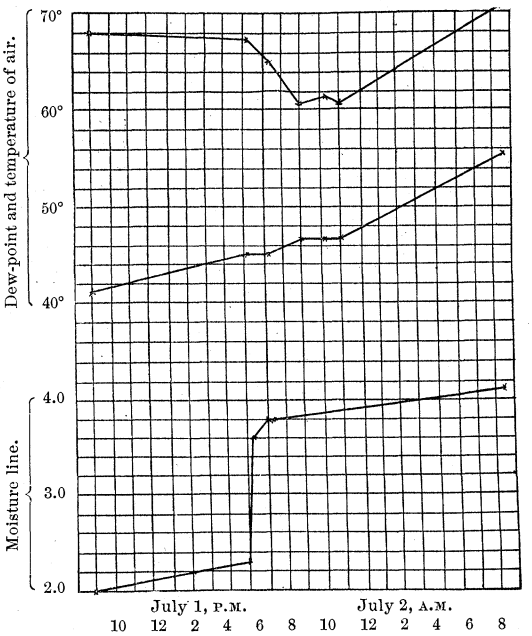
time a similar moist region, of 15° altitude and perhaps 35° length, was discovered in the south-east; and this in turn was found fifteen minutes later to be partly filled with cloud. After an hour or so they had all disappeared. The appearance was as though a body of air heavily charged with moisture, having become heated, was seen rising bodily at six o'clock, while at seven the consequent cooling had condensed in part its moisture.

One of the most striking facts noted is the suddenness with which a hygrometric change occurs, as indicated by the spectroscope. During the fine weather of June 30 and July 1, the spectroscope had indicated unusually dry air with almost absolute uniformity. During July 1, as the diagram shows, there had been a very slight increase in the moisture present, as indicated by an observation at six P.M. Fifteen minutes later, happening to glance through the spectroscope, I was greatly surprised to see how much blacker the line looked. A new set of readings was taken, giving a much higher amount of moisture, as indicated by the sudden rise in the curve. The sky was almost entirely free from clouds, with a light breeze from the south-west. Measurements were made in both cases all along the western half of the horizon, the eastern being too dark at that hour. At seven o'clock a moderately dense bank of stratus clouds had risen in the west to an altitude of 15° or 20°. The record at seven and seven-thirty showed little further hygrometric change. The sky was soon entirely overcast with clouds. This hygrometric change was not a mere momentary one, connected with cloud-formation; but the later record showed it to be the beginning of a period of moist air and showery weather. The hygrometer, it will be noted in the diagram, gave little sign of change for some hours. Other sudden changes of equally striking character have been observed. That, as has been suggested by Capron and others, the physical state of the suspended water, the size of the aqueous particles, may have an influence in its light-absorbing power, and so explain in part such changes, is very possible; but the evidence that such is the case appears to be far from conclusive.

It is believed that a series of spectroscopic observations, continued for a considerable period of time at different stations, would give much light on a number of important questions in meteorology, particularly in the study of the formation of showers and storms. The instrument is apparently admirably adapted to do this work, by its ability to trace accurately the motions of masses of vapor in the upper atmosphere. The discussion of the more important questions which arise in carrying on this investigation is deferred until a larger mass of figures and facts have been accumulated.




C. S. COOK.

## NOTES ON SASSAFRAS-LEAVES.

THERE are three distinct forms of sassafras-leaves. The simplest is ovate, varying to oval and obovate. A second form is three-lobed, the incisions running from near the middle of the upper half of the leaf's edge to the centre of the blade. The third form is midway between the entire and three-lobed sorts, and has but one side-lobe; the opposite half of the leaf being entire. It is as if one-half of a three-lobed leaf were joined by the midrib to the opposite half of an entire one of the same size. This form may be very appropriately called the 'mitten.'

In the study of these three forms, branches of sassafras have been gathered from a large number of places through the surrounding country. Some have been obtained from the woods, and others from the open field. Branches were cut from the largest trees and from the smallest, from vigorous trees and those of slow growth. Ten hundred and fifty leaves were examined: and of these, five hundred and thirteen were entire; four hundred


4
1
2
3

and fifty-eight, three-lobed; and seventy-nine, 'mitten form.'

