Science.

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SOLUTION OF PROBLEMS.

(*For Problems see Answers to Correspondents.*)

1. Let one side of the triangle be x. Then perpendicular from apex on base is $\frac{x\sqrt{3}}{2}$

Since Sp. G. of lamina is one-third that of water, the area of the part submerged is one-third whole area.

Let p be the distance from apex to height of water along the perpendicular, then the distance from the side of the lamina along the level of the water to the perpendicular is $\frac{p}{\sqrt{3}}$.

Area of part submerged is $p \times \frac{p}{\sqrt{3}} = \frac{p^2}{\sqrt{3}}$

Area of whole lamina $= \frac{x^2\sqrt{3}}{4}$

But $\frac{x^2\sqrt{3}}{4} = \frac{3p^2}{\sqrt{3}}$

$$\therefore p = \frac{x}{2} = \frac{\frac{x}{2}}{\frac{x\sqrt{3}}{2}} \text{ of whole perpendicular} = \frac{\text{perpendicular}}{\sqrt{3}}$$

2. (*a*) Apex down. Let sides equal a.

Then sides of triangle immersed are $\frac{a}{2}$

Area of triangle immersed $= \frac{a^2\sqrt{3}}{16}$

Area of whole triangle $= \frac{a^2\sqrt{3}}{4}$

$$\frac{\text{Area of part immersed}}{\text{Area of whole}} = \frac{\frac{a^2\sqrt{3}}{16}}{\frac{a^2\sqrt{3}}{4}} = \frac{1}{4}$$

$\therefore$ Sp. G. is one-fourth that of water.

(*b*) Similarly with base downward.

3. Let A = 1 lb. wt.
B = 2 lb. wt.

Since Sp. G. of A is 2, its weight in water will be $\frac{1}{2}$ lb.

Then weight of B in water must be $\frac{1}{2}$ lb., to balance.

$\therefore$ Loss of B in water = $1\frac{1}{2}$ lb.

$\therefore$ Sp. G. $= \frac{2}{1\frac{1}{2}} = \frac{4}{3}$

4. $8.85 = \frac{\text{Weight in air.}}{\text{Weight in air} - 887}$

$\therefore$ Weight of copper in air is 999.9 grains; say 1,000 grains.

Let v = Volume of copper.
1,000 − 887 = 113 = wt. of v of water.
1,000 − 910 = 90 = wt. of v of alcohol.
$\therefore$ Sp. G. of alcohol is $\frac{90}{113}$ nearly.

5. Pressure on sides of lower half of cone is the weight of the water in the part below the horizontal plane plus the weight of a cylinder of water having for its base the horizontal plane and for height half the vertical height of the cone. The pressure on the rest of the cone is the weight of the balance of the water.

Let h = vertical height of cone.
r = radius.

Wt. of whole cone $= \frac{1}{3}\pi r^2 h$

Wt. of lower half $= \frac{1}{3}\pi \frac{r^2}{4}\cdot\frac{h}{2}$

Wt. of cylinder above mentioned $= \pi\frac{r^2}{4}\cdot\frac{h}{2}$

$\therefore \frac{1}{3}\pi r^2 h$ should by the question be equal to

$$2\left(\frac{1}{3}\frac{\pi r^2}{4}\frac{h}{2} + \frac{\pi r^2}{4}\cdot\frac{h}{2}\right)$$

which is true.

THE OYSTER.

The common clam which has been selected as the type of the mollusca to be studied by the Senior Leaving students, has so many points of resemblance to the oyster that the following facts in regard to the latter may be found of interest to students. The main difference between the two forms are the sedentary habits of the oyster, while the clam is locomotory, and also the inequality in development of the right and left valves, which in the clam are equally developed.

One of the best bottoms for oyster culture is the Chesapeake Bay. It is covered with soft, black mud, swarming with microscopic organisms, which the oyster turns into food—the most nutritious and palatable. Its sedentary habits lead it to fasten itself to rocks, bowlders, and other firm objects, thus preventing it from being engulfed in the slimy ooze sent down by the rivers of the Chesapeake. The gill is perhaps the most important organ of the animal. It is at once a breathing organ purifying the blood; a pump for bathing itself with water, thus drawing in streams laden with microscopic food; and a brood-chamber where the young are nursed until they are large enough to take care of themselves.

The method of securing the food is interesting. The surface of the gills is covered by an adhesive secretion, and also by cilia. These drive the water over the gills, when the microscopic organisms stick fast, like flies on fly-paper. The mouth is always open, and the anterior ends of the gills fit into the groove formed by the lips so that the slimy food, as it is pressed forward, naturally slides into the mouth.

Both the egg cells and the male cells in the American oyster are voided into the ocean. Contact occurs there, if at all, but enormous numbers of egg cells must annually perish. It is estimated that an adult average Maryland oyster lays 16,000,000 eggs. This is on the authority of Professor Brooks. If half of these developed into female oysters and half into male, in the fifth generation there would be 66,000,000,000,000,000,000,000,000,000, 000, 000 oysters. These would make eight earths. The oyster lays eggs each year.

