Science Bulletin

Volume 1 | Number 2 Article 9

12-1928

Hydrostatics

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SCIENCE BULLETIN

Issued monthly. Entered as second class mail matter at the post-office, Cedar Falls, Iowa, under the act of August 24, 1912.

EDITORIALLY SPEAKING

We greatly appreciate the friendly comments on the first issue of the SCIENCE BULLETIN from our readers; and we have tried to answer your questions. In these first issues we are of necessity "feeling our way in the dark". You only, friendly reader, can give us light. This Bulletin can become increasingly efficient if you will write NOW and tell us: what kind of articles you need; what part of the contents you consider nonessential and what especially helpful; what ideas or methods of your own have proved valuable; what problems we can help you to solve; in short, wherein we are failing or succeeding in helping you personally. Address all correspondence to the editor.

Our staff is cooperating wonderfully. A wealth of material is being contributed. Your helpful letters reach us daily. We wish for you a well-filled stocking and a glorious Holiday vacation. Merry Christmas!

LABORATORY UPKEEP

Chemistry

Proper care of the laboratory is the phase of the high school chemistry teacher's task most apt to be neglected. This and later articles will point out some of the "little things that make perfection".

Bottles of sodium and ammonium hydroxide and of hydrochloric, sulfuric and nitric acids—the acids, both dilute and concentrated—should be placed on the desk shelves, at least one set for every two individual desks. Their labels should be in the glass. Bottles for other solutions and solids can be placed on wall shelves. Their labels should be uniform, with Denison No. 205 for small bottles and No. 201 for large bottles. Use No. 223 for number labels. Print labels neatly in India ink and protect them by painting with melted paraffin or colorless shellac, preferably the latter. To assist the pupil in learning formulas, the writer prefers to print formulas only on bottle labels and hang near the shelves a framed bottle directory, carrying in alphabetical order the entire name and shelf number. File solids and solutions separately. Use bottles uniform in shape and of two sizes, the smaller for the more expensive and the little used chemicals. The bottles should be wiped when they become clouded from fumes. Never place stock bottles in the laboratory because they spoil the uniform appearance of the shelves and their contents are liable to contamination. Do not allow pupils either to remove liquids by introducing a tube into a bottle or to return "left over" chemicals to bottles. Pollution is sure to result. Accustom pupils to holding stoppers between the fingers while using bottles. Rubber, not glass, stoppers are best for alkalies. If a glass stopper sticks, try first gently tapping upward on the projecting under edge. Failing in this, gently heat the neck on all sides with a small Bunsen flame and loosen the stopper before it also becomes heated and expands. A sealed stopper sometimes yields to the same treatment that sealed it, viz., inverting it (in a beaker, for safety) and allowing its contents to penetrate between the sealed surfaces.

R. W. GETCHELL.

HYDROSTATICS

Physics

The teacher may introduce this subject to the class by reference to the meaning of "pressure" as used in mechanics. Explain to them that the gauge pressure in a steam boiler or auto tire refers to the number of pounds pressure on each square inch of inner surface. Sometimes a problem will make it clear. Suppose that an automobile weighs 2400 pounds and that this weight is equally distributed to the four wheels. If the tires were inflated to sixty pounds, how much of the tire surface would continually be in contact with the road? Dividing six hundred pounds or one-fourth of the total weight by 60 gives 10 square inches as the answer.

In most texts on High School Physics, the discussion of the mechanics of liquids is largely limited to the

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of the class are taking work in manual training or farm shop work, valuable practice in both fields can be obtained either by building hog houses for farmers, or by repairing old houses and providing light and ventilation for them.

These studies of type in the breeding herd, of market classes and grades and of housing and equipment provide an excellent basis for the further study of management and feeding questions. This work will be the more valuable because we can apply it directly to the conditions studied in the field.

H. EARL RATH

HYDROSTATICS

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fundamental principles of hydrostatics, with hardly a reference to fluids in motion. Furthermore, the discussion of hydrostatics centers upon three principles, viz., Archimedes' and the two dealing with static pressure. The two latter are: (1) The pressure in a liquid at rest varies directly with the depth and density of the liquid, (2) Any external pressure applied to an enclosed liquid is transmitted undiminished in all directions. It is necessary that the teacher keep clearly in mind these three great concepts and their practical bearing on modern environment. This should lead him to coordinate his lessons in a well-knit project group.

Experience has taught the writer that the average beginning student cannot readily discriminate between the two principles of liquid pressure in their practical application. Accordingly he should be led to realize that the first principle of pressure is one that follows from the weight of the liquid itself. It is applicable to liquids in natural containers as a lake as well as to those enclosed in such vessels as the standpipe of a city water system. To state that the pressure of water in a lake at the depth of 100 feet is about forty-three pounds per square inch, means that the weight of a column of water of one square inch cross section and extending one hundred feet below the surface is forty-three pounds. At a depth of 200 feet this pressure would be 86 pounds, thus increasing in direct ratio with the depth.

The second principle of pressure commonly discussed in high school texts is known as Pascal's Principle. It refers particularly to external pressures applied to liquids wholly enclosed, such as cylinders of barber's chairs. The difference between the effects of applying external pressure to a solid and to a liquid should first be stressed. If ten pounds of force are applied to a solid in a downward direction it means a total of ten pounds of force in that one direction. If, however, ten pounds of downward force are applied by a movable piston to a liquid enclosed in a cylinder, it means the application of a force in an upward, lateral and downward direction. The magnitude of the force on any surface of the enclosing vessel would be equal to its area times 10 pounds.

Three corollaries grow out of the laws of Hydrostatics. One, the so-called Hydrostatic Paradox, states that "the pressure of a liquid in the bottom of the open vessel enclosing it is independent of its shape and dependent only on the depth and density of the liquid." This is usually illustrated experimentally with Pascal's vases. It is not a new principle and can easily be deduced from the idea of gravity pressure. A second corollary records that "liquids in a system of connecting tubes rise to the same level regardless of the size or shape of the tubes." Since the gravity pressure of any liquid at a given depth would be transmitted equally to all other surfaces at that depth it is evident that the heights of the connected liquid columns must be equal. The third corollary states that "the pressure at any given point in a liquid at rest is equal in all directions." Were this not true it is clear that the various portions of a liquid could never come to rest. The instructor must be careful to subordinate these corollaries to the fundamental principles. In fact, one test of good teaching rests in the ability to discriminate clearly between a major concept and its incidental outgrowth.

(To be continued)

L. BEGEMAN