and melt it, and add thereto an equal weight of lead and mix the whole together thoroughly; then if I take out the mixture and cool it rapidly, I get an ingot composed of copper and lead, almost wholly in mechanical mixture. Suppose, instead of cooling it rapidly I leave it to cool slowly; an almost complete separation of the two metals takes place; the lead, being the heaviest of the two, accumulates at the bottom of the mold. The separation in this latter case is not perfect, for the copper will retain about 2 per cent of lead, and the lead also about that percentage of copper. There is, therefore, no proper alloy of these metals in the strict sense of the term.

Next let us take copper and iron, and the iron we use will be that which is most like pure iron—wrought iron. Suppose we expose the mixture of copper and iron to a very high temperature; we shall not get anything but a mechanical mixture; when the proportion of the iron increases beyond a certain degree, we can distinguish under the microscope small grains of that metal, diffused through the mass. Iron is a white metal, and copper a red one. In every other case that I know, when two metals differing in color form a true alloy, the product differs in color from either of the metals, but in the case of this mixture of iron and copper, the product is a ruddy colored mixture like copper, the iron being diffused through it. That is to my mind a satisfactory proof that it is a mechanical mixture, and not a true alloy. To get this mixture in the best manner, take some oxide of iron and oxide of copper, as fine as possible, and mix them up intimately with some finely powdered charcoal, and then subject the mass to a high temperature; the charcoal, as we know, will then reduce both the oxides, and set free the metals in a condition most favorable for their combination.

Metallic copper or native copper is frequently found in connection with other copper ores; sometimes in vast masses, as near Lake Superior, where it was said there was one mass of copper in the metallic state weighing not less than 500 tuns. In this condition it is, perhaps, one of the most expensive ores of copper, for the metal is excessively tough, and cannot be blasted, but must be prepared for the market by being cut up with tools. The next ore is the oxide of copper; there are really two oxides of copper, the red and the black, and they are among the richest ores of copper. Then we have the blue and green carbonate; the latter is commonly called "malachite" and is frequently applied to ornamental purpose. These latter ores are compounded of oxide of copper, carbonic acid, and water; and when heated up to a good red heat, they lose water and carbonic acid, and the residue consists of oxide of copper. In treating an ore of this kind, then, we may consider ourselves, therefore, as virtually treating an oxide of copper. There is another class of ores in which copper is combined with sulphur; one exactly similar in all respects to that compound I have before described—the gray sulphide of copper, an extremely valuable ore. Then there is another in which iron occurs as a constituent—common yellow ore or copper pyrites; it consists of copper and iron, and sulphur. Sometimes copper pyrites is mistaken by inexperienced persons for iron pyrites, a compound of iron and sulphur, which is far less valuable than the other, but here is a simple test by which you can infallibly distinguish between them. Apply the point of a penknife in the case of copper pyrites, you can scratch it easily; but in the case of iron pyrites, you can make no mark upon it.

CHEMICAL NOTES.

Action of Heat on Gases and Vapor Condensed by Charcoal.

When wood charcoal, saturated with dry chlorine, is placed in the longer branch of Faraday's siphon gas-condensing tube, and the heat of boiling water is applied to it, the shorter branch being placed in a freezing mixture, a portion of the gas is volatilized. Pressure being thus developed, liquefied chlorine soon appears in the tube. The experiment is well adapted for a lecture demonstration. The author has liquefied in this manner ammonia, sulphur dioxide, hydrosulphuric acid, hydrobromic acid, ethyl chloride and cyanogen.

Wood charcoal retains so firmly the vapors of the volatile liquids, bromine, hydrocyanic acid, carbon sulphide, ether and alcohol, that, upon repeating with them the experiment just described, no liquid is obtained.

Pouillet observed a slight evolution of heat when water, oils, ethyl acetate, and alcohol were absorbed by mineral powders, and still more marked effects with organic powders. The author finds that, with charcoal, still more heat than in the above case is given out when it absorbs liquids upon which it has, apparently, no chemical action. Thus with 5—10 grains of charcoal, and 40—80 grains of bromine, the temperature was raised 30° C. If the charcoal had been previously heated to expel gas, and then cooled *in vacuo*, the absorption of bromine being also conducted *in vacuo*, no doubt the rise of temperature would have been still greater. —*Melsens. Comptes Rendus—Journal of the Chemical Society.*

Sugar from Caoutchouc.

Caoutchouc from Madagascar yields a saccharine substance, which A. Girard has named "matezite," from the native word for caoutchouc. Matezite is white, very soluble in water, less soluble in alcohol, from which it crystallizes in tufts. It melts at 181° to a vitreous mass, which does not crystallize on cooling, and may be sublimed at 200°—210° without decomposition. It deposits in drops. Its formula is $C_{10}H_{20}O_9$; and on treatment with hydriodic acid, it undergoes a decomposition analogous to the others, forming a sugar called by the author *matezodambose*.