Artificial fertilization consists in mixing the egg cells and male cells in small vessels where contact is sure to occur. Sea water soon destroys impregnated eggs. In early life they are motile. The embryos swarm to the surface. Their enemies are fish, cold winds and rains. Ice, heavy wind-storms also carry off great numbers. Planting of dead shells will build up a new bed, since it forms a solid base upon which the young oyster may fasten itself and so escape being engulfed in the soft mud.

ANSWERS TO CORRESPONDENTS.

G.R.—Question.—What are good supplementary texts on Zoology?

Answer.—"Guides for Scientific Teaching," published by Heath & Co., Boston, edited by Alpheus Hyatt.

Subscriber.—Question.—Will you give the solution to the sixth question on the Senior Leaving Physics paper for 1893.

Answer.—For solution see another column.

S.A.R., Trenton.—Question.—Will you please give solutions to problems 32, 33, page 45; and 47, 52, page 47, of Hamblin Smith's Hydrostatics, and the sixth on the last Senior Physics paper.

Answer.—The solutions are given numbered 1, 2, 3, 4, 5, in another column.

SIMPLE EXPERIMENTS IN PHYSICS.

(SELECTED.)

1. Diffusion of Gases.—Fill bottles with hydrogen and oxygen gases; connect by a straight glass tube passing through the corks so that the hydrogen bottle shall be uppermost. In half an hour apply a lighted taper to each.

2. Capillary Action.—Take a wire bent into fork form, having arms of equal length, and turn up the free ends of the wire. Place a needle in the bent ends of the wire and lower gently into water. What happens when you remove the wire? Examine the edges of the needle. Treat another needle similarly so as to be parallel to the first. Then drop a drop of alcohol between them.

3. Porosity.—Fill a colloidion balloon with hydrogen, and tie the open end securely, let go; it w ll rise to the ceiling. In ten or fifteen minutes it falls and is collapsed, why?

Dip a crayon in water; break. What is the condition of the centre?

Take a graduated test tube and half-fill with water, mark height, add some salt, mark height quickly, allow to stand for half an hour; account for the diminution of the combined volumes.

Tie a piece of chamois over the end of a glass tube two feet long and half inch diameter; a test-tube with a small hole in the bottom will do. Fill with mercury.

4. Pressure in Fluids Proportional to Depth.—Obtain a tin tube, two inches diameter, three feet long, closed at one end. Have openings along the side, and fit into these perforated rubber corks, seal up small pieces of glass tubing at one end and insert into the cork perforations. These will act as plugs which can be quickly removed. Fill the tin with water, remove the plugs all at once.

5. No Lateral Pressure in Fluids Falling Freely.—Use preceding apparatus, but have the whole bottom formed of a solid rubber cork. Remove this when the other plugs are removed.

6. To Find the Relative Densities of Two Liquids.—Fit a florence flask with a two-hole rubber cork. Into the perforations fit tightly two glass tubes, bent just as they leave the flask so as to be separated. Place the ends of the tubes in the liquids placed in tumblers. Heat the flask, allow to cool. Compare heights of the liquids in the stems.

OF GENERAL INTEREST.

The Breathing Pores of Plants.—The number of stomata or breathing pores on leaves varies from six thousand to three thousand per square inch. In most cases the great majority of these are on the under surface of the leaf. In the leaves of the water lilies, which usually lie flat upon the surface of the water, they are more abundant on the upper surface.

Ants.—Ants have many strangers in their homes; some they use as cows, others are welcome because they emit a pleasant odor, some are kept as pets, still others are useful as scavengers, while many are simply tolerated. But the ant is not indiscriminate in his friendships; his friends must be either harmless, agreeable, or of use to him. Ants are, as a rule, aristocratic. Society relations are fixed. Each species is a "caste apart;" and it is easier for a camel to go through the needle's eye than for an individual ant of one species to recognize a cousin of another species.

Yawning.—Yawning, which is regarded by most persons as merely a sign of weariness or sleepiness, is considered by M. Naegeli as a therapeutic agency. He believes that a series of yawns, with the stretching that accompanies them, would make an excellent morning and evening exercise. The lungs can not fail to be benefited by the inflation they get.

Application of Cold.—Among some recently observed interesting results of application of cold, M. Raoul Pictet has found that at—150° all chemical reaction is suppressed. Thus, if sulphuric acid and potash are brought together at this temperature, they do not combine. Litmus paper, introduced, keeps its color. It is possible to restore energy to these substances by passing the electric current, and the current passes readily, whatever the substances; at —150° all bodies are good conductors. The disappearance of affinity at a low temperature can be utilized to get absolutely pure substances; and M. Pictet has thus obtained alcohol, chloroform, ether, and glycerine.