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Atmospheric Pressure

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water column. This tube can be made from a straight glass tube thirty inches long and one-fourth inch internal diameter. Bend the tube at its middle point into a rounding U shaped form. Fill the two arms of the tube with water to a height of about eight inches and attach one arm to the gas jet with a piece of rubber tubing.

The difference in the height of the two columns of water when the gas is turned on will enable the pupils to calculate the gas pressure, using the principle of gravity pressure applied to a water column. Let us assume the difference in the height of the two water columns to be eight inches. Then the gas pressure would equal the weight of a column of water of one square inch cross section and eight inches high. The computation is simple. First convert the eight cubic inches of water column to cubic feet by dividing by 1728. Then multiply the quotient by 62.4, the weight in pounds of one cubic foot of water. If the pressure is to be determined in grams per square centimeter instead of pounds per square inch, we need only to measure in centimeters the difference in the heights of the two water columns. The result is the numerical answer, since one cubic centimeter of water weighs one gram.

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ATMOSPHERIC PRESSURE

Physics

Having learned the meaning of "pressure" from the study of hydrostatics, the pupil is easily led to understand the striking phenomena of atmospheric pressure. He should readily appreciate that the term refers to the gravity pressure of the atmosphere. For example, an atmospheric pressure of 14.7 pounds per square inch refers to the weight of an average column of air resting on one square inch of the earth's surface at sea level. The first experiment should be one to demonstrate to the class that air has weight. This can be done by means of an air pump and an ordinary quart bottle. The bottle is fitted with a one hole rubber stopper carrying a short glass tube of quarter inch bore, and to the end of this is attached a rubber tube. The bottle with its connections is first weighed on an ordinary beam balance. The air is then partially exhausted and the tube closed with a pinch clamp. When it is again placed on the balance the original weights should over balance it. Thus it is shown that the air removed from the bottle has weight. In case the school does not possess an air pump, it is best to use a thin walled chemical flask and exhaust the air by means of steam pressure as explained in the General Science article of this issue.

The historical side of this interesting subject must not be neglected in class room discussions. The following instance may be discussed. Galileo had learned that air has weight through his oft repeated experiment similar to the one described above. He first weighed a container full of air under ordinary pressure, then when it was filled under high pressure and noted that the second weight was the greater. He did not, however, clearly understand the phenomena of atmospheric pressure, as shown by his incorrect explanation of the action of a siphon or a suction pump. The action of water in these devices was accounted for by the old Aristotelian statement that "Nature abhors a vacuum". It remained for Torricelli, an ardent disciple of Galileo, to associate atmospheric pressure and the height of the water column in a suction pump. He devised the famous experiment which bears his name and which is now practically applied in the mercurial barometer. He designed this apparatus to measure the weight of the atmosphere which in his words was "now heavier, now lighter". This experiment, known as Torricelli's experiment, is described in all high school physics texts and need not be discussed in detail here. The actual experiment was not performed by Torricelli but was first carried out by his pupil, Viviani, in Florence, Italy in 1643.

An account of the experiment reached Paris the next year and came to the notice of Pascal. He could not try the experiment until 1646 when glass tubes were available to him. Pascal reasoned that if the atmosphere supported the mercury column, the height of the column should

(To be continued)