CHEMISTRY AND PHYSICS.

BY ALEXANDER OTT.

Chemistry as a science investigates the nature and properties of organic and inorganic matter, it examines the process of composition, decomposition or analysis, it studies affinity and antogonism of different bodies.

Natural philosophy refers to a change of form, place and size, chemistry to a change of nature or essence; for instance, the putting of zinc into water, in order to deoxidize the latter, and the addition of sulphuric acid is simply mechanical, because it merely brings things together, producing only a change of place, but the decomposition of water, the uniting of the oxygen with the zinc, the formation of oxide of zinc, its instantaneous dissolution by the acid and the disengagement of the hydrogen in a gaseous form are chemical phenomena as they change the nature of the ingredients or substances.

As remarked before, chemistry goes hand in hand with natural philosophy, as the peculiar properties of matter and the relationships of the same constantly demand the cooperation of those two important sciences. While physics observes, studies and generalizes all phenomena of a visible or perceptible character, as for instance the relations of the atmosphere by heat by means of thermometers, barometers and rain-gages,* chemistry investigates the mysterious process of assimilation and decomposition of the invisible atoms of matter.

Chemistry, although purely experimental in its character, depends, like natural philosophy, upon a sound understanding of the preliminary principles which explain to the student the definition of matter, the expansion of solids, liquids and gases through the agency of the caloric or heat, while physics investigates extension, impenetrability, gravity, inertia, cohesion, divisibility, compressibility, elasticity and other properties of organic and inorganic matter. In its nature, however, natural philosophy is not so empirical or experimental as its sister-science, but depends more upon calculation, hence a good knowledge of arithmetic, algebra and the leading principles of geometry is required to make the study of the same a profitable one. It is very true a person may gain a practical knowledge by the simple way of empiricism and without a proper guide, but it will always be a smattering. This accounts in many instances for the failure of the manufacture of the most necessary articles, such as glass, sugar, iron, etc.

Previous to entering on the real subject of chemistry, it will be necessary to explain a few technical terms used frequently both in this science and in natural philosophy. We often hear and read of density and specific gravity, without perhaps understanding the meaning of the same.

Density signifies originally dense, thick, and as a *terminus technicus* it means the mass, volume or quantity of matter (*materia*), compared with the mass, volume or quantity of matter of a certain standard body. By specific gravity (from the Latin *gravitas*, heaviness, weight) is understood the weight of a body, as compared with the bulk or volume of a certain standard body.

This standard of unity is in all cases of solids and liquids pure water at the temperature of 60° Fahr.

It may be well to mention here by way of parenthesis, that Fahrenheit's scale commences at 32 degrees below the freezing point of water; and, that consequently, the boiling is 32&180, or 212 degrees. Hence we understand by specific gravity or weight, the number expressive of how many times the weight of an equal volume of water is contained in the weight of a certain substance. For instance, if the specific weight of pure or sulphuric ether, a colorless, transparent, fragrant liquid, is at 60° about .720, and the vapor of this thin and mobile fluid has a density of 2.586, it signifies that equal quantities of these two liquids and of distilled water weigh in the proportion of the numbers .720, 2,586 and 1.

In relation to gases, the standard of unity of specific gravity is atmospheric air.

The specific gravity of any particular liquid compared with that of water is obtained by weighing equal bulks at the standard temperature, and by then dividing the weight of the liquid by the weight of the water. The surest way of weighing equal volumes of two liquids is to weigh them successively in the same vessel, which of course has to be equally full on both occasions.

In chemical laboratories a thin glass bottle or flask, with a narrow neck and large enough to hold when half filled up the neck about 1000 grains of distilled water at 60°, is commonly used.

The term extension is generally applied in the three dimensions of length, breadth and thickness, impenetrability is the property of excluding all other matter from the space which it occupies.

Caloric, from the Latin *calor*, means either the sensation we experience on touching a hot body, or it is the cause of the sensation. Caloric is known to exist in a free or sensible, and in a latent or insensible state. The former, that is, the free caloric, has the remarkable property of a tendency to escape from a hotter to a colder body, so as to produce every where an equilibrium of temperature. The propagation of this element is going on either by conduction or by radiation. By the first, that is, by conduction, is understood the passing of the caloric through the body, from one particle to the other.

