

611-1295 (40-575) Soap Boat

Introduction: surface tension is a curious thing. In brief, it is the tendency of similar molecules to stick together when they are arrayed in a sheet. In the case of water, the first layer of molecules can be thought of as an elastic sheet or film. Objects of low enough mass are able to float on this film even though they are denser than water. As an example, consider how a water strider is able to walk across the surface of a pond even though it is far too dense to float. It uses the surface tension of the water to walk across as we might do on a trampoline. Surface tension can be altered by the presence of surfactants, or materials that coat the surface of a liquid. Our demo uses this property. To use your soap boat, you will need a reservoir of water and an extremely common surfactant: liquid hand soap.

Operation: to use the soap boat, first place it in water. The longer the reservoir, the more dramatic the effect. Make the boat float, and gently position it so that it stops moving. When it is floating quietly, it's time to add the soap. Dribble a small amount of hand soap into the small tank at the stern of the boat. In a few moments, the boat will begin moving forwards.

Why does it do this? The soap spreads out over the surface of the water. Now, water has a much higher surface tension than soap does, so the coating of the water with soap lowers the total surface tension. However, the soap is only applied off the stern of the boat. This means that there is greater surface tension on the bow than the stern. This, in turn, creates a small force on the bow of the boat, causing it to creep forwards.

You may find that after one or two uses the soap has coated all of the water. This will interfere with the demo, because there needs to be a surface tension gradient in order for the boat to work. If the surface tension in your tank is uniform, there is no differential to pull the boat along.

You can also experiment with other liquids, such as alcohol, glycerin, oils, or any other surfactant you wish to try. Some will raise the surface tension of water, while others will lower it. Some may have no noticeable effect. You can experiment with just about any liquid you want to try. The boat is made out of polyethylene, which is a very chemically resistant plastic. It will not be harmed by most chemicals that you have in your lab or home. Note the effects.

Warranty and Parts:

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.