The luminosity of a hydrocarbon flame is decreased by anything which hinders the separation of free carbon.

W. C. W.

**Discontinuous Phosphorescent Spectra in High Vacua.** By W. CROOKES (*Chem. News*, **43**, 237—239).—The author some time ago drew attention to the fact that many substances, when submitted in high vacua to the molecular discharge by means of an induction coil, emitted phosphorescent light, the phosphorescent sulphides, the diamond, the ruby, and various other forms of alumina, crystalline and amorphous, being mentioned. Pure alumina, chemically prepared, has very strong phosphorescence; alumina, in the form of ruby, glows with a full rich red colour, and the emitted light, when examined with the spectroscope, is seen to be discontinuous. There is a faint con-

tinuous spectrum ending in the red, somewhere near the B line, then a black space, and next an intensely brilliant and sharp red line, to which nearly the whole of the intensity of the coloured glow is due. This coincidence is of considerable interest, as it shows a relation between the action of molecular impact and of sunlight in producing luminosity. The phosphorescence induced in a crystal of ruby by the molecular discharge is not superficial, but the light comes from the interior of the crystal, and is profoundly modified according as its direction of vibration coincides or makes an angle with the axis of the crystal, being quenched in certain directions by a Nicol prism. Sunlight falling on the ruby crystal produces the same optical phenomena. The crimson glow of alumina remains visible some time after the current ceases to pass. When the residual glow has ceased, it can be revived by heating slightly with a spirit-lamp.

After long experimenting with chemically pure alumina precipitated from the sulphate, a curious phenomenon takes place. When sealed up in the vacuum two years ago, it was snow-white, but after being frequently submitted to the molecular discharge, it gradually assumes a pink tinge, and on examination in sunlight, a trace of the alumina line can be detected. The repeated molecular excitation is slowly causing the amorphous powder to assume a crystalline form. The following experiment was made:—Two earthen crucibles were tightly packed, the one with sulphate of alumina, the other with the acetate. They were then exposed, side by side, to the most intense heat of a wind-furnace—a heat of nearly the melting point of platinum. The resulting aluminas were then tested in the molecular stream; the sulphate gave a crimson glow and spectrum line, the acetate gave no red glow or line, but a pale-green phosphorescence. Besides the ruby, other native forms of crystallised alumina phosphoresce; corundum glows with a pink colour; sapphire gives a red and green glow; the mineral spodumene (aluminium and lithium silicate) gives a brilliant rich golden-yellow colour, but shows no spectrum line, only a strong concentration of light in the orange and yellow.

The author in the next place investigated if the other earths would show phosphorescent properties similar to those of alumina, and especially if any of them would give a discontinuous spectrum. Glucina phosphoresces with a bright blue colour, but no lines can be detected in the spectrum, only a concentration of light in the blue. Phenakite (aluminate of glucinum) behaves like glucina, but shows a residual glow after the current is turned off. Thorina has very little, if any, phosphorescence. However, on putting it in a tube furnished with well insulated poles, whose ends are about a millimeter apart in the centre, and heating strongly during exhaustion, the earth on cooling absorbs the residual gas with such avidity that the tube becomes non-conducting, the spark preferring to pass several inches in air rather than strike across the space of a millimeter separating the two poles. It is probable that this strong attraction for gas is connected with the great density of the earth thorina (sp. gr. 9.4). Zirconia gives a very brilliant phosphorescence of pale bluish-green colour. No lines are seen in the spectrum. Lanthana shows no phosphorescence. After it has been heated for some time before the blowpipe, it phosphoresces