Glycyrrhizin, or Liquorice Juice.

P. Griessmayer says: "It has been suspected that sugar, extracted from liquorice root, has been used for the purpose of adulterating beer, and yet the opinion of chemists has been that such sugar is not fermentable. Glycyrrhizin is a glycoside, which, on boiling with acids, decomposes into glycyrretin and sugar. Even after boiling it with water, sugar may be detected by Fehling's test. The sugar obtained in this manner was treated with yeast, and after three days the fermentation was complete, and alcohol was found in large quantity by means of the well known reaction converting it into iodoform. During the latter stage of the fermentation a peculiarly disagreeable putrid odor was perceived, and the substance emitting it passed over into the distillate; the disagreeable taste of some German beers is doubtless owing to this body.—*Dingler's Polytechnisches Journal.*

Amylammonium Chloride.

Amylammonium chloride, introduced under the skin of the rabbit, guinea pig, and dog, causes, in small doses, a marked diminution of the pulse, and some fall in temperature. In larger doses convulsions are produced, which end in death. With man a dose of from 8 to 16 grains lowers the pulse 10 to 20 beats per minute, and occasions a fall in temperature. Dr. Dujardin-Beaumetz has administered this salt with advantage in some cases of typhoid fever. Amylamine has not the sedative action on the nervous system which trimethylamine possesses, but surpasses it greatly in its effect on the pulse, and in its toxic action.

Experiments on the Preservation of Eggs.

F. C. Calvert finds that eggs, either entire or pierced at the end by a fine needle, may be kept for three months without change in an atmosphere of nitrogen, hydrogen, or carbonic anhydride. In dry oxygen entire eggs undergo no change, but if the gas is moist the egg becomes covered with a white filamentous mold.

An egg pierced at the extremity soon becomes putrid either in dry or in moist oxygen, the amount of oxygen consumed, and of carbonic anhydride and nitrogen evolved, being much greater in the latter case than in the former.

New laid eggs immersed in weak chlorine water contained in a stoppered bottle underwent no change for nearly eight months, but on leaving the bottle open for a week, they became covered with *penicillium glaucum*.

Eggs kept in a weak solution of chlorinated lime soon began to show signs of change externally by the growth of penicillium. With lime water and with calcium sulphite, similar results were observed.

Eggs kept in solution of phenol exhibited no change for three months. They were then slightly coated with penicillium, but their contents were perfectly sweet.

Camphor for Seeds.

According to A. Vogel, camphor is found to have a marked effect in stimulating the germination of seeds, both by shortening the period of germination and causing more seeds to sprout. Turpentine has a similar action, but seems to exert a hurtful influence on the further development of the plant, which is not the case with camphor.

The Costly Mistakes of Civil Engineers.

President White, of Cornell University, makes the following strong assertion in a recent lecture:

"Another great department bearing on a multitude of industries, directly and indirectly, is civil engineering. Take one among the fields of its activity. We have in the United States about 70,000 miles of railway, and every year thousands of miles are added. I do not at all exaggerate when I say that millions of dollars are lost every year, by the employment of half educated engineers. Proofs of this meet you on every side. Lines in wrong positions, bad grades, and curves, tunnels cut and bridges built which might be avoided. All of us know the story. But this is not all. Hardly a community which has not some story to tell of great losses entailed by bad engineering in other directions. Here it is the traffic of a great city street interrupted for a year because no engineering can be found able to make the calculations for a 'skew arch' bridge, a thing which any graduate of a well equipped department of engineering can do; there it is a city subjected to enormous loss by the failure of its water supply system because the engineer employed made no calculation for the friction of water in the pipes; in another instance it is a whole district sickened by masma, because a half taught engineer was entrusted with its drainage. We must prepare men for better work; and for every dollar thus laid out, we shall create or save thousands. Nay, we shall save lives as well as money. Mr. Baldwin Latham, in his recent book on "Sanitary Engineering" and Dr. Beale, in his work on "Diseased Germs," show by statistics that a proper application of engineering to sewerage would save one hundred thousand lives yearly in Great Britain alone, and the same truth holds in this country."

One Hundred and Twelve Miles an Hour on the Ice.