That peculiar property of the body, by means of which the transmission of heat takes place, is called the conducting power. In iron, for instance, the caloric is quicker communicated than in glass, hence the degree of facility of conducting heat, depends on the nature of the substance. The great variety of organic and inorganic matter, represents naturally different degrees of communicating heat. Furs and porous substances, for instances, are the poorest conductors, while metals and stones are the best ones. Charcoal dry wood, bricks and glass conduct slowly and less than earths, which generally are bad conductors, and silk, feathers, down, etc., conduct least of all.

By the transmission of the caloric by radiation, is understood the removal of heat from heated bodies in every direction, like rays of light from the sun. The degree of radiation, and consequently the intensity of radiant heat depends much on the peculiar nature of the surface. Bright polished surfaces, for instance, do not radiate so rapidly as dark and rough ones.

A very remarkable property of heat is expansion, a phenomenon which may be easily observed. A thin iron wire that, when cold, fits a certain proportionate hole, will, on being heated, be found to have become so thick as to make its passage through the same opening impossible. In reference to liquids or fluids, air and gases, etc., the same interesting fact of heated bodies having a tendency to expand, and when cold, to resume its former size, is observed.

Upon this curious phenomenon depends a principle by means of which the thermometer is constructed, an instrument that, as its name indicates, is derived from the Greek language, signifying the measurer of heat. It is principally used to observe meteorological or atmospheric changes.

This useful instrument is made of a capillary glass-pipe or tube, of an equal diameter, one end being closed and enlarged into a bulb, by means of the blow-pipe flame, while the other is somewhat drawn out and left open. The bulb being carefully heated by a spirit lamp, the open end is put in a vessel of mercury, and as soon as the bulb has reached a lower temperature, a portion of that volatile, mobile matter (that is mercury) rises into it, replacing the air which had been expanded and expelled by the heat. The remaining air is easily removed by bringing the mercury in a state of boiling, thus the whole space becomes gradually filled with mercurial vapor, which, when condensed, admits the passage of the metal into the instrument by the pressure of the air, till it is entirely full. The thermometer has now to be heated, till sufficient mercury has been expelled by the expansion of the remainder, so that its level in the tube will have reached the common temperature of the required point. After this, by an another application of the flame, the column rises up to the top, whereupon the tube at one end is hermetically closed by the blowpipe.

As soon as the graduation of the thermometer is finished, a scale comparable with that of other instruments is attached.

From the time that thermometers were first introduced, great improvements have been made, so as to have as sure a guide for observations of atmospheric changes as can be expected. Independent of the volatile and mobile matter of quicksilver, as a medium of filling instruments, alcohol is sometimes used for measuring very low temperatures. Air was originally that gaseous element of which thermometers had been made. They were used especially by some French *savants*, like M. Pouillet and others, for estimating low temperatures.

Mercury is either metallic or quite pure. As a metal it is sometimes found in the shape of globules disseminated through the natural sulphuret. Considerable beds of the latter or cinnabar, as it is also called, are met with in certain parts of Spain, Italy and South America. The metal is disengaged from its accompanying impure matter by heating the sulphuret in an iron retort with lime or scraps of iron, or by roasting it, as it is technically termed, in a furnace, the vapors are then conducted in a large chamber, that is, a small well-closed space, where the condensation of the mercury takes place, while sulphurous acid escapes.

The color of mercury is almost silver white, and it shines brightly. At all ordinary temperatures it remains a liquid, and becomes a solid when reduced to 40° Fahr. It is then soft and malleable. It boils at 662°, emitting a very dense, transparent, colorless vapor. Although this remarkable metal volatilizes at all temperatures above 68° or 70°, it is generally prevented by the presence of small quantities of lead or zinc from a speedy state of volatility. Its specific gravity at 60° is 13 56.

By experiments shown in German high-schools, pure quicksilver is, when heated to near its boiling point, changed, after a slow absorption of oxygen, into a crystalline dark red powder, which is the highest oxide. With reference to the affinity of quicksilver and other metals, its combinations with oxygen and the peculiar action of nitric acid on the same, a future article will explain a variety of interesting and useful metamorphoses taking place within the domain of experimental chemistry and physics.

*The rain-gage is an instrument made to ascertain the amount of water that is discharged by the clouds in the shape of rain, snow and hail.