of a rich brown. Didymia has scarcely any phosphorescence. Yttria shows a dull greenish light, giving a continuous spectrum. Erbium phosphoresces with a yellowish colour, and gives a continuous spectrum. Titanic acid phosphoresces dark brown, with gold spots in places. Stannic, chromic, ferric, and ceric oxides do not appreciably phosphoresce. Magnesia phosphoresces with a pink opalescent colour, and shows no spectrum lines. Baryta (anhydrous) scarcely phosphoresces at all. The hydrate shines with a bright orange-yellow light, but shows no discontinuity of spectrum, only a concentration in the yellow-orange. Strontia phosphoresces with a beautiful deep-blue colour, without any lines or bands. Lime phosphoresces of a bright orange-yellow colour, changing to opal-blue in patches, where the molecular discharge raises the temperature. On stopping the discharge, there is a decided residual glow. No lines are seen in the spectrum of the light. Calcium carbonate shows a strong phosphorescence, which begins to appear at a comparatively low exhaustion (5 mm.). The interior of the crystals shines of a bright straw colour, and the ordinary and extraordinary rays are luminous with oppositely polarised light. Calcite shows the residual glow longer than any substance experimented with. Calcium phosphate gives an orange-yellow phosphorescence and a continuous spectrum. Potash phosphoresces faintly of a blue colour without lines. Soda phosphoresces faintly yellow, and gives the yellow line in the spectrum. Lithium carbonate gives a faint red phosphorescence, showing the red, orange, and blue lithium lines in the spectroscopy. The diamond phosphoresces with great brilliancy. In this respect perfectly clear and colourless stones "of the first water" are not the most striking, and they generally glow of a blue colour. Diamonds, which in sunlight have a slight fluorescence, disappearing when yellow glass is interposed, generally phosphoresce more strongly than others, and the emitted light is of a pale yellowish-green colour. Diamonds which phosphoresce red generally show the yellow sodium line superposed on a continuous spectrum.

With regard to the degree of exhaustion at which various substances begin to phosphoresce, it is mentioned that the majority of bodies do not phosphoresce until they are well within the negative dark space.

During the analysis of some minerals containing the rarer earths experimented on, certain anomalies have been met with, which seem to indicate the possible presence of other unknown elements awaiting detection.

D. B.

**Galvanic Polarisation.** By F. EXNER (*Wien. Akad. Ber.*, 82 [ii], 1091—1100).—This is in answer to Beetz's papers (this Journal, 38, 837).—The author is of opinion that a given metal in a given gas does not produce a constant quantity of polarisation; but that this quantity, for example, in the case of platinum in hydrogen, depends essentially on the way the hydrogen in the voltameter is utilised; for if the second electrode be either copper in a solution of copper sulphate or silver in a solution of silver nitrate, then the polarisation current is due either to the reduction of the copper or of the silver; and as these reductions are not thermally equal, they will each yield a different electromotive force of polarisation. From this he draws the

conclusion, that the estimation of the polarisation of only one electrode, as a constant, is valueless. Beetz objects to this, and supported his objection by the experiment with the three separate cells, *Z*, *A*, and *B*, which were connected together by a tube of acidulated water (*loc. cit.*). The current from a primary circuit going through a voltameter had its electrodes in *A* and *B*; *Z* contained an amalgamated zinc plate, and was in connection with *A*. The circuit being closed and the ions disengaged, the polarisation of *A* was measured, by connecting it with the earth, and *Z* with an electrometer. *A* contained platinum in dilute sulphuric acid; *B* was first platinum in sulphuric acid, then zinc in zinc sulphate, copper in copper sulphate, and silver in silver nitrate. The author, however, shows that the method of proof, and not the thesis, is at fault; for if the middle cell *A* be connected with the earth, and the cell *Z* with an electrometer, then the polarised platinum plate is always opposed to the same electrode, and therefore the force is always the same, whatever *B* contains. The metal and liquid ought to have been changed in *Z*, and not, as Beetz did, in *B*.

The author states further, that the positive pole of an element, if it is not chemically altered, takes no part in the production of electricity. His experiments agree with this statement; Beetz's do not. He accounts for this from the fact that he used water free from oxygen, which Beetz did not; therefore, in the case of the elements, Zn—Ag; Zn—Cu, the loss of electromotive force was due to the oxidation of the positive poles; whilst in the case of the Na—Zn element, it was due to the fact that there was one current from the sodium in one direction, and another caused by the decomposition of the water and the simultaneous oxidation of the zinc, in the opposite direction; this being the case, the force of the element Na—Pt = 1.33, less the force of the element, Zn—Pt = .73, difference = .60, should equal the force of Na—Zn; Beetz found .68. Beetz objects to this explanation, because, after allowing a Na—Zn element, in which the two plates were put in separate vessels connected by a tube filled with acidulated water, to work for 17 hours, he found zinc sulphate in the liquid round the zinc plate, but none in that round the Zn—Na plate; he infers that "even zinc, when negative in the circuit, is not attacked by dilute sulphuric acid." The author, however, explains it this way: the current from the sodium being the stronger, decomposes the zinc sulphate as soon as it is formed, and deduces further that this Na—Zn element is, in fact, two elements working one against the other. He refers to another point, viz., the relation of the electromotive force of the primary current to that of the polarisation current (this *Journal*, 36, 578), about which Beetz quotes contradictory statements.

