ter of the Reseda luteola. The decomposition which is produced when the lotase is put in contact with the lotusine, this taking place when the plant is ground with water, is represented by the following reaction: $C_{22}H_{19}NO_{10}$ (lotusine) + $2H_2O = C_{15} + H_{10}O_6$ (lotoflavine) + HCN + $C_6H_{12}O_6$ (dextrose). Hydrocyanic acid is found in small quantities in many plants, and according to Treub and Greshoff it is often present in the atmosphere. The only glucoside well known at present which produces this acid is the amygdaline of bitter almonds, which, under the influence of emulsine, also contained in the almonds, forms dextrose, benzaldehyde and prussic acid. This new glucoside presents, therefore, a great scientific interest.

## ESTIMATION OF TUNGSTIC ACID IN ITS ORES.

Carrying out the method recommended by Blair in his "Chemical Analysis of Iron," page 264, Mr. Herbert M. Shilstone made a large number of tungstic acid determinations in wolfram and scheelite ore concentrates for the American Tungsten Mining and Milling Company, of Long Hill, Conn., a few months ago, and found the following methods very satisfactory, accurate results having been obtained without excessive care or unusual precaution.

For the analysis of wolfram he proceeds as follows: The ore concentrate is very finely pulverized and passed through a No. 13 bolting cloth. From 0.3 to 1.00 gramme is weighed and brushed into a small beaker, nitric acid is added, the beaker covered, and the whole digested or heated on the water bath for one-half hour. Hydrochloric acid is now added, and the digestion continues until the ore concentrate is thoroughly decomposed. It is generally left on the water bath all day. It is necessary to replenish the nitric and hydrochloric acids during the digestion, retaining about 25 cubic centimeters of solution in the beaker all the time.

When the ore concentrate appears to be perfectly decomposed it is evaporated to dryness on the water bath (a higher temperature is not desirable), is then redissolved with hydrochloric acid and evaporated down again, redissolved again with hydrochloric acid, diluted with water, filtered, washed thoroughly with acidulated water and then with alcohol. The tungstic acid now remains on the filter along with the undecomposed silica, etc.

It is treated on the filter with ammonia, the filtrate allowed to run into a platinum dish, then evaporated to small bulk, and excess of ammonia added, filtered again if necessary into a platinum crucible, evaporated carefully to dryness, heated gently to drive off the ammonia and finally ignited at a high heat. Cooled and weighed as tungstic acid.

If the ore concentrate is not thoroughly decomposed in the first case, the residue from the first filter must be redigested with acids, treated as before and the result added to the first.

For scheelite he uses a fusion method (as per Fresenius' Zeitschrift, 29, pages 104, 105), which he finds gives results as accurate and is more rapid in operation.

From 0.3 to 1.00 gramme of the finely powdered ore concentrate is mixed with about 10 grammes of equal parts of soda and potash carbonates and fused in a 2-ounce crucible for two hours; the crucible is now given a circular motion so as to coat the inside with the melt, and then chilled by immersing in a beaker of cold water, without letting the water in the top of the crucible. When cool the melt probably will crack away from the sides of the crucible; if not, the crucible must be laid on its side in a small beaker just covered with water and digested on the water bath until the melt is dissolved. The crucible is washed thoroughly and the washings run into the same beaker; it is better to rinse the crucible finally with a dilute solution of hydrochloric acid which must be kept for further use. Continue the digestion of the melt until it is thoroughly decomposed and the soluble tungstate of soda dissolved in the hot water, filter off the undissolved residue and wash thoroughly with hot water.

The acid washings of the crucible are now added to about 200 cubic centimeters of a 25 per cent solution of hydrochloric acid and brought to a boil, the filtrate containing the tungstate of soda is added slowly and constantly stirred, and the beaker is kept covered to avoid loss by spitting as much as possible. A precipitate of tungstic acid will be thrown down if there is an excess of acid; if not a further addition of boiling hydrochloric acid must be added until it gives an acid reaction with litmus paper; the boiling is continued for one-half hour, the beaker removed from the fire and allowed to stand twelve hours in the cold. Filter off as much of the supernatant liquid as possible, never filling the paper more than half full, add a little water and a few drops of nitric acid to the precipitate and transfer as carefully as possible to the filter, taking all precautions. For a very fine precipitate mop out beaker and wash precipitate until washings are no longer acid, dry in the air bath at 110 deg. C., remove the precipitate from the filter and ignite the filter paper, moisten the ash with a few drops of ammonium nitrate and ignite again, add the precipitate of tungstic acid, ignite first at a low heat and finally at a high temperature, cool and weigh as tungstic acid.