---Tennessee money was selling at a premium of seven per cent. over greenbacks in Memphis on the 15th ult.

WAR BETWEEN MONEY KINGS.

The following story, taken from a French paper, relative to a pique between the Rothschilds and the Bank of England, is going the rounds:

It seems the bank refused to discount a draft drawn by the house of Anselme Rothschild, of London, saying they discounted only their own paper, and not those of particular parties. Three weeks after, Nathan Rothschild, after gathering together all the five pound notes he could find in England and on the continent, presented himself at the bank at the morning hour, and drawing forth a portfolio well filled, received payment in gold. After carefully testing each piece, he put them in a sack, and produced another and another portfolio, continuing to do so for the seven hours the bank was open, during which time he had bagged many thousand francs. A servant removed the sacks as they were filed. At each of the other nine pay counters an employee of the house of Rothschild had been likewise engaged, so that the house during the day had been able to draw from the bank 5,250,000 francs, in gold, and no one else could get a place to present a check. The bankers laughed at the pique of the Rothschild. They laughed a little less the second day, when he made his appearance with his nine clerks and took his station as on the day before. They laughed none at all on the third day when the same ten made their appearance as soon as the bank opened; but they trembled in their boots when they heard the king of bankers intimate that he had five pound notes enough to continue his game two months, and that he had already drawn 320,250,000 francs in gold from the Bank of England, which never owned as much. The bank feared, and there appeared in the evening and morning papers a notice to the effect that thereafter the bank would pay the paper of the house of Rothschild as its own.

"NOT THE LORD, BUT BURGOYNE."—The Rev. James Gallagher used to tell the following anecdote with great zest:

During the Revolutionary war, reports were circulated, as they are now, either wholly false or greatly exaggerated. In passing from one to another, something was sure to be added, until the story would hardly be known to the author of it. The people in certain sections of New York were in great consternation from a report that Burgoyne was marching down from the lakes with an immense army, and going to sweep over the whole country, bringing utter desolation to the inhabitants. An old lady heard the report, and understood it that Burgoyne was to open the lakes and let out the water, and drown the whole region. Full of the terrible vision, she ran to a neighbor's to tell her the latest news about the war. "Do you know that we are going to be drowned? Burgoyne is going to let the water out of the lakes, and make a great flood and we shall all be drowned! Oh! what shall we do?" Her neighbor, with more intelligence and more piety, did not seem to be greatly disturbed, but calmly replied: "That certainly must be a mistake. It cannot be true, for God has promised in his word that he will no more destroy the inhabitants of the earth with a flood." "Ah, honey! I know that, but it's not the Lord who is going to do it; it is Burgoyne!"

LIFE OF A BISHOP IN THE FIFTH CENTURY.—St. Hilary rose very early in the morning; he always dwelt in the town; from the time that he arose any one who wished to see him was received; he heard complaints, adjusted differences, performed the office of a justice of the peace; he afterwards repaired to the church, performed service, preached, taught, sometimes for many hours consecutively. Returned home, he took his repast; and while this lasted he heard some pious reading, or else he dictated, and the people entered freely and listened. He also performed manual labor, sometimes spinning for the poor, sometimes cultivating the fields of his church. Thus passed his day, in the midst of his people, in grave useful occupations of a public interest, while every hour had some result.—[Guizot's History of Civilization.

OLD DR. WARREN STONE.—This celebrated surgeon, at New Orleans, having been arrested, walked boldly up to Gen. Butler, and in an abrupt, curt manner, said:

"Here I am, General, and I want to know what I was arrested for."

Butler replied, contemptuously:

"I had you arrested because you are a great rebel, and the influence of such a man is dangerous to the community. I shall send you to Fort Jackson to get you out of my way."

The old Doctor looked steadily into the repulsive, crooked eyes of his enemy, as he indignantly replied:

"Great rebel, hey? You'll send me to Fort Jackson, hey? I glory in being a rebel; you can send me to Fort Jackson, and be damned!"

---Lumber is selling in Philadelphia at $16 to $18 per thousand, and laths at $1 25 to $1 40.

---The abolitionists out West call democrats "copperheads" and "butternuts;" and abolition papers in the East call them "traitors."

SKETCH OF LUTHER.

