half as weak again. Consequently the smallest possible effective light for the formation of chlorophyll is attained by intermittent illumination. During the formation of chlorophyll light is supplied in superabundance by a continued illumination in the same manner as at the heliotropic bendings.

A FRENCH physiologist, M. Gley, has made some delicate experiments on himself with regard to the effects of attention and intellectual work on cerebral circulation. His results confirm those of M. Mosso, and he has added some new observations. He finds that the rhythm of the heart through intellectual work is slightly accelerated; and this increase seems in direct ratio of the intensity of the attention. Thus the pulse was more frequent when the author studied geometry, with which he had little familiarity, than when he studied philosophy, of which he had a good knowledge. While the heart-rhythm is accelerated the carotid artery is dilated during cerebral work, and the carotidian pulse becomes dicrotic. But the radial pulse becomes smaller and less ample. The phenomena of congestion observed in the brain persist a certain time after cerebral activity.

CHEMICAL NOTES

BY the action of methylic iodide, in presence of sodium, on an alcoholic solution of morphine, M. Grimaux has succeeded in producing codeine, identical in properties with the naturally-occurring alkaloid (*Compt. rend.*). If ethylic iodide is employed in place of the methyl salt, a new alkaloid differing in composition from codeine by CH_2, is produced. M. Grimaux proposes to call all the homologous bodies of this series *codeines*, and to distinguish the commonly called codeine as *codomethyline*, the new homologue as *codethyline*, &c.

IN *Gazzetta Chimica Italiana* S. Valente describes a striking lecture experiment illustrative of the fact that chlorine replaces iodine from binary-compounds. A jar, 500 c.c. capacity, is filled with dry hydriodic acid gas, and another, 250 c.c. capacity, with dry chlorine, the jars being separated by a glass plate, and the larger being uppermost; on withdrawing the plate decomposition of the hydriodic acid occurs with a flash of rose-coloured flame, and separation of iodine.

SS. BARTOLI AND PAPASOGLI claim to have prepared mellitic and hydromellitic acids by the long-continued electrolysis of water, using carbon electrodes (*Nuovo Cemento*).

S. FUNARO describes two nickeliferous minerals from the Apennines in the *Gazzetta Chim. Ital.*, to one of which he gives the formula $(FeNi)_7S_8$, and to the other the formula $Cu_2R_{10}Sb_4S_{17}$, where R = Cu : Fe : Ni = 3·4 : 4·2 : 2·4.

IN continuing his investigation of the action of hydrogen peroxide on aromatic compounds (NATURE, vol. xxiv. p. 111) Dr. A. R. Leeds shows that in some of these compounds the peroxide acts only as an oxidiser, in other cases it replaces hydrogen by (OH), and sometimes both actions occur together (*Berliner Berichte*).

THE same chemist has repeated (*Amer. Chem. Journ.*) many of these experiments, wherein ozone is said to be produced by the action of heat on metallic and non-metallic oxides; he finds that in every case the supposed ozone reaction, obtained by bringing the evolved oxygen into contact with potassium iodide and starch, is due to traces of impurities, generally to traces of chlorine.

ACCORDING to M. Chappuis (*Bull. Soc. Chim.*) the phosphorescence of phosphorus in oxygen or air is an accompaniment of the combustion of phosphorus vapour by ozone. Phosphorus is not luminous in pure oxygen at 15°, and at the ordinary pressure, introduction of a trace of ozone causes luminosity; those substances which hinder the luminosity of phosphorus, *e.g.* turpentine oil, are substances which destroy ozone. If a little turpentine oil is brought along with phosphorus into a tube containing pure oxygen, and a small quantity of ozone is then passed in, the phosphorus exhibits luminosity for a few moments only; M. Chappuis supposes that this is due to the combustion of phosphorus vapour by the ozone, and that the transiency of the phenomenon is explained by the rapid removal of the ozone by the turpentine oil.