## THE HEAVENS IN MARCH, 1901.

BY HENRY NORRIS RUSSELL, PH.D.

This is another uneventful month from an astronomical standpoint. Of all the planets only Mars is visible in the evening sky; and so we may well devote part of our time to the consideration of the strange markings on his surface, as was promised a month ago.

These objects, the so-called "canals," were discovered by the Italian astronomer, Schiaparelli, about fifteen years ago, and have since been seen so frequently, and by so many observers, that there is now no doubt of their reality. They appear, under favorable conditions, as fine straight dark lines running across the ruddy parts of the planet's surface—the so-called continents—in all directions. Their actual width must be 40 or 50 miles at least, since a narrower line would hardly be visible at so great a distance. Many of them reach the "seas" just at the head of some bay and frequently three or more converge accurately to a single point. Most remarkable of all, a large number of them have, at certain times, been seen "doubled," the single line being replaced by a pair of parallels, two or three hundred miles apart, and this duplication seems to follow the course of the Martian seasons. When the air is unsteady, the canals appear as faint, ill-defined streaks; and some of the ablest observers have never seen them otherwise.

They are very difficult objects to observe, but nevertheless, the facts of observation have accumulated far more rapidly than satisfactory explanations for them. They can hardly be rivers, because they are quite straight, and frequently run from one sea to another. It has been suggested that they are cracks in the planet's surface, but though this accounts for their straightness, it hardly explains the regularity of their arrangement, and much less their duplication.

A mere glance at one of the recent drawings of Mars suggests with great force another hypothesis—namely, that the canals are artificial structures of some sort. But here again we meet with serious difficulties. Why should an artificial waterway be fifty miles wide? And how can their doubling be accounted for?

Perhaps the best of existing theories, and certainly the most stimulating to the imagination, is that proposed by Mr. Lowell and his fellow-workers at his observatory in Arizona, who have devoted a great deal of attention to the subject. He regards the dark greenish portions of Mars' surface as areas covered, not with water, but with vegetation, while he believes the ruddy areas to be deserts. The planet's surface is evidently pretty flat, as mountain ranges, if present, would be conspicuous, just as they are on the moon. According to Mr. Lowell, there is much less water on Mars, in proportion to his surface, than on the earth, and much of it is frozen up in the polar ice-caps during the Martian winter. As the ice melts in the spring, the water floods the lower lying regions of the surface—the "seas"—and keeps them green and flourishing. The canals are artificial watercourses, built to carry off the water where it is needed. On each side of them is a strip of irrigated land, bearing the same relation to them that Egypt does to the Nile, and it is this belt which is wide enough to be visible from the earth. The duplication of the canals is accounted for by the ingenious idea that, for some reason, the Martians cut the water off from the central part of this strip first, so that it dries up while the edges are still green.

Mr. Lowell has a good many other facts to back up his theory. One of the most important is that he has seen a number of the canals prolonged upon the "seas." It is hard to see on the old theory how a canal could be dug in the ocean, but there is nothing very remarkable in a belt of dense vegetation near an irrigating canal in a sparsely grown tract. There are also many instances of seasonal change among the canals, and certain parts of the seas, which bear out his theory.

There is, however, something to be said on the other side. The regularity of the arrangement of the canals may be more apparent than real. When several faint lines near the limit of visibility are *nearly* straight, and intersect *near* the same point, the figure which they present, seen as it is only by glimpses when the air is steadiest, is very likely to be drawn by even the most careful observer as composed of *straight* lines, intersecting exactly in one point, so that too much stress must not be laid on the published drawings.

