

# Professor Brainstorm's Margarine Tub Boats

## About this Activity (Information for Parents and Teachers)

This activity explores sinking and floating, and addresses other generic practical science issues, such as the importance of working scientifically.

There is a chance that water may get splashed or spilt during this experiment - so you may want to place the bowl on a large plastic sheet. Or if the weather is fine, why not do it outside.

This experiment is designed for children aged from 4 to 7 years (Reception to year 2).

You can also turn this experiment in to a game. For more information see below.

### What you Need

- A large bowl (e.g. a washing up bowl)
- A margarine carton. (It doesn't matter what size - in fact if you are going to do the experiment then having several different sizes is useful.)
- Some small pebbles or stones

### Margarine Tub Boats - The Game

- Place your bowl on a surface which will not be damaged if it gets wet - and fill the bowl with water. (The depth of the water should be at least a couple of centimetres deeper than the height of the margarine tub.)
- The first person places the margarine tub so that it floats on the water - and then places a pebble carefully in the tub.
- The second person places another pebble in the tub - and so on.
- The person who makes the tub sink loses the game. They will have to try harder next time.

### Margarine Tub Boats - The Experiment

You can do the experiment in a similar way to the Game. However, this time we are not interested in who makes the boat sink. Instead we want to find out how many pebbles we can place in the tub before it sinks.

- Play the game again. When the tub sinks, remove the pebble which made it sink - and count how many other pebbles are in the tub. Write this number down.
- Repeat again several times - and each time write down how many pebbles you can place in the tub before it sinks.

Does it always take the same number of pebbles to make the tub sink? Can you think of a reason why you might not get the same answer every time?



There are several reasons:

- It depends how carefully you add the pebbles to the tub.
- It also depends on whether the tub remains level. You may have noticed in some of the games that if more of the pebbles are at one end, the tub will tip towards that end. And once one corner of the tub goes below the level of the water, the water floods in - and the boat sinks.
- Another factor is that the pebbles may not all be the same size. If the margarine tub is getting low in the water, adding a large pebble may make it sink. But perhaps you could have added a smaller pebble without making it sink.

Can you think of a way that we can deal with this last problem to make our experiment more accurate?

- One approach would be to make all the pebbles the same size. Then we wouldn't have to worry about whether we were adding a large pebble or a small one. But it might be difficult to find lots of pebbles which are exactly the same size as each other.
- An alternative is that we could weigh the amount of pebbles.

So why not try the experiment again - only this time we are going to do it slightly differently:

- Try to add the pebbles carefully so that the tub remains level all the time.
- And this time when the margarine tub sinks, take out the pebble which made it sink - and then weigh the rest of the pebbles.
- Do the experiment several times - and write down your answer each time.

You will probably still get lots of different answers - but this time we have taken our measurements in a more scientific way.

### Now try this ...

Fill the margarine tub with water - and then place it in the bowl of water. Does it float?

Yes, it does - although it will be floating so low in the water that the rim of the container is only just above the surface of the water.

Now see how many pebbles you can add before it sinks.

It will probably sink as soon as you add the first pebble.

So when the margarine tub is filled with water it can hardly hold any additional weight before it sinks. But if we tip the water out, we can add lots of pebbles without it sinking. So in this case there must be something in the margarine tub which is helping to keep it afloat. What is it?

The answer is ... Air.

### Margarine Tub Boats and the Plimsoll Line

In the experiment you will have noticed that as you add more weight (i.e. more pebbles) the margarine tub floats lower and lower in the water. The same thing happens with a real ship. As more cargo is added, the ship floats lower in the water.

If you look at the side of a large ship you will see that it has a Plimsoll Line (see picture on right). This shows how low the ship is floating in the water - to make sure that the ship is not overloaded.

