

A TEMPERANCE MATCH.
BY GEORGE S. HODGINS.

It may seem extraordinary, but it is nevertheless strictly true, that so innocent an article of domestic use as an ordinary sulphur match may be made apparently to exhibit a most marked antipathy to alcoholic stimulants of various kinds. The ordinary wooden match does not protest by word of mouth, nor does it burst into the indignant flame of protest, when brought in contact with spirits. Under certain circumstances, however, it will act with great promptness in placing itself as far as it can beyond the reach of the obnoxious stimulant.

The conditions under which a match may be made to show its temperance principles are readily obtained. If it be thrown upon the surface of some pure clear water, contained in a bowl or soup-plate, it will be ready for trial. For the sake of definiteness let us call the head of the match that end to which the red phosphorus mixture has been applied; and the other end we will here call the tail. If, as the match lies motionless upon the surface of the water at or near the center of the containing vessel, we take a minute drop of undiluted whisky or other strong spirit, and carry it upon the end of a knitting needle, and drop it upon the tail of the match, we will see that the match will instantly move off briskly in the direction toward which the head was pointing. It will probably only stop when it strikes the side of the bowl. We can now drive the match back again to the other side of the bowl by the addition of another drop from the decanter. In fact, the match may be driven back, forward, sideways, or given a circular motion, in accordance with the portion of the match to which we apply the stimulant. In all cases the match will certainly move away from the whisky. It will always endeavor to free itself from the influence of alcohol. It will remain true to its temperance principles under all these conditions. One point, however, that is well worthy of notice here is that it is not necessary to actually touch the match with the drop on the knitting needle. It is sufficient to deposit the drop on the surface of the water, but quite close to the match, and it will act as readily and quickly as if it had been touched.

It may be, as our investigation proceeds, that we shall find that the desire to escape from the alcohol is not entirely to be attributed to the temperance proclivities of the match itself. In fact, the match may not have any real connection with the cause which produces its motion. A little piece of paper folded down the center and touched at one end may be made to move as the match has done, in the case before us.

Another fact which directs us to look further for the cause of the phenomenon is that a scientific toy has been made in the form of a miniature boat. In this boat a small space at the stern when filled with ether or other liquid readily mixing with water, and discharged through a small hole, covered with a piece of linen, will cause the boat to move forward as long as this novel method of using "fuel" continues.

From these experiments with match and paper, and from the action of the miniature boat, it is evident that it is to the water and the alcohol or ether that we must look for the explanation of the apparent mystery.

The surface of clear, still water is a film stretched and tense, like the head of a drum. This may be proved by slowly and carefully filling a tumbler so that as the water rises in the glass the surface may be kept still and without tremor. If the water be poured in steadily and in small quantity, the level of the water may be made to rise above the top of the tumbler. The edge of the liquid will bend down to meet the glass all the way round. The tumbler may thus be made to hold more water than its actual cubical contents would amount to. The overfull tumbler may even be carried from place to place, if no sudden jar or tremor ruptures the enveloping film or skin. This film is of infinite thinness, but it is in no way a scum upon the surface. It can be instantly broken and it will instantly reform. It is always there, pulling equally in all directions, and doing so all the time. Now this film, common to all liquids, has a definite amount of tension. It varies in different liquids. In some it is greater, and in some less, but the films of all liquids have a certain amount of surface tension.

When the match floated on the water, it was lying in this surface film, and as the film was pulling it equally in all directions, no motion was possible. When the drop of alcohol was placed upon the film of water at the tail of the match, the alcohol spread out for a moment, and formed also a film of exceeding minuteness, but with less tension than that of the water. Taking the place of the water film at the tail of the match, it destroyed its tension, and the pull of the film at the head of the match drew it rapidly away from the less powerful pull applied by the alcohol. There was momentarily a tug of war game played with the match, by the water film at the head, and the alcohol film at the tail, with the result that the water film, being the stronger, pulled the match away from the spirit. When the alcohol had mixed with the water,

the normal surface tension of the latter being restored, the match was again acted upon by a balanced pull in all directions. So also in the case of the little boat. Its motion resulted from the continuous release of surface tension behind, and the pull, upon the bow, of the stronger tension of the film in front. The pull upon each side, in opposite directions, being balanced, no side motion was possible.