There is also a controversy in the astronomical world as to the reality of the doubling of the canals. Prof. W. H. Pickering has pointed out that lines a little out of focus are often seen double. Any one may verify this by following his directions. Draw a few fine dark lines on a piece of paper; place them three or four feet from the eyes, close one eye, and look with the other at the finger held a foot or less from the face. The lines will appear distinctly double. Of course he does not deny that observers have focused their telescopes properly; but the eye when tired with long or careful gazing may, and often does, alter its focus suddenly and almost arbitrarily. This explanation is, however, strenuously opposed by many observers and the question is by no means settled.

Another objection of a different kind raised against the vegetation theory is that Mars receives much less heat from the sun than the earth does, and, unless he has much more internal heat, it is hard to see how his ice-caps can be so much smaller relatively than the earth's. Other substances might freeze and melt in the same way; the polar caps might be of frozen carbon dioxide, or even frozen in as far as their telescopic appearance is concerned.

So at present we can only say that no completely satisfactory theory of the condition of Mars' surface has been advanced, much less demonstrated, although those which assume the presence of intelligent life on the planet will always remain the most attractive to the imagination.

### THE HEAVENS.

The western sky still contains the familiar winter constellations. Along the Milky Way lie Cassiopeia, Perseus, Auriga, Gemini, Canis Minor and Canis Major; and west of it the most conspicuous groups are Orion and Taurus.

At our chosen hour of 9 P. M. on the 15th Ursa Major is well above the pole. Besides the Dipper one can easily recognize the group of stars nearer Capella which form the animal's head, and the three pairs of small stars, almost in a straight line, which lie to the southward above Leo, and mark its paws. In the northeast are Bootes and Corona Borealis, and farther south is Virgo. Leo, identified by the conspicuous "sickle," with Regulus at the end of its handle, is approaching the zenith. Between Regulus and Procyon, a small group forms the head of Hydra, whose body is marked by a long line of rather inconspicuous stars extending eastward beyond the horizon.

### THE PLANETS.

Mercury is evening star till the 7th when he passes between us and the sun and becomes a morning star once more. He will not be visible to the naked eye till near the end of the month, when he rises over an hour before the sun. On the afternoon of the 12th he is in conjunction with Venus. Venus is still morning star, but is now so nearly behind the sun, that she rises but forty minutes earlier on the 1st and only twenty minutes before him at the month's end. Mars is conspicuous in the east in the early evening, and passes the meridian about 10 o'clock in the middle of the month. He is beginning to recede from the earth, but is still very bright. Jupiter rises about 2:30 A. M. on the 15th, Saturn about 3 o'clock, and Uranus a little before one. Neptune is still in Taurus, setting about midnight.

### THE MOON.

Full moon occurs early on the morning of the 5th, last quarter on the forenoon of the 13th, new moon on that of the 20th, and first quarter on the night of the 26th. The moon is nearest the earth on the 20th, and farthest away on the 8th.

She is in conjunction with Mars on the morning of the 4th, Uranus on the evening of the 12th, Jupiter on the afternoon of the 14th, Saturn the next morning, Mercury on the night of the 18th, Venus on the afternoon of the 19th, Neptune on the morning of the 26th and Mars once more on the evening of the 30th.

On the night of the 20th the sun enters the sign of Aries, and spring begins.

Oyster Bay, January 21, 1901.

## MUSICAL SOUNDS FROM THE ELECTRIC ARC.

Mr. W. Duddell, an electrician of London, has discovered a method of producing musical sounds from the electric arc, and recently gave a lecture upon these investigations before the London Institution of Electrical Engineers. It is only the solid carbon, that which is homogeneous in its nature, that is capable of producing these unusual sounds. The cored carbons are absolutely silent. Not only is it possible to obtain musical sounds, but they may be varied so as to produce a tune, and to exemplify his thesis, the inventor played a popular air. The variations in the sounds are accomplished by a by-pass or shunt placed across the carbons, and which have the same effect as the fingers and keys upon a flute. Mr. Duddell, in the course of his lecture, arranged four arcs in series to increase the intensity of the sound, and by varying the self-induction and capacity in the shunt circuit by means of a keyboard, of two octaves, produced his tune. The keyboard may be placed at any distance from the lamps without depreciating the musical effects emitted by the arcs. The inventor has also requisitioned the electric-light arc for receiving telephonic messages transmitted from another point of the building.