D. A. L.

**Elasticity and Electric Conductivity of Carbon.** By W. BEETZ (*Ann. Phys. Chem.* [2], 12, 65—75).—The modulus of elasticity of the coke used for the electric light is deduced from the note emitted when a piece is thrown into acoustical vibration. The experiments on the electric conductivity show an irregular decrease in the resistance with the rise of temperature at first, and afterwards an increase. The author explains the irregularity by attributing to the

coke a structure similar to that of certain metallic oxides (*e.g.*, *pyrolusite*).

**Thermic Theory of Galvanism.** By J. L. HOORWEG (*Ann. Phys. Chem.* [2], 12, 75—90).—In this paper the author concludes the exposition of his theory as applied in detail to the phenomena of electricity, and sums up the whole in the following propositions:—

1. Every development of electricity is a consequence of the disturbed motion of heat in the contact of two heterogeneous bodies.

2. Electricity is propagated from one point to another in two different ways, namely, by conduction and by dielectric action.

3. Bodies may be divided into dielectric and adielectric. The conductivity of the former class increases with the temperature; that of the latter decreases.

4. An electrolyte is a decomposable dielectric.

5. In every closed circuit of which at least one member is a dielectric, the sum of the differences of potential is not zero. The least variation of potential adjusts itself in the circuit, but is continually re-established by the heat: hence a galvanic current is produced, the direction of which is determined by the sign of the aforesaid sum.

6. The galvanic current subsists at the expense of heat at some of the points of contact, and causes the development of heat at others. It continues if sufficient heat is supplied from without (thermo-current) or from within (voltaic current); otherwise it disappears with a rapidity determined by the resistance of the circuit.

7. The electrolytes in the circuit are always decomposed, and this usually produces new differences of potential, which together diminish the above-mentioned sum, and may even reduce it to zero (chemical polarisation).

8. The change of temperature in a part of the circuit is determined by the galvanic heating, by the absorption of heat at the places of contact, and by the chemical heat. These changes of temperature lead to the production of fresh differences of potential (thermic polarisation).

R. R.

**Application of the Second Proposition of the Theory of Heat to Chemical Phenomena.** By A. HORSTMANN (*Ber.*, 14, 1242—1250).—After referring to his own experiments (*Ber.*, 9, 1625), this Journal, 1877 [i], 433), and to those of Isambert (*Compt. rend.*, 92, 919), on the dissociation of a solid into two gaseous products, the author points out that by means of the formula  $Q = ATu \frac{dp}{dT}$ , the heat

of formation of the dissociated compound may be calculated from the tension of its vapour at the temperature T; Q = the amount of heat absorbed;  $p$  = the vapour-tension; T = the temperature calculated from the absolute zero; A = the mechanical equivalent of heat  $\frac{1}{4\frac{1}{2}}$ .

If we neglect the volume occupied by the original solid, then  $u$  (the increase of volume by the decomposition) =  $mv$ , if  $v$  = the volume of the molecular weight,  $m$  of the gaseous products. For the differential  $\frac{dp}{dT}$ , we may use the difference of two vapour-tension determinations,

divided by the difference between the temperatures at which they were made,  $\frac{p_2 - p_1}{T_2 - T_1}$ , the difference of temperature being small. The mean values of  $p'$  and  $p''$ , also of  $T'$  and  $T''$  can be used for  $p$  and  $T$ .

