the earth in the vicinity uninhabitable by them. Besides some such substance as the salts alluded to must be employed on account of the slow reaction of the acid, keeping up a supply of deleterious gas for several days, or longer than the insect can defy its influence by shutting its respiratory orifices.

It is found that 1442 grains of sulpho-carbonate of potassium will poison from 111 to 132 cubic feet of air, and will drive insects from 198 to 284 cubic feet of earth, killing not merely the comparatively delicate vine louse, but the larvæ of crickets and other large insects. The mode of application is to make a hole at the root of the vine, about 1 foot deep and 16 inches broad. Into this pour five or six quarts of water mixed with from six to eight quarts of the sulpho-carbonate solution at 40° Baumé. When the liquid is well absorbed, the hole is filled up, and the operator passes to another vine. The solution is thicker than water, and, when mingled therewith, percolates slowly through the ground, reaching the deepest roots.

In order to render the sulpho-carbonate of potassium or of sodium, which salts closely resemble each other in their toxic properties, easily portable, M. Dumas suggests mixing them with twice their weight of slaked lime. The powder thus obtained is very easily sprinkled over the surface of the soil.

RATE AND CAUSE OF GLACIAL MOTION.

The movement of a glacier has many resemblances to that of a river. It follows the windings of the valley; is more rapid in the center than at the sides, at the surface than at the bottom, because the center of the surface is subject to the least friction; the part having greatest motion changes to the right and to the left of the center as the glacier changes its direction; it moves more rapidly when the descent is steepest, and where there are least obstructions; it becomes broken up and uneven when the bed is rough; and a large stream is often made up of smaller ones joining one another. The distance to which the ice river flows depends upon temperature and the amount of precipitation. In cold and wet years, it may extend fifty feet further than ordinarily; while under opposite conditions, the lower edge of it may melt away more rapidly than it advances down the valley, and hence seem to recede. It always descends in summer beyond the region of snow and ice, and flowers and other summer vegetation are not uncommon in close proximity to the ice mass. The force with which a glacier advances is so great that trees and forests, houses and villages, offer no more apparent resistance than a straw in its way.

Many students of glaciers have made investigations more or less carefully, respecting the rate of glacial movement. But there are so many modifying circumstances—as position and formation of the valleys; inclination, size, and thickness of the glacier; influences of the seasons and the weather—that even in the same glacier the rate is so variable that no universal law can be established. Some move most rapidly at the upper part, least at the lower, and just the average in the middle, while others move with greatest rapidity at their lower extremity. Eight inches per day may be considered a fair average of all glaciers and all parts of each. In the earlier investigations on this subject, only rough and inaccurate means were used for making the measurements, such as building a hut on the ice, or leaving some object, as De Saussure's ladder, on the surface, and noting how far it had descended each year, or after an interval of several years.

The works of James D. Forbes on glacial phenomena rank among the classics of physical science. He was a precocious Scotch youth, whose mother, by the way, came very near being the wife of Sir Walter Scott when she was young; the only thing that prevented was the simple fact that she said "no" when Sir Walter wanted her to say "yes." Young Forbes was studying Science, and entreating his father to buy him a telescope when a mere child. At eight, he composed sermons. Before ten, he was reading Phædrus with his father, having previously read Cæsar. At seventeen he was contributor to the Philosophical Journal, then edited by Sir David Brewster. At twenty-four he was elected to the chair of Natural Philosophy at Cambridge. He was then a member of the Royal Societies of Edinburgh and London, and writer in the Edinburgh Review. This savan, better known as Principal Forbes, made the first accurate determinations concerning the rate of glacial movement. He used the theodolite which his father gave him, in place of a telescope. By mounting this upon the glacier in various positions, and taking an exact point of observation on the wall rock, he made correct measurements at fixed intervals of time. He also set up rows of pegs in exact line across the glacier, and, by noticing their later deviations from a straight line, determined the rate of motion in different parts.

From these exhaustive and delicate observations, he arrived at the following conclusions: (1) Glacial motion is approximately regular; (2) it is nearly as great during the night as during the day; (3) a marked increase of motion is due to heat of the weather; (4) the center of the glacier moves more rapidly than the sides.

The cause of this motion has been subject to much discussion, and, cold as the subject is, it has occasioned frequent heated contests and many warm words. Beds of tough clay will rest on a considerable slope without sliding; loose stones and *débris* will rest on a hillside with an inclination of 80°; and at the embankment formed by the material shot out from Mount Cenis tunnel, the inclination is much steeper than this. But ice, more rigid than the hardest clay, will move on a slope inappreciable to the eye. And the question stated is: "What property does ice possess which enables it to creep upon slopes down which only fluids and semi-fluids can move?" De Saussure ascribed the motion of ice to a mere gliding or sliding upon an inclined plane, like that of a piece of slate detached from the roof. But this could not take place over a very rough bed or in presence of an immovable obstruction. De Charpentier—and, in his earlier writings, Agassiz—explained the movement by an expansion of the mass due to freezing, in the crevices, during the night, of water which melted during the day. But this would necessitate an alternation of rate between day and night which the best observations do not detect.

