Experimental Set with Many Questions III

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I have presented the idea of "Experimental Sets with Many Questions" at the last two Fairs of Inventions of Physics Teachers. I would like to introduce another set because I consider the method of asking questions that concern an experiment as very useful to bring the physics lessons alive.

The use of such sets may help the teacher to prepare interesting revision lessons and optional exercises. These sets can liven up the work with students and they can lead to easier understanding and longer keeping of the acquired information.

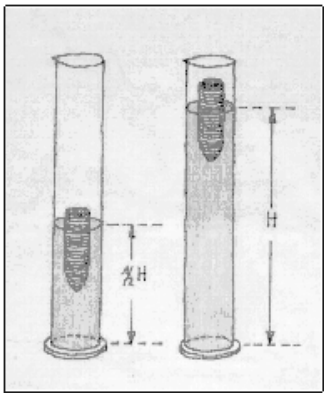
The emphasis in these sets is often put on the moment of surprise and a seeming discrepancy to students' life experiences. The questions concerning a set are sometimes connected together. The purpose of mentioned features of the set is to make it easier to remember the phenomenon or process presented and its characteristics for a longer time. This is why the finding of the correct answer must be preceded by a deeper train of thought which is based on the utilization of theoretical facts referring to the issue and their selection for the particular situation that is presented in the experiment.

The sets described in this report were made years ago for the finals of the High School Students' Physical Tournament. It has become a tradition to direct the crucial questions of the final round to experimental sets. This tradition gave these sets the name "Experimental Sets with Many Questions". The principle is to formulate a tight logical series of questions concerning the experiment. Experiments of one set refer either to the same phenomenon and show its various effects or they refer to various physical phenomena that yield similar results. Every question concerns a different modification of the experiment. Students are requested either to predict the result of the experiment or to explain the effect that takes place in the example.

The experimental set in this article is presented in the same way as during the Physical Tournament. The rules of the Tournament limit the number of questions to a maximum of four; the brief characterization of the experiments does not reveal the principle of the phenomenon. The contestants are required to give comprehensive answers to questions concerning the observed phenomenon.

Buoyancy

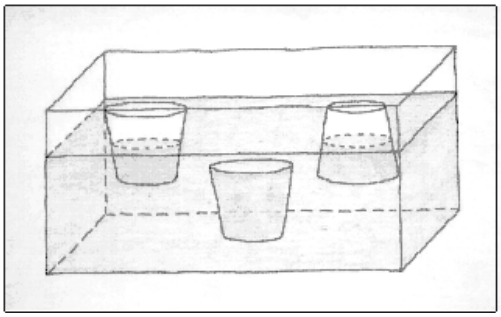
1. Two objects of the same shape and volume are floating in water inside two cylinders. The height of water surface in the first cylinder is H/2 and H in the second cylinder.



Question 1. (explanation)

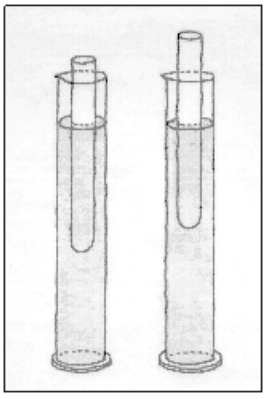
Which object is buoyed up by a large force?

2. Three equal vessels are placed in an aquarium. The first vessel is partially filled with water and floats on the surface, the second vessel is completely submerged in water and the third vessel is floating on the water surface bottom up.



Question 2. (explanation)

Compare the buoyant forces exerted on each vessel.

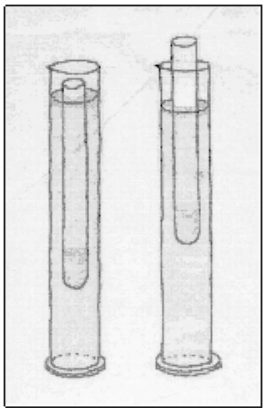


3. Two empty test tubes are floating in two cylinders. The first test tube is immersed in water, the second in glycerin. We pour a certain amount of glycerin in the first test tube and the same amount of water in the second test tube.

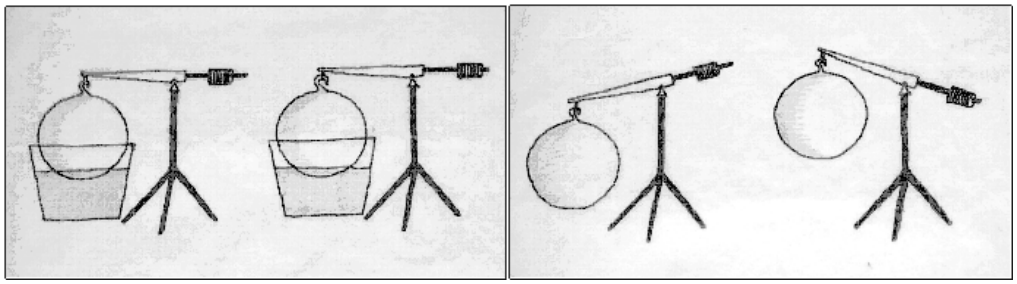
Question 3. (prediction)

Which test tube changes the height of its immersion more?

Answer:



4. Two glass bulbs are hanged on two weighing scales. The bulbs are partially immersed in water so that the scales are in equilibrium:



Each scale moves in another direction if we put the bulbs out of the water.

Question 4. (explanation)

Why were the scales in equilibrium when the bulbs were immersed?

(The determinative role belongs to the adhesive forces between the surface of water and glass in this case. One must realize that the equilibrium of two-lever scales is very fine and can be changed by means of very weak forces.)

While using similar "Experimental Sets with Many Question", it is possible to formulate questions in other ways, change their number or to modify the experimental set.

The surprising nature of the effects that take place in the "Experimental Sets with Many Questions" increases their attractiveness, awakens the interest of the students in the phenomenon and provokes questions. The stimulating of such an attitude in the students is an extremely effective promoter of success in physics education.