The first leaves of spring were invariably entire, and a lobed leaf was rarely found until the fourth leaf was passed in counting from the base of the branch toward the tip. No regular order was discovered. In one case the arrangement was as follows: three entire, four three-lobed, one 'mitten,' one three-lobed, one 'mitten,' one three-lobed, one 'mitten,' one three-lobed; on another branch, four entire, one 'mitten,' five three-lobed, one 'mitten,' three three-lobed, three 'mittens.' The leaves on short spurs of old trees were nearly all small and entire; when the branches were somewhat longer, and the leaves larger, there were one or more three-lobed or 'mitten' leaves in the middle of the stem. A number of branches taken from slow-growing trees gave the following aggregate: entire leaves, seventy; 'mittens,' six; three-lobed leaves, three. A vigorous young sprout gave twenty-seven three-lobed leaves, one 'mitten' near the middle of the stem, and no entire leaves. Another had two entire blades at the base, and twelve three-lobed leaves above. A number of these rapidly-growing young trees together gave twenty-seven entire leaves, fourteen 'mittens,' and eighty-one three-lobed leaves.

The entire and smaller leaves are in the majority on slowly-growing trees; while, on the young sprouts, larger three-lobed leaves predominate. The 'mitten' form is mostly found with the entire leaves. This form of leaf is probably about equally divided between the 'right-handed' and 'left-handed;' though, of the number found (seventy-nine), those with the 'thumb' to the left, when held with under side upward, exceeded the other sort by half. About every thirteenth leaf is a 'mitten,' — a form not found mentioned in the botanical description of the sassafras.

There seems to be no order in the arrangement of the three forms upon the branch. Leaves from the buds were examined, and all of the three forms were found. Each kind is distinct, from a very early state; and there is no indication that one ever passes into the other. No intermediate forms have been found. The venation of the three forms is very much the same. There is a midrib running lengthwise through the leaf, and a strong lateral vein on each side, which runs from near the base to beyond the middle of the leaf. Smaller veins form the framework of the middle and upper parts of the leaf. The portion of parenchyma absent in a lobed leaf is midway between the strong lateral veins. This is very clearly shown in a 'mitten,' where one side is lobed, and the other entire. It would seem as if the lobing is a failure to fill up the framework, and apparently due to a too vigorous growth of the veins, and a lack of a sufficient amount of the soft, filling tissue. In the formation of leaves the sassafras is certainly 'at loose ends,' but in this it is not alone.

Fig. 1 shows an entire sassafras-leaf; fig. 2, a three-lobed leaf; and fig. 3, a 'mitten.' Fig. 4 shows the young leaves of the three forms. All the illustrations are drawn from nature.

BYRON D. HALSTED.

New York, July 2, 1883.

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## *THE UNITS OF MASS AND FORCE.*

IN the original definition of the gram it was regarded as a weight, and therefore a force, being the weight at the level of the sea, and at the latitude of 45°, of one cubic centimetre of water at its maximum density. It was thus virtually defined as a force. But as we shall soon see, although defined as a unit of force, it has become in practice a unit of mass. In the C. G. S. system of units this change is accepted, and the definition is modified accordingly; that is, one cubic centimetre of water is taken as the unit of mass, and this mass is called the gram without reference to its weight.

In volume i., *Cours de physique*, M. Jamin criticises this change. The high standing and character of this great work, as well as the eminence of its author, entitle his views to respectful consideration, especially as the question involves the fundamental elementary conceptions of physics in a way to render it of interest to the general student.

We set out with the proposition that what we commonly consider units of weight, such as the *kilogram* and *pound*, practically become units of mass in all the ordinary affairs of life. The reason is, that in practice bodies are weighed by balancing them against pieces of metal, and not by means of a spring balance. A pound weight is indeed heavier the farther north we go; but then, whatever we weigh with it is heavier in the same ratio. Accordingly, if by means of a weight we weigh a pound of tea at the equator, at the poles it will still weigh the same as a pound weight, although in reality heavier than at the equator. This is obviously a great practical and commercial convenience; because the quantity or mass of the tea is the important question to those who deal in it, while its gravitating force is of secondary importance. Were a perfect