In review of Principal Forbes' results, it is not strange that he looked upon the glacier as a river of ice, and attributed its motion to the viscous or plastic nature of the mass, in consequence of which it is urged downwards by its own weight, like tar or treacle. An infinite number of minute rents occur when the ice is subject to violent strain, and the bruised surfaces are forced to slide over one another, producing a *quasi* fluid character in the motion of the whole. This is quite consistent with the rapidity of motion in different portions, due to friction, inclination, and bulk of the glacier, and its compression on entering a narrow passage, and expansion as the channel widens. But we can hardly conceive that ice, with its known unyielding and brittle nature, could thus be changed merely by its own weight. Tyndall also ascribed the motion to fracture and regelation, due to the pressure of its own weight, and extending to every minute particle. Faraday had previously noticed that two moist pieces of ice freeze together when in contact. Canon Mosely opposed the last two theories with the idea that there is a constant displacement of ice particles over and alongside one another, to which is opposed that force of resistance known in mechanics as shearing force, which force weight alone is not able to overcome. He claims that, considering ice a solid body throughout, there must be some other force besides gravity to drive it forward, as even clay, so much more yielding than ice, does not descend by mere weight.

Another theory held by Professor James Thomson and his brother, Sir William, and advanced by two or three others about the same time, is based on the idea that the freezing point of water is lowered by pressure. Condensation as the result of pressure diminishes the capacity for heat, and hence some latent heat becomes sensible. This free heat, instead of remaining free, expends its force in melting contiguous molecules of ice. As water occupies less space than ice, the melted ice makes more room for the unmelted particles; these then have space to yield to pressure, and move in the direction in which it is exerted. The water, subject to less pressure, moves in the direction of gravity, and, coming in contact with ice colder than itself, freezes. The ice again resists pressure and is melted, and in this way there is a constant change in the position of molecules, which has the effect of giving ductility and movability to the mass. Ice has been subjected to great force in Bramah's hydrostatic press, by which it can be made to assume any desired shape by the use of suitable molds. This is explained by supposing that the pressure liquifies the ice, which, in the melted state, conforms to the shape of the mold and then consolidates when the pressure is removed. This theory seems quite plausible and is accepted by many. The only apparent objection is in the question as to whether the weight of the superincumbent mass is capable of producing pressure sufficient to liquefy the ice below; and we are not aware that this question has yet been conclusively answered.

Croll's theory, which is considered the only tenable one by another class of physicists, ascribes the motion to heat rather than to pressure. The heat of the sun melts the surface of the ice, and if it were constant would in time melt the solid mass; but when the sun's rays are removed from any molecule, it congeals and, by its condensation, gives off heat which melts another molecule. The molecule, during the instant it remains water, is acted upon by gravity and assumes a lower position in the ice mass; this on freezing gives off its heat to a lower molecule, which in its turn seeks a lower place. The heat of the sun is thus transmitted through ice by the melting and freezing process, from molecule to molecule, and every melted molecule sinks lower in the mass. Thus the sun's heat causes the ice gradually to work down hill. The sun is aided in heating the interior, by warm winds and rains which are admitted by cracks and fissures (always abundant), by the internal heat of the earth, and by heat caused by friction of the moving mass on the bottom. Experiments made by Professor Agassiz, by means of a hole in the ice 200 feet deep, lead to the conclusion that the internal part of a glacier has a comparatively high temperature, and in winter this is greater than the surrounding atmosphere. But his results were somewhat contradictory, and the real state of temperature in the center is mainly a matter of conjecture. The objection to this theory appears in Forbes' results, that motion is approximately regular—nearly as great during the night as during the day.

All the investigations thus far noticed on the rate and cause of glacial motion have been confined to local glaciers, like those of the Alps. In our own age there is manifestly but little opportunity to study phenomena connected with any existing continental ice sheet. We may some day obtain information in this line from a study of a sheet glacier of Greenland, and would doubtless have been able before now, if arctic explorers had succeeded in reaching points sufficiently far north. Agassiz said, at Penikese: "Since we have no positive data, we can form some idea of their motion by the number of icebergs which they send forth annually; for these icebergs could not exist but for the advance of the glaciers into Baffin's Bay, where their ends are lifted up by the water, broken off, and floated south. We do not know what these icebergs amount to, though it would not be difficult for an observer at the south end of Baffin's Bay to ascertain approximately by counting the number of icebergs that pass a given point annually." He assumes that the continental glaciers moved at least as fast as 100 feet per year. At this rate it would take over 50 years for a boulder of Lake Superior copper to travel one mile south; and as some are found 500 miles south of their home, it would have required 25,000 years to reach this distance. This affords us one of the many indications of the vast antiquity of our globe.