EXPERIMENTS on the action of heat on oxides of manganese, by S. V. Pickering, are detailed in *Chem. News*. According to this chemist some specimens of manganese oxides undergo a slow molecular change when kept. Thus a sample containing, when freshly prepared, 85·149 per cent. MnO_2, 9·356 per cent. MnO, and 5·490 per cent. H_2O, *lost* 1·065 per cent. oxygen when heated to 100°, but after eighty days the same sample *gained* 0·24 per cent. oxygen when heated to 100°, and 1·114 per cent. at 195°.

HERR E. RAMANN concludes from his experiments (*Berliner Berichte*) that the passivity of iron is always caused by the formation of a layer of magnetic oxide (Fe_3O_4) on the surface of the iron. In addition to nitric acid, the following liquids induce passivity in iron, viz. ammoniacal silver nitrate solution, solutions of nitrate of silver, ammonium, aluminium, nickel, cobalt, or iron.

THE same author describes an amalgam of iron, nearly of the composition expressed by the formula Hg_3Fe_2, prepared by the action of sodium-amalgam on finely-divided iron in presence of water. Dry sodium-amalgam has no action on iron.

HERREN V. MERZ AND W. WEITH have investigated the action of heat on various amalgams with the view of determining whether these bodies lose mercury regularly as temperature increases, or whether they exhibit the properties of definite compounds. The results, which are detailed in the *Berliner Berichte*, seem to show that many amalgams, *e.g.* of gold, silver, copper, bismuth, lead, cadmium, &c., although very easily decomposed by heat, nevertheless contain their component elements in definite proportions by weight; such amalgams are probably to be classed as molecular compounds. Amalgams of the alkali metals exhibit the properties of definite compounds in a greater degree than amalgams of the other metals.

IN the *Berichte* Herr V. Meyer publishes a note on the densities of the vapours of the halogens, in which he states that he means to relinquish the further working out of these problems to M. Crafts. He states that he has obtained numbers for the densities of phosphorus and arsenic which stand midway between those required by the formulæ P_4 and As_4, and P_2 and As_2.

VARIOUS papers on new nitrogen derivatives of carbon compounds are published in the same *Berichte*, by Prof. V. Meyer and his students; these papers promise results of much interest. Hitherto "azo-compounds" have only been known in the aromatic series; nitroso-substitution compounds of what is apparently azo-ethane are described by Prof. Meyer, especially $NO-C_2H_4-N_2-C_2H_4-NO$. A new series of organic bases called "*ketines*" is also described. The starting-point of this series is *ketine* or nitrosoacetene, $CH_3-CO-CH_2(NO)$.

HERR STRECKER (*Annalen Phys. Chem.*), from determinations of the velocity of sound in chlorine, bromine, and iodine gases, has obtained the following numbers for the specific heats of these gases:—

	Chlorine.	Bromine.	Iodine.
At constant pressure ...	0·115	0·05504	0·03489
At constant volume ...	0·08373	0·04257	0·02697
Ratio of values of the two specific heats ...	1·323	1·293	1·294

From these results it is concluded that the action and reaction between the atoms in the molecules of these gases is different in kind from that which subsists in other diatomic molecules, *e.g.* oxygen or carbon monoxide.

REMSEN has again investigated the action of finely-divided iron in inducing the formation of cyanide when nitrogen is passed over a hot mixture of carbon, iron, and an alkaline metal; he finds (*American Chem. Journ.*) that freshly reduced iron induces a large formation of cyanide, but that iron after keeping for some time loses this power.

FROM experiments on the decomposition of barium carbonate by ammonium chloride solution, Tommasi (abstract in *Berliner Berichte*) concludes that an aqueous solution of sal-ammoniac contains free ammonia and free hydrochloric acid.

REFERENCE was recently made in these Notes to the experiments of Jones on gaseous boron hydride; Reinitzer describes experiments (*Wien. Akad. Ber.*) which appear to show that when dilute hydrochloric acid acts on potassium boride the solid green-brown amorphous powder which is formed is a boride of hydrogen approximately of the formula $B_{3\cdot32}H$.

