A SUGGESTION FOR PRESENTING THE IDEA OF WEIGHT EXERTED AT THE CENTER OF GRAVITY.

BY HENRY S. CURTIS.

Boys' High School, Brooklyn, N. Y.

A difficult idea to present to students of the high school age is that involving the fact that the weight of a body may be regarded as a single force acting at its center of gravity. The experiment of determining the weight of a lever (generally a meter stick), is taught in most high school laboratories. The student is told, first to find the center of gravity of the stick, by balancing on a fulcrum, and then, displacing the fulcrum to some other position on the stick and counterbalancing, to find what weight, acting at the center of gravity of the stick, would have the same moment as the counterpoise. This unknown weight proves to be the weight of the stick itself and the student verifies by weighing on a balance. So far, so good. But in a class of average intelligence many will wish to know why the unknown weight should be located at the center of gravity of the stick any more than at any other position, and why this weight should be the weight of the stick when only a portion of the stick is on that side of the fulcrum. It is true that this difficulty may be met in a way, by showing that the moment of the excess portion of the stick on the one side (assuming, of course, that the stick is uniform throughout), is equivalent to the moment of a weight equal to the weight of the stick and located at the center of gravity. But to prove this, the distance of the excess portion of the stick must be measured from the fulcrum to its center of gravity, which is attempting to prove a fact by assuming what is to be proved. An algebraical method of presentation may be employed but is open to the same objection.

To tell a class beforehand definitely what they are to find out or to lead them to conclusions that do not appeal to their reason, is to rob an experiment or demonstration of its chief value.

The author has found the following method of presentation of the subject much more logical and helpful and not too hard. It is utilized to best advantage as soon as possible after the question of the equilibrium of three parallel forces has been discussed and preferably after the experiment relating to such has been performed in the laboratory.

The class has learned, 1st, that if three parallel forces are in equilibrium, the single force acting one way, is equivalent to the sum of the other two forces, and 2nd, that the two forces acting together, are to each other inversely as their distances to the line of direction of the resultant. While these ideas are still fresh in the minds of the class, proceed as follows:

Suspend a meter stick from two fairly sensitive draw scales, so that the stick rests horizontally and the cords supporting it are approximately perpendicular to it. Attach the cords leading from the scales at different distances from the center of the stick, say for convenience, one at the end and the other at a distance of 25 centimeters from the center (see figure).

Ask the class if the condition is that of three parallel forces: they will see without difficulty that it is and that the single force is the weight of the stick itself. Suppose that the combined readings of the draw scales is 150 grams. Scale A will then register 50 grams and scale B 100 grams. Ask the class where the single force must be applied to give such readings and they will say that, since the forces are to each other inversely as their distances, that force B must be half as far from the single force as force A. Where then must the single force be to satisfy the conditions? The answer will be, at the center of the stick (in this case its center of gravity also). But this single force is the weight of the meter stick. It therefore follows that the weight of the stick may be regarded as a force applied at its center of gravity. A number of trials will strengthen this conclusion.

Such a method of presentation has several marked advantages. It is simple and logical; it is based on ideas readily assimilated and understood by students of average intelligence; it leads to conclusions that most students will appreciate and recognize as reasonable and definite.

No originality is claimed for the method; it is doubtless used by many teachers. But for those who have not tried it, it was felt that the idea might prove helpful and hence the foregoing.