W. C. W.

**Temperature of Ignition of Gaseous Mixtures.** By MAILLARD and LE CHATELIER (*Compt. rend.*, 91, 125—828).—Two methods were adopted for determining the temperature of ignition. (1.) By comparing the volumes of detonating gas and of air, which at the same temperature would fill a porcelain pyrometer. (2.) By placing side by side in a furnace an air pyrometer and a porcelain tube, through which passes the gaseous mixture. The first method is applicable to mixtures which condense after explosion; the latter to those in which there is no change of volume. Mixtures of hydrogen and oxygen, with or without air or carbonic anhydride, inflamed between 552° and 569°. Carbon monoxide and oxygen detonated at about 647·5°. The temperature of ignition did not vary appreciably when the proportions of carbon monoxide and oxygen were varied, or when nitrogen was added to the mixture, but the addition of carbonic anhydride raised it considerably. It was also noticed that carbon monoxide and oxygen would burn gradually, at a temperature considerably lower than that at which it exploded, such combustion often beginning at 477°, and when mixed with carbonic anhydride at 496°.

In like manner, marsh-gas and oxygen will undergo slow combustion, and when raised to a certain temperature will explode, *after the expiration of a variable time*, which is longer as the temperature is lower; it is obvious, therefore, that there cannot be any well-defined temperature of ignition with these gases. A mixture of 0·7 litre of oxygen and 0·3 litre of marsh-gas exploded after a few seconds, at 650°. At 600° no explosion took place, but the mixture underwent slow combustion; when the proportions of the gases were reversed, explosion resulted between 640° and 660°, whilst the addition of 90 per cent. of air raised the required temperature to 730—790°.

Pure marsh-gas when heated alone to 770° is not decomposed, but at 962° it slowly increases in volume by 30 per cent., which then remains stationary. From these experiments it is tolerably certain that the detonating point of marsh-gas is not higher than 790°, and that combustion can take place at much lower temperatures. These results are in opposition to the experiments of Davy, who found that a mixture of marsh-gas and oxygen would not explode by the intervention of an iron rod heated to whiteness; the authors explain the anomaly by showing that the action is slow, and that the gases do not remain long enough in contact with the heated iron to acquire the property of exploding; if, on the contrary, they were steadily heated in an iron crucible, supposing such an operation to be possible, instead of having a white-hot rod plunged into them, they would explode at a red heat, without any trouble.

J. W.

**Supposed Heating of Ice.** By A. WÜLLNER (*Ann. Chim. Phys.* [2], 13, 105—110).—The author has repeated, by means of a modified

form of apparatus, the experiment described by Carnelley (*Nature*, Feb. 10th, 1881, 341), and finds that *so long as the bulb of the thermometer is completely surrounded by dry ice its temperature does not reach 0°*. If the thermometer rises higher, either the bulb is no longer quite covered with ice, or it is surrounded with water, along with a thicker ice layer. The course of the experiment in other respects was exactly as described by Carnelley. When the bulb becomes partially bare of ice, the thermometer rises even to 50° before the ice becomes detached, and by rapid heating would probably rise considerably higher. The detached ice, when it comes in contact with the hot glass, dances about like Leidenfrost's drops.

In order that fusion may not take place, it is necessary that the ice be not too thick, but how thick was not determined. In one experiment in which the thermometer bulb was surrounded by a coating of ice of 1 to 1.5 cm. thick, and strongly heated with the flame of a Bunsen's burner, the temperature quickly rose to 0°, when fusion commenced, *not, however, on the surface, but in the centre of the ice, and in such a way that the water was forced out through the surface in small drops*, like blisters, and these on removing the lamp instantly froze. On re-heating, the same phenomenon was repeated several times.

In a quantitative experiment, in which 75 grams of ice were kept under low pressure, and exposed to the temperature of steam from boiling water for five hours no fusion occurred, and 42 grams of ice had volatilised into the condenser.

