Density and floating objects experiments

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Abstract

Information on first international school videoconference on floating objects among schools from Czech Republic, Germany and Poland. Description of some interesting experiments on the subject of density and object floating.

On the 20 March 2009 we organized the videoconference within Comenius program among secondary schools in Sedlcany in the Czech Republic, Hebbelschule in Kiel in Germany and our Secondary School nr V in Opole, Poland.

The topic of the conference was 'Object Density'. Students from cooperating schools were to prepare suitable experiments and present them to the schools' audiences in front of the Internet camera. In order to achieve it we used SKYPE program.

We definitely consider this type of cooperation worth introducing into schools as, apart from learning about physical issues, the students develop their English skills. The cooperation of the teachers of different subjects influences the relations between teachers and students and creates background for fresh and creative ideas.

The conference was prepared from our side by the teacher of physics Krystyna Raczkowska Tomczak and the teacher of English Alicja Wujec Kaczmarek.

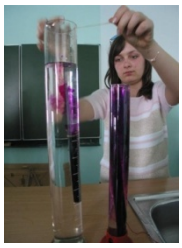
The students of our school worked on the phenomenon of floating for the whole last year and now we would like to present some experiments on the subject which are less often shown in schools.

Experiment 1. The influence of temperature on liquid density.

Into two empty vessels we pour water: hot into the first one and cold into the second one. Then we put an aerometer into the vessels of cold and hot water and compare immersion. The aerometer goes deeper in hot water and it does not go so deep in cold one.

Conclusion: Hot water is of lesser density so hydrostatic lift force is weaker and the aerometer goes deeper.

Experiment 2. Underwater Volcano



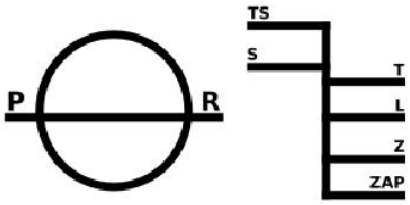
We can illustrate the same phenomenon by a different experiment. Into the transparent cylindrical vessel filled with water we put a small container filled with coloured hot water. After a while the container goes up.

Application

1. Galileo thermometer which allows estimating the temperature of the surrounding on the basis of immersion of floating objects.

2. Plimsolla sign engraved or painted on the ships' sides. The sign shows possible immersion for given waters and different climate zones.

TS – In fresh water in tropical climate
S – in fresh water in winter
T – in tropical zone
L – in summer in moderate climate
Z – in moderate climate in winter
ZAP – in winter in North Atlantic



Air density is also important in air transport. It is directly proportional to its pressure and indirectly proportional to its temperature. In tropical zones and on high situated airports we can observe lesser density of air which consequently requires longer runways or the planes cannot be fully loaded.

Experiment 3.

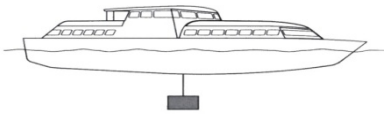
Into a transparent cylinder filled with water we put a suitably loaded jar which floats completely immersed.

After turning on aeration (aquarium set is used here) average water density decreases and the jar sinks.

Application

Gases getting out of the ocean bottom through decreasing water density can make a ship sink.

Experiment 4. Smugglers' ship



We put a closed plastic container suitably loaded into another container in a similar shape. We used deodorant caps. We immerse the set twice.

1. When containers are put into each other (goods loaded onto the ship) a ship sinks because the volume of an immersed part is too small and the weight of the ship is bigger than hydrostatic lift.

2. With a piece of two-sided sticky tape we glue a loaded container to the other one (goods are loaded under the ship) and a ship floats as the volume of an immersed object is bigger than in previous case with the same weight so hydrostatic lift compensates set weight.

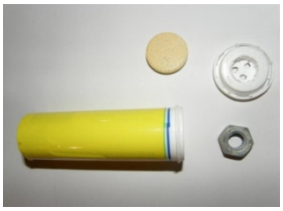
Experiment 5. Flotation

Into a glass filled with carbonated water we put raisins or grapes. The fruits gradually sink and then go up to the surface. The effect happens when object density artificially decreases by joining with gas bubbles.

The patent author is an American teacher C. B. Everson(1886). Her discovery was completely accidental. Washing bags for chalcopyrite stained with fat she realized that fine elements of mineral go up to the surface with foam.

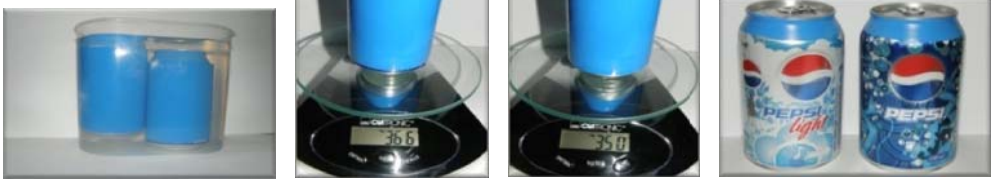
Experiment 6. Submarine with effervescent tablet

Effervescent tablets container is loaded in such a way to make it float vertically evenly with water surface. Then we put into an effervescent tablet and pour into some water closing the container with a cap with three holes (which can be done with a heated up nail). A rocket starts in a while.



Experiment 7. Floating or sinking?

We immerse two cans with the same volume into a container filled with water. One can float and the other sinks.



Conclusion

One can is heavier which means that two cans are filled with liquids of different density. In one can there is Pepsi sweetened with sugar and the other is sweetened with sweetener.

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