CONSIDERABLE doubt has been expressed whether calomel is or is not liable to decomposition in the human system, with production of corrosive sublimate. According to experiments described by P. Hoglan (*Chem. News*) calomel is slowly changed

by the action of water at the temperature of the body with formation of corrosive sublimate; and this change is accelerated by the presence of citric acid, sodium chloride, or sugar.

FROM analyses and examination of the distillation vessels used in zinc furnaces, Herren Schulze and Steiner (*Jahrb. für Mineral.*) have found that these vessels contain well-formed crystals of *zinc-spinell* (or zinc aluminate) along with crystals of tridymite. The authors discuss the bearing of their results on the natural formation of minerals of the spinell group in limestones; they point out that the generally accepted hypothesis that such limestones must have been in a fused state for some time, is not necessary, but that the minerals may have been formed by the action of vapour penetrating the solid hot limestone. The action of gases on a softened rock mass may give rise to molecular changes resulting in the production of various minerals.

PHYSICAL NOTES

A CONTINUOUS registering thermometer for recording the temperature of the body has just been described by its inventor, M. Marey. It consists of a brass tube communicating with a Bourdon manometer, containing oil, and closed. Any change of temperature, by altering the internal pressure, makes the curved manometer tube curl more or less, and to it is fixed an index which registers the movements by inscribing them on a recording cylinder. The thermometric bulb may be at some distance from the inscribing apparatus, being connected by a flexible tube of annealed copper. Two such bulbs may be applied to different parts of the body, even to the interior. It is possible therefore to note the relations between the temperatures of the interior and exterior of the body. If we remember rightly, an analogous but more portable instrument was suggested some time ago by Mr. Donald Macalister, but we are not aware whether his instrument is yet before the public.

PROF. E. LOMMEL describes in *Wied. Ann.* a new polarising apparatus in which two plates of platinocyanide of magnesium, cut perpendicularly to the optic axis, are used as polariser and analyser, just as in the tourmaline pincette. Such a section of this crystal transmits a blue light, which, when the angle of incidence exceeds 2°, is found to be perfectly polarised in the plane of incidence, and it therefore can be used, if tilted to that extent out of perpendicularity to the axis, as a polariser for a pencil of parallel blue rays. One curious point in respect to the behaviour of a thin film thus prepared is the following:—Let ordinary non-polarised light be looked at through the crystal while the latter is normal to the line of sight. A white central spot, perfectly circular in form, and non-polarised, is observed in the middle of a blue field, which is polarised at every point radially. The only other crystals which can be used for polarising pincettes are the tourmaline and herapathite (iodo-sulphate of quinine): the point of difference between these and the platinocyanide of magnesium is that while the two former (which are negative crystals) absorb the ordinary ray, and must therefore be cut parallel to the optic axis, the latter absorbs the extraordinary ray, and must therefore be cut at right-angles to the optic axis.

THE galvanic properties of carbon have been closely examined by Dr. Hanichi Muraoka, a Japanese student at Strassburg. He determined the specific resistance and the change of resistance with increase of temperature of all kinds of hard carbon, including Siberian graphite, gas-retort carbon, the artificial carbons used for electric lighting by several well-known firms, and even the graphitic compound used in Faber's lead-pencils. The specific resistance (at 0° C.) of the last was 952·0, while that of the first was 12·2. The artificially-prepared carbons ranged from 36·86 to 55·15. In all however the resistance *decreased* with a rise of temperature, the coefficient of decrease being greatest for the Siberian graphite, least for a carbon pencil prepared from coke by Heilmann of Mühlhausen. This result entirely confirms the recent researches of Siemens and Beetz. The thermo-electric powers of the various samples of carbon were also determined, with respect to that of graphite; their thermo-electromotive force was in every case + to graphite, and varied from 423 microvolts for the Faber pencil carbon to 9·26 microvolts for the gas-retort carbon (of Parisian manufacture) used for battery plates.