T. C.

**Thermochemical Investigations.** By C. v. THAN (*Ann. Chim. Phys.* [2], 13, 84—105).—The method previously proposed (*Ber.*, 10, 947) for determining the heat of combustion of gases at constant volume by the use of Bunsen's ice calorimeter, can only be considered as approximate, since several sources of error were overlooked. In the present communication a method is described in which these errors are avoided, and very exact results are obtained in the case of the combustion of hydrogen in oxygen. As a result of the experiments it is found that 1 litre of ( $H_2 + O$ ) gas, measured under normal conditions, when burnt at a constant volume, and completely condensed to water at 0°, evolves a quantity of heat sufficient to melt 2,503,634 grams of ice, with a probable error of + 0.02 per cent.; 1 gram of hydrogen, therefore, when burnt at constant volume, equals 419,273 ice-calories, or 427,789 ice-calories when burnt under constant pressure. This agrees very nearly with the values obtained by Schuller and Wartha (*Ann. Chim. Phys.*, 2, 378, 1877), viz., 418,815, and 427,326 respectively.

Berthelot's statement (*Compt. rend.*, 40, 1241) that the same result is obtained whether the ( $H_2 + O$ ) gas is burnt under constant pressure or at constant volume, is incorrect, the difference in fact amounting to as much as 2 per cent.

T. C.

**Study of the Explosive Properties of Mercury Fulminate.** By BERTHELOT and VIEILLE (*Ann. Chim. Phys.* [5], 21, 564—574).—The authors' experiments in connection with this subject turn upon the following points:—(1.) The nature of the products of explosion.

(2.) The heat disengaged during explosion. (6.) The density of the fulminate. (4.) The pressure developed during explosion in closed vessels, under varying conditions. The explosion of the fulminate was effected within a steel bomb or eudiometer made for the purpose. The charge, wrapped in tin-foil, was suspended in the centre of the apparatus, and was fired by igniting in contact with it a fine platinum wire by electricity. The eudiometer was first filled with nitrogen at a known temperature and pressure. After the explosion the volume of the gases produced was measured, and an analysis made. In five experiments, the number of c.c. of gas obtained from 1 gram of fulminate varied between 230 and 238 c.c.; the theoretical number being 235.8 c.c. Its analysis gave the following results:—

HCN + CO <sub>2</sub> .	CO.	N.	H (error).
0.15	65.70	32.28	1.87 = 100.00

From these figures it will be seen that the fulminate decomposes according to a very simple reaction into carbon monoxide, nitrogen, and mercury,



The detonation of the fulminate does not produce, under the above experimental conditions, any substance capable of undergoing sensible dissociation: consequently no gradual combination can subsequently result which might moderate the pressure of the gases or diminish the violence of the initial shock; on the other hand, it is probable that the explosion would be even more sharp and sudden than it actually is, were it not slightly tempered by the condensation of vapour of mercury.

*Heat Produced.*—By conducting the experiments with the eudiometer immersed in the water of a calorimeter, it was easy to ascertain the amount of heat evolved on explosion. As a mean of five concordant results, 1 gram evolved 403.5 thermal units, a number to which  $\frac{1}{80}$ th should be added in order to take into account the small amount of mercury vapour present. This figure calculates for one molecule in grams to +116 units at constant volume, or +114.5 units at constant pressure; a quantity of heat which would be capable of raising all the products, supposing them to be already gaseous, to about 4,200°.

*Heat of Formation.*—It is easy to deduce from the foregoing the heat of formation of mercury fulminate from its elements, C<sub>2</sub> (diamond) + N<sub>2</sub> + O<sub>2</sub> + Hg (liq.) = C<sub>2</sub>N<sub>2</sub>HgO<sub>2</sub>, absorbs 51.6—114.5 = -62.9 units.

This quantity is negative, as might be expected. The disengagement of heat in the decomposition of the fulminate arises, then, from two causes: (1) the separation of the elements; (2) the simultaneous combustion of the carbon by the oxygen, with production of carbonic oxide. When the fulminate is mixed with chlorate or nitrate of potassium, the carbonic oxide is converted into carbonic anhydride, and the amount of heat disengaged is double that produced by the pure fulminate; the initial shock is, however, so far tempered and moderated by the phenomena of dissociation, due to the carbonic



anhydride, that the mixed fulminate is less violent in its ultimate effects.

The density of mercuric fulminate was found to be 4.42.

*Tension Exerted in Closed Vessels.*—This was measured by means of the well-known "crusher gauge" devised by Noble, applied in a special apparatus, which is described at length and illustrated by a diagram in the original memoir. The results are compared by introducing into the same receptacle increasing weights of the explosive substance; and the ratio of the weight of the explosive to the internal volume of the vessel is called the "density of the charge."