Another very curious but simple experiment, which illustrates the differing surface tensions of various liquids, may be made with the bowl of clear water. If, upon the surface of the water you place a small drop of coal oil, you will find that the oil slowly spreads out in a circular patch. If upon this circle of coal oil, a minute drop of alcohol be placed, the circle will be instantly destroyed, and the oil will tremulously break up and fly outward in all directions over the surface of the water. If you are fortunate enough, as is sometimes the case, to succeed in having the drop of coal oil remain without spreading out, it will lie on the surface of the water, forming a minute flattened globule, very much in shape like an ordinary magnifying glass, more correctly described as in the form of a bi-convex lens, and the experiment will be more interesting. If upon the lens of coal oil floating on the water, a small drop of alcohol or pure whisky be placed, it will remain for a moment in apparent rest, glistening on the top of the oil lens. As you watch, the whole will, all at once, with a sudden quiver, break up, the alcohol disappearing, while the coal oil globule, as it were, explodes, and scatters its particles outward in all directions.

The coal-oil globule floated upon the surface film of the water, which it did not break, just as a needle may be made to float upon the water, for the selfsame reason. The globule of alcohol stood there momentarily, and the oil just then resisted it. As the alcohol, with its feeble surface tension, sank upon the oil, it destroyed the tension of the film forming the oil's upper surface. The pull of the lower oil surface, resting unbroken on the water, was greater than that of the oil and alcohol-permeated upper surface; the upper surface consequently ruptured, while the tense under side of the oil rolled it over and under, and flung the oil outward in all directions, with a miniature convulsion. The alcohol and water mixing left the oil particles scattered and detached, outside the area of disturbance. The whole oil globule, with both surfaces in tension, had had its upper surface broken into by the alcohol, and the unbalanced pull of the underside film destroyed it in a moment, as if by magic.

THE SIZE ILLUSION OF THE DEPRESSED LETTER P.

BY DR. J. E. WALLACE WALLIN.

The illusion consists in the apparent transformation of the capital P into a lower-case p when it occurs depressed in the line. The illusion quantum is independent of the position of the P in the word, as seen in the following examples:

Prin	PaPas	PriP
prin	Papas	Prip

It does not seem to be increased by still farther lowering the P, nor by lengthening the word, nor by being placed in juxtaposition to capitals instead of lower-case letters. Indeed with some capitals the result of the latter expedient is to diminish its strength. The illusion does not occur with other capitals whose lower-case letters are similar, namely: C, O, S, U, V, W, and X.

On first blush this would seem to be an instance of a psychological illusion, an illusion of assimilation. The loop in the P assimilates with the contiguous letters when placed on a level with them, the psychological law being that when the differences between compared extents are small the extents assimilate and seem equal, and when the differences are pronounced they contrast and appear more pronounced. But the width of the loop is no wider, in the above examples, than the top of the r nor the bottom of the a; and, in the following examples, the illusion is magnified rather by contrasting with a larger extent (O, which is longer than the loop and slightly wider) than by assimilating with a smaller one (i, here, however, the difference is so pronounced that the illusion might, rather, be considered to follow the law of contrast, whence P should appear enlarged and the illusion weakened):

iiiPiii	OOOPOOO
iiipiii	OOOpOOO

It appears, then, that the illusion occurs: (a) in situations offering no motives for assimilation or contrast (the best example, perhaps, is with the lower-case o); or (b) in those offering either motive. Hence these two motives can, at best, play only a subsidiary rôle.*

The illusion is, perhaps, only another case of the illusion of the vertical. We may assume that the average level of the line of regard in traveling over the line of print is near the upper edge of the preponderant letters (which, indeed, certain experiments indicate). When the letter P, therefore, is in its normal position