In the Boston Society of Natural Science a few weeks ago, Professor Shaler, while accepting Croll's theory in the main for the movement of local glaciers, advanced the belief that the cause of *sheet* glacial movement was the melting of ice at the bottom by the pressure of the superincumbent mass, and that this water, in its effort to escape in the direction of least resistance—or towards the edge,—would push forward boulders, gravel, etc., and thus cause the southerly movement of erratics. He thinks the ice sheet itself did not move, and attributes the cause of scratchings on the boulders and bed rock to local movement at the edge of the ice sheet when it was melting, which movement Mr. Croll's theory may explain. The continental glacier, on account of the unevenness of the earth's surface, must often have moved up hill for miles, and sometimes for hundreds of miles, if it moved at all, and for this he thinks there is no adequate explanation.

SCIENTIFIC AND PRACTICAL INFORMATION.

GROWING ROSES.

"An Old Rosorian" says: "Roses require a strong soil, highly enriched with good rotten manure; an open situation and loamy soil for the strong growing, hardy kinds, and a protected aspect and light soil for the teas and other tender varieties. The hybrid perpetuals in my judgment are the most desirable among the hardy roses, as they are the best for all the various purposes to which they are applied in garden and lawn decoration. The teas, however, are the diamonds *par excellence* of the race, although needing great care in their culture. I advise that they be grown in pots, and sunk in the ground during the summer, and removed to a cold frame or greenhouse during the winter. If left remaining in the open ground, they should stand on the south side of a wall, fence, or hedge, and on the approach of cold weather, receive a covering in the form of a shed open to the south, and the plants have a liberal supply of manure over the surface of the ground, and plenty of leaves over the whole plant. If roses are set out in autumn, perform the operation very early in November, so as to allow the roots to obtain a hold in the soil before cold weather. Give them a thorough dressing of manure to protect against sudden changes. Choose a dry day for planting, the drier the better. Be careful to tread the soil firmly around the plants; this is very important. A cloudy day is the most desirable for removal; and moisten the roots first, to be followed by a thin coat of dry earth over the fibers."

CHEAP COOKERY.

We noticed, while visiting a large steel-making establishment recently, that the workmen at noon ingeniously utilized the ingots of steel, which lay cooling in the yard, as cooking stoves, and seemingly prepared their dinners over the heated metal as easily as over a fire. The idea is a good one, and might be adopted with advantage by the men in all metal-working concerns. We believe that the custom is not common among the workmen in this country, nor in the ironworks in England, though it owes its origin to and has long been practised in the tin melting establishments of Cornwall. It is considered quite a civility there to offer a visitor a chop nicely broiled over a recently run ingot of tin. The big hammer block, we were told as an especial wrinkle, is the best place to fry things, as it is smooth and usually just hot enough. Ingots are ordinarily rough and generally somewhat too warm. In winter time, a workman can economize considerably, and at the same time get a hot dinner, by thus utilizing the wasted heat of the metal.

PORTLAND CEMENT.

Three tests are used:—1. Resistance to tensile force. 2. Specific gravity. 3. Water test. The first is by making a specimen briquette in a mold with a transverse section of 2·25 square inches, the specimen being held vertically in clips, which is placed under the short arm of a steel yard balance, and broken. Mr. Bazalgette used a test of 500 lbs. on an area of 2·25 square inches after 7 days immersion in water. The second method is by finding the weight in pounds of the struck bushel. The water test is useful when the others cannot be applied. It consists of gaging a small quantity of the dry powder with water, and immediately immersing it in water. If the sharper edges crack or break away after a short time, the cement is too hot or fresh, or is inferior in quality. The weight of good Portland cement ranges from 100 lbs. to 130 lbs. per bushel, equal to from 80 lbs. to 102 lbs. per cubic foot. The lighter kinds set more rapidly than the heavier, but are weaker. Mr. Bazalgette specified a specific gravity of 110 lbs. to a bushel.

THE VORACITY OF PICKEREL.

According to M. Peupion, who has been practically investigating the subject, a pickerel will eat 47 pounds and 4 ounces of fish per pound of its own weight per year.

THE following is one way to cut a bottle in two: Turn the bottle as evenly as possibly over a low gaslight flame for about ten minutes. Then dip steadily in water; and the sudden cooling will cause a regular crack to encircle the side at the heated place, allowing the portions to be easily separated.