Density of the charge.	Weight of fulminate.	Pressure in kilos. per sq. cm.
1	2.43 grams.	477
2	4.86 "	1730
3	7.39 "	2697
4	9.72 "	4272

In the last experiment the steel piston was broken into several pieces, and the copper washer was forced out in the form of a thin leaf into the space of  $\frac{1}{100}$  mm. existing between the piston and its concentric canal. These phenomena are characteristic of the violence and rapidity of the decomposition by detonation.

But although the local action is more violent with the fulminate than with other explosive materials, it is not right to conclude that the mean pressures developed by the combustion of a charge of given weight are greater also. In fact the contrary is the case. With gun-cotton, Sarrau and Vieille obtained under similar conditions—

Density of the charge.	Pressure in kilos.
1	1085
2	3120
3	5575
4	8745

results which are, moreover, in accordance with the data concerning the quantities of heat and the volumes of the gases produced by the two explosive agents. Similar results obtain when mercuric fulminate is compared with dynamite, the actual pressure developed being only 75 per cent. of that produced by the latter substance or by nitro-glycerol.

The superiority of the effect of the fulminate is mainly due to three causes, viz., the instantaneous character of its decomposition by simple ignition; the almost total absence of dissociation among its gaseous products; and its great density. By reason of these conditions the definite products of the reaction seem to be formed all at once, before the matter has had time to acquire a volume sensibly greater than that which it occupied in its primitive state. If then the fulminate detonates in a receptacle, and in contact with its walls, it develops against the latter at the first moment an instantaneous pressure having no relation to the mean pressure, which is necessarily regulated by the capacity of the recipient. Thus the fulminate, under its absolute density of 4.42, would appear to develop by contact or pressure equal

to 48,000 atmospheres; whilst gun-cotton, compressed to a density of 1.1, would develop only 24,000 atmospheres. Similar experiments and calculations will show that no explosive substance gives by contact an instantaneous pressure in any way comparable to that produced by the sudden detonation and decomposition of the metallic fulminates.

J. W.

**Vapour-densities of Homologous Ethers.** By O. SCHUMANN (*Ann. Phys. Chem.* [2], 12, 40—65).—The paper relates to the class of compound ethers formed by the alcohol-radicle salts of organic acids. The apparatus employed was similar to that described by Städel and Hahn (*Annalen*, 195, 218). The numerical results are given in a series of tables, and among the general conclusions drawn from them are the following:—For these ethers an exact accordance with Kopp's law of the boiling point at the pressure of 1 atm. is not found. The tension-curves cannot always be represented by Biot's interpolation formula with three constants. Increase of the molecular weight of the acid with a simultaneous and equal decrease of that of the alcohol acts in the same sense as an increase of the molecular weight of the whole compound; that is, the acid influences the form of the tension-curve more than the alcohol does. The author finds that his results are in complete accordance with a formula given by Winkelmann (*Ann. Phys. Chem.* [2], 9, 208 and 358) for expressing the relations between the temperature and pressure of a saturated vapour. R. R.

**Tension of Aqueous Vapour in Presence of Different Hygroscopic Bodies.** By W. MÜLLER-ERZBACH (*Ber.*, 14, 1093—1096).—The relative dehydrating power of two hygroscopic bodies was determined by enclosing the substances for several days in a tube containing air, and then ascertaining which of the two had increased in weight. The following are the results of the experiments:—

Phosphoric anhydride, sulphuric acid, sp. gr. 1.84, and dry potassium hydroxide are equally powerful in attracting water. Sodium hydroxide and calcium chloride attract moisture with almost equal force.

Sodium hydroxide can be completely dehydrated if it is left in a closed vessel containing potassium hydroxide. W. C. W.