The Poughkeepsie *Eagle* gives an interesting account of an example of such movement, which recently took place on the Hudson river at Poughkeepsie. "The wind blew very fresh from the south, and the owner of the new ice boat Cyclone determined to take advantage of the favorable opportunity for timing his yacht. The Hudson at this point is very wide, and at the course selected its breadth is one mile. Having made every preparation for the feat to be accomplished, the reef points were shaken out of the sails, and every stitch of canvas spread to the gale. With two men on the windward runner to keep the boat down to the ice, the helm was turned, the sails filled, and in a moment, with every inch of canvas drawing, she was under full headway. Like an arrow from a bow she darted away on the course, clouds of pulverized ice following in the track of her runners as they hummed over the surface of the river, and in what seemed but an instant the river had been crossed and the mile accomplished in the almost incredible time of thirty-one seconds, being at the rate of two miles in a minute and two seconds, or 112½ miles per hour. Persons on shore compared the speed of the flying racer to that of a meteor flashing through the sky, and watched her movements with eager interest. The owner afterward put the boat through some movements on the ice, and astonished the lookers-on by sailing all the way across the river on one runner, the force of the wind throwing her over on her beam ends and raising the windward runner from ten to twelve feet above the ice. Although but few were found willing to partake of the amusement, all seemed disposed to coincide in the opinion that ice yachting is the most exhilarating of sports, and the evolutions of which one of these yachts is capable, the most graceful of anything they had ever witnessed."

We have in various articles in the back volumes of the SCIENTIFIC AMERICAN illustrated and described the philosophy which governed the movement of ice boats, and have pointed out the reasons why they were frequently driven at a considerably higher velocity than the speed of the wind by which they were propelled. But we think the above statement of velocity needs further verification.

Allowing that the breeze which propelled the boat was a high wind, its velocity could not have exceeded thirty-five miles per hour, while the boat moved at the rate of one hundred and twelve and a half miles per hour, which is faster than a tornado. The wind of the latter reaches a velocity of one hundred miles an hour, pressing with a force of fifty pounds to the square foot upon whatever object it touches, sweeping away buildings and trees in its fearfully rapid progress.

Correspondence.

Harmonic Law of the Planetary Distances.

To the Editor of the Scientific American:

Permit me, through your valuable paper, to publish to the world a new harmonic law existing between planetary distances and motions. It is superior to Kepler's third law, which, although only an approximation, has been the basis of all theoretical astronomy for the last two hundred and fifty years. The following will be found mathematically exact:

The square root of the quotient arising from dividing the distance of any exterior planet by the distance of any interior planet, multiplied by the velocity of the exterior planet, shall equal the velocity of the interior planet. I give the last corrected figures of planetary distances and motion, so that any one, acquainted with the first rules of arithmetic, can work the problem, proving the existence of this beautiful and exact law, another signature of the Omniscient Almighty:

	Mean distances in miles.	Mean motion per hour.
Mercury	35392638	105 (thousand +) 330 miles.
Venus	66191478	77 " 050 "
Earth	91430220	65 " 533 "
Mars	139312226	53 " 090 "
Jupiter	495693149	27 " 744 "
Saturn	872134583	21 " 221 "
Uranus	1753851052	14 " 963 "
Neptune	2746271232	11 " 958 "

Kingstown, Ind. ALFRED LUTHER.

REMARKS BY THE EDITOR.—Our correspondent should communicate his results to Professor Daniel Kirkwood, of Bloomington, Ind., who is called by Mr. Proctor the "Kepler of Modern Astronomy." Kepler's laws are as follows: 1. Each planet describes round the sun an orbit of elliptic form, and the center of the sun always occupies one of the foci. 2. The areas described by the radius vector of a planet, round the solar focus, are proportionate to the time taken in describing them. 3. The squares of the times of revolution of the planets round the sun are proportional to the cubes of their major axes. The search for this last law (which applies to the satellites also) cost Kepler 17 years' calculation. Harmonic relation appears throughout the universe. Overtones in music, the formation of crystals, *phyllotaxis* or the arrangement of leaves around the stem, all show most curious numerical relations. The lines of fluted spectra of the first order are supposed to be successive harmonics of a single motion in the molecules of luminous gas. Perhaps these harmonic laws may yet teach us, beside the distances of planets, the distance of atoms and the size of the molecule.

Charcoal for Wounds, etc.

To the Editor of the Scientific American:

The best simple remedy I have found for surface wounds, such as cuts, abrasions of the skin, etc., is charcoal. Take a live coal from the stove, pulverize it, apply it to the wound and cover the whole with a rag. The charcoal absorbs the fluids secreted by the wound, and lays the foundation of the scab; it also prevents the rag from irritating the flesh, and it is antiseptic.

If, however, you prefer a white scab to a black one, use quinine instead. This possesses all the virtues of the charcoal, and is, besides, astringent and tonic. P.

HACHISCH.—M. Naquet has lately been studying the physiological action of hachisch. The extract of hemp seed (*cannabis indica*) administered to various persons produces a great exuberance of ideation; it is not new ideas, but the exaggeration, amplification, and combination of ideas which pre-existed in the person's mind. Hachisch produces one curious effect (which is also observed in acute mania); this is a singular inclination to make puns and plays upon words.