* On the Helmholtzian assumption the loop is more separate and distinct when the P is in its normal position. Its size is therefore overestimated.

the eye is obliged to deviate in the vertical direction in order to project its important parts upon the macula; and a vertical movement amounts to an exaggerated judgment of height. The actual process, of course, may be simply a motor tendency or an association. At the same time, the situation allows two co-operating factors: the law of perspective, according to which the high ground appears more remote, which, with optical impressions from identical distances, amounts to exaggerated size; and the fact that the depressed P extends below the lower line of the lower-case letters, exactly as in the case of the lower-case p. This association may in itself be so strong as to lead the judgment astray. That it is a factor may be proved by elevating the lower-case p:

Prin
Prin

Here the force of the illusion, however, is somewhat lessened, which may be due to the conspicuousness of the marks distinguishing the two fonts above.

SCIENCE NOTES.

A word may be said concerning the regeneration phenomena which are strikingly characteristic of the lower groups of plants, but which in the higher plants do not seem to be well emphasized, and are certainly less understood. The regeneration of the root tip has been best studied. In none of the higher plants has it been possible from a single isolated active non-sexual cell, or a small group of cells, to regenerate the plant.

The discovery by Millardet about twenty years ago of the remarkable fungicidal value of Bordeaux mixture was the starting point of the scientific and practical development of the use of fungicides, and has resulted in a very wide use of the compounds of copper for the purpose of preventing plant diseases. Several destructive diseases of potatoes, such as early blight and late blight, or potato rot, which often cause great loss to the growers of this crop, are now easily prevented by spraying the plants with Bordeaux mixture; and by adding a little Paris green to the mixture protection is afforded by the same treatment against the ravages of the potato beetle. The black rot and brown rot of the grape, which at one time practically destroyed the grape industry of the Central and Eastern States, have been carefully investigated and an effective remedy found in Bordeaux mixture. In fact, this mixture, which is a combination of copper sulphate and lime, has been found an effective protection against the larger number of parasites which attack plants through the leaves, stems, or fruit.

We desire to know much more concerning the individual planets. Everybody asks: "Are the planets inhabited?" and no favorable answer has yet been given. If one means by the question, inhabited by such beings as we are structurally, then one can say that if one of us were transported to any of the planets we could not live there a minute. Some, like Jupiter, are too hot; others, like the moon, too cold, or without air to breathe or water to drink, or with too great or too little gravity for our bodies. One does not need to assume such likeness, especially since we know something of the past history of man and animals on the earth, adapted to it in form, size, structure, habits and intelligence all correlated. To assume intelligence of our type is hardly allowable any more than for structures like ours. Vertebrate skeletons are not necessarily the only form in which intelligence of high type may abide. The implements and skill of astronomers are yet to determine what can be learned about this question. Taking what we know about the development of life on earth, it would seem to be insanely improbable that, among the millions of millions of huge bodies in the universe, all apparently made of the same kinds of matter and subject to the same laws, the earth is the only one among them all to have life and mind developed upon it. But at present we do not know that it may not be true. Let the twentieth century find out.

Innumerable storage reservoirs and vast distribution systems for supplies of pure water bear witness to the enormous debt which public health science owes to engineering science, as do proper street construction and, still more, those splendid systems of sewerage with which so many modern cities are equipped, and which not only serve to remove quickly the dangerous liquid waste of human and animal life, but also keep low and wholesome the level of the ground water, reducing dampness and promoting dryness of the environment, and thereby strengthening that physiological resistance by means of which the human mechanism fights against the attacks of infectious disease. Nor do the services of engineering science end here, for the fluid content of the sewers must always be safely disposed of, and sewage purification is to-day a problem of engineering science no less important or difficult than that of water purification. These same processes of the purification of water and sewage are matters of so much moment in public health science that in almost every country experiment stations are now maintained at public and private expense for the purpose of working out the most practical and most scientific methods of purification.