**Compressibility of Oxygen; Action of this Gas on Mercury in Eudiometrical Experiments.** By E. H. AMAGAT (*Compt. rend.*, 91, 812—814).—Regnault has stated that it is impossible to make an exact experiment respecting the compressibility or dilatation of oxygen, since this gas is absorbed by mercury in appreciable quantity, even during the short time necessary for the experiment. The experience of the author is in direct opposition to this statement; he has distinctly shown that at 14° and at 100° mercury and oxygen, if perfectly pure and dry, can remain in contact for a much longer time than is necessary in any experiment on compressibility, without the slightest action taking place.

Knowing the general accuracy of Regnault's work, the results obtained were surprising to the author himself, but their accuracy was confirmed by a great many concordant experiments which were con-

ducted at varying temperatures below 100°, and between 110 and 420 atmospheres' pressure.

The mean coefficient of dilatation,  $\frac{v' - v}{v(t' - t)}$ , between 14.7° and 100.2° at varying pressures is as follows:—

	Atm.	Atm.	Atm.	Atm.	Atm.	Atm.
Pressure....	113.4	141.1	181.1	240.9	342.1	418.9
Coefficient..	—	0.00456	0.00469	0.00477	0.00443	0.00407
<i>p</i> v at 100.2°	—	6430	6515	6630	6911	7189
<i>p</i> v at 14.7°..	4638	4626	4648	4711	4993	5336

J. W.

**Changes in Volume of some Metals on Fusion.** By F. NIES and A. WINKELMANN (*Ann. Chim. Phys.* [2], 13, 43—83).—Of the eight metals (tin, lead, zinc, bismuth, cadmium, antimony, iron, and copper) submitted to investigation, six, viz., tin, zinc, bismuth, antimony, iron, and copper, expand at the moment of solidification, so that the solid is less dense than the liquid metal. No final conclusion could be drawn as regards the two remaining metals, lead and cadmium, although the authors are of opinion that they also expand on solidification.

Quantitative determinations were made in the case of tin, zinc, and bismuth, and it was found that the specific gravity of bismuth is between 1.031 and 1.0497 times as great in the liquid as in the solid state; a sample, whose density was 10.2 in the solid state, assumed a density of 10.77 when melted. For tin and zinc the ratio between the density in the solid and that in the liquid state was also greater than unity, viz., 1.007 and 1.002 respectively.

It is considered probable that experiment will prove that all metals expand on solidification.

T. C.

**The Phenomenon commonly called the "Cry of Tin."** By J. C. DOUGLAS (*Chem. News*, 43, 203).—If a piece of tin be bent it emits a sound; this, being regarded as a property peculiar to tin, has been termed the cry of tin. The cry of tin is due to crystalline structure; it is not, however, characteristic of tin only, as generally supposed, but may be emitted by zinc and probably by other metals when crystalline in texture. Rolling, in the case of tin and zinc, and probably in other cases, destroys the property with the alteration of texture. If, as supposed, this sound is characteristic of the crystalline structure of metals, it is thought that it may afford a means of great practical use, whereby by the sound a metal emits we may draw conclusions as to its texture, and hence its fitness for certain purposes; or by the sound emitted by a beam when bent we may draw conclusions as to its safety, the microphone or other appliance being called in to aid us where the sounds are exceedingly weak.

D. B.

**Determination of Chemical Affinity.** By W. OSTWALD. Part IV (*J. pr. Chem.*, 23, 517—536).—The author has fully investigated

nitric, hydrochloric, and sulphuric acids, and calcium and zinc oxalates. The quantity of oxalate which is decomposed increases in a perfectly regular manner with increase of temperature, the curves representing the reactions being nearly straight lines. Only in the case of comparatively concentrated acids was the curvature marked. The influence of dilution is much more complicated than that of temperature, the diluting water forming various hydrates with the acid, and causing decomposition of the oxalates. Curiously the influence of dilution is simplest with sulphuric acid, although formation of acid salts and hydrates might have been anticipated in this case; the action *increases* very regularly as the concentration *diminishes*. In all cases indeed the amount of dissolved oxalate increases with dilution, after a certain point of dilution is reached. Nitric acid dissolves more calcium oxalate as the concentration increases; zinc oxalate, however, in decreasing amounts. At 20° hydrochloric acid dissolves equal proportions of the calcium salts at all dilutions.

The author finds that the law of Guldberg and Waage is not strictly applicable to the calculation of the relative affinity. O. H.

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