HERR P. VOLKMANN observes that in the determination of the specific gravity of heavy liquids, such as quicksilver, by means of the specific gravity bottle or pyknometer, the change of volume of the vessel caused by the internal pressure may introduce a source of error, especially as the glass vessel may suffer a sub-permanent strain from which its recovery is not immediate. He gives an example of this error in the case of a pyknometer provided with a capillary tube marked in equal divisions. This pyknometer was filled with mercury *while standing in mercury* until the top of the column stood at 68·1 divisions. On taking it out of the mercurial bath the column fell to 65·4, and on dipping it it again rose to 68·5. The necessary precautions to avoid this error having been taken, a redetermination was made of the specific gravity of distilled mercury at 0° C., the density of water at 0° C. being assumed (at Pierre's value) as 0·999881. The new value for the density of mercury comes out as 13·5953 ± ·0001, which is a little less than the lowest of the values given by Regnault.

PROF. S. P. LANGLEY has made the following calculation:—A sunbeam one square centimetere in section is found in the clear sky of the Alleghany Mountains to bring to the earth in one minute enough heat to warm one gramme of water by 1° C. It would therefore, if concentrated upon a film of water 1-500th of a millimetre thick, one millimetre wide, and ten millimetres long, raise it 83⅓° in one second, provided all the heat could be maintained. And since the specific heat of platinum is only 0·0032, a strip of platinum of the same dimensions would, on a similar supposition, be warmed *in one second* to 2603° C.—a temperature sufficient to melt it!

THE alteration of the zero of thermometers after undergoing sudden changes of temperature is a well-known phenomenon, as is also the gradual rise in the zero in thermometers during the first few months after they have been made. M. Pernet has lately examined the question whether the distance between the "boiling point" and the "freezing point" of a thermometer is constant at all different stages of secular alteration in volume of the bulbs, and finds that this is so, provided the freezing point be determined immediately *after* the boiling point. On the other hand, if the boiling point be determined and a long interval elapse before the zero is determined, there is considerable error. Suppose a thermometer to be (owing to recent heating or to long rest) in any particular molecular state. In this state its reading will probably be in error: but this amount (so far as due to the above cause) may be ascertained by immediately plunging the thermometer into ice, and observing the error of the zero reading. In order that a thermometer should read rightly at any particular temperature it should be exposed for a considerable time to the temperature for which exact measure is desired, or else for a few minutes to a slightly *higher* temperature.

THE transparency of ebonite to heat rays may be shown by the following pretty and simple experiment. A radiometer is set revolving by the light and heat radiated from an argand gas-flame or the flame of a paraffin lamp. When a thin sheet of ebonite is interposed the rotations continue though with slightly diminished energy. But the thinnest sheet of note-paper interposed suffices to check the revolution of the vanes.

PROF. GRAHAM BELL has sought to prove whether the diaphragms subjected to intermittent radiation in one of the forms of the radiophone did or did not execute mechanical vibrations. The experiment of Mr. W. H. Preece of attaching a Hughes' microphone to the disk had led to negative results. But Prof. Bell has shown that the central region of the disk (on which the rays fall) is set into mechanical vibration; and he has proved the point by employing a modification of the mechanical microphone of Wheatstone. A stiff metallic wire is fixed to the centre of a thin metallic disk mounted at the extremity of a flexible hearing tube. When the end of the wire is pressed against any vibrating body its sounds are heard, and the vibrations at different points of the disk of a radiophone can be successively explored. The vibrations are found to be almost entirely confined to the illuminated area at the centre of the disk. A Hughes' microphone attached to the edges of the disk would therefore not easily give any indications. With this simple apparatus one very curious effect was obtained. An intermitted beam of rays was focussed upon a brass kilogramme weight, and the surface was explored with the point of the metallic microphone. Over all the illuminated area and for a very short distance outside it a feeble but distinct sound was detected, but not over other parts.

MR. EDISON has devised a new meter for voltaic currents even more ingenious than the "Weber-meter" which he proposed a year ago to fix in houses supplied with electric lamps. In the