A coarse, rugged, plebeian face it was, with great crags of cheek bones—a wild amount of passionate energy and appetite! But in his dark eyes were floods of sorrow and deepest melancholy; sweetness and mystery were all there. Often did they seem to meet in Luther the very same opposite poles in man's character. He for whom Ritchie had said that his words were half battles—he, when he first began to preach, suffered unheard agony. "Oh! Dr. Stanpitz," said he to the vicar general of his order, "I shall die in three months; indeed, I cannot do it." Dr. Stanpitz, a wise and considerate man, said, upon this: "Well, Sir Martin, if you must die, you must; but remember that they need good heads up yonder, too; so preach, man, preach, and then live or die as it happens!" So Luther preached and lived, and he became, indeed, one great whirlwind of energy, to work without resting in this world; and also before he he died, he wrote very many books—books in which the true man appeared; for in the midst of all they denounced and cursed, what touches of tenderness lay. Look at the Table Talk, for example, we see in it a little bird, having alighted on the bough of a pear tree that grew in Luther's garden. Luther looked upon it, and said: "That little bird, how it covers its wings, and will sleep there, so still and fearless; though over it are the infinite starry spaces and the great blue depths of immensity, yet it fears not—it is at home; the God that made it too is there." The same gentle spirit of lyrical admiration is in the other passages of his book. Coming home from Leipsic in the autumnal season, he breaks forth into living wonder at the fields of corn. 'How it stands there," he says, "erect on the beautiful taper stem, and bending its beautiful golden head with bread in it—the bread of man sent to him another year." Such thoughts as these are as little windows, thro' which we gaze into the interior of the depths of Martin Luther's soul, and see visible across its tempests and clouds a whole heaven of light and love. He might have painted—he might have sung—could have been beautiful like Raphael and great like Michael Angelo. —[Carlyle.

A SINGULAR CASE OF NERVOUS SYMPATHY.

A singular story is related of an occurrence in a cotton mill in Lancashire, in 1787. A girl put a mouse into the bosom of another girl who had a great dread of mice. She was instantly thrown into convulsions, which lasted 24 hours. The next day three more girls were thrown into similar convulsions, and the following day six more. A physician was sent for, but before he arrived twenty-three girls had been seized in the same way, and one man who had been employed in holding them during the fits. The work in the factory was stopped, and the idea prevailed that some disease had been introduced by a bag of cotton which had recently been opened. This conviction spread through the country, and three more factories, four or five miles distant, were infected, although the workers in them had never seen any of the original patients, but, like them, were impressed with the belief that the plague had been caught from the cotton. The convulsions were so violent as to require four or five persons to prevent the sufferers from dashing their heads against the wall. The doctor bethought him of trying the effects of electric shocks, and the application was uniformly successful. As soon as a few had been relieved, and the disorder was shown to be a nervous affection, easily cured, and not introduced by the cotton, no fresh case occurred.

WELLINGTON'S STRATEGY.—On a certain occasion during Wellington's campaign on the Pyrennes, that "Great Captain" being displeased with the dispositions General Picton had made for receiving the assault of Marshal Soult, who menaced him in front, ordered the plan to be entirely changed. But the difficulty was to delay the attack of the French until the charge could be effected. This the Iron Duke accomplished in person, in the following manner: Doffing his cocked hat and waving it in the air, he rode furiously to the head of a regiment, as if about to order a charge. Thereupon arose a tremendous cheer from the men, which was taken up by corps after corps until it reverberated along the whole extent of Picton's line. As the cheer died away, Wellington was heard to remark musingly, as if addressing himself—"Soult is a skillful but cautious commander, and will not attack in force until he has ascertained the meaning of these cheers. This will give time for the sixth division to come up and we shall beat him." It turned out as he anticipated. Soult naturally enough supposed these tremendous shouts announced the arrival of large reinforcements, and did not attack until too late. Had he struck at the right moment, he would have won an easy victory; as it was, he met with a bloody repulse. This was strategy; not the strategy of books, but the strategy of ganius, engendered and executed in the same moment.

"ARTEMUS" EXCITED.—"Artemus Ward" says that "unless there's different management of the war right off, the American eagle will have to disguise himself as a Shanghi rooster, and make tracks for Canada, while the goddess of liberty will have to go out doin' gen'ral housework at two dollars a week."