

In our daily lives, we see that many things sink in water, while many others float on it. This raises a question in our minds: why do some things float and some others sink? An obvious answer that comes to our mind is that a stone sinks as it is heavy and paper or plastic floats as it is light. But does this answer some other questions? No. A massive ship does not sink, but a small stone does. Therefore, we accept there must be some reason behind these riddles. It is said if there is a reason, there is essentially science behind it. So, what is that science?

While teaching measurement in class VII, I had to work on the concept of density.

I asked students, 'How is it that some things float on water and some sink?'

To this, children had a logic. 'Some things are light in weight, and some are heavy. Things that are light in weight float and the heavy ones sink.'

I said, 'Okay. If that is so, let us conduct an experiment. Look, here is a bowl and a small iron nail. Tell me, which one is light, and which is heavy?' 'The bowl is heavy, and the iron nail is light,' answered the children.

I dipped both things in a container filled with water. We all saw that the nail sank, while the bowl continued to float.

'Why did it happen?' I asked the students.

One child said, 'The bowl is shallow which is why it swims. But the nail is not shallow.'

'But all of you said the thing which is heavy will sink.'

This put the children into a dilemma. They said, 'No, no, we cannot say that.'

'So, what else could be the reason?' I asked.

The children began to discuss among themselves. But when they did not arrive at any original answer, I took this a step forward and showed them one more experiment.

I took a beaker and put 200ml water into it. Thereafter, I put 200ml kerosene oil into it. After some time, we could see that the kerosene oil and water separated and formed distinct layers.

Perhaps, the children had seen this earlier also, because some children could be heard saying, 'Look, both will get separated.'

I asked, 'Why didn't these two liquids mix with each other?'

One group of children explained, 'It happened because kerosene oil cannot dissolve in water.'

A second group of children said, 'Water contains salts as a result of which it is heavy and goes down. But oil may be containing air because of which it comes up.'

The third group of children went on to say, 'What you put first went down and what was put later, came up. If we had poured oil first, it would have remained below.'

One child said, 'During the first experiment, we saw the nail sank, but the heavy bowl did not. Here, the difference is how diffused the matter is. Maybe oil has greater diffusion.'

Since all felt that their logic was better, there was no other option but to find out by conducting another experiment. It was imperative to draw an exact conclusion.

We took some water in a test tube and heated it. After some time, it started giving out bubbles, proving that water contained air. It did not take long for children to understand that there is air in water, which negated one of their arguments.

Then, we turned to another argument. One child put kerosene oil first and then water into a beaker. The entire amount of kerosene oil came above water gradually. This way, another argument was proven wrong.

Then, we moved on to deal with the next argument. I took approximately 100ml water in a beaker. Then, I slowly poured glycerine along the inner surface of the test tube. The children were quite eager to know what would ultimately happen. A layer of glycerine settled down at the bottom and water came up.

I asked, 'How come this happened when glycerine dissolves in water?'

The children said that we cannot say that the matter is insoluble hence, the layer is formed. This layer was also formed even when it dissolved. 'Perhaps glycerine is more viscous than water,' they suggested. But this almost rejected the logic of the undissolved matter.

The last logic was way too different and forced us to think. A child said if we expand this nail by beating, it may float. The boy said oil spreads more and water spreads less. This logic gave a new direction to our understanding. But many students still could not understand it.

I asked children, 'Which of the two is lighter, one kg cotton or one kg sugar?'

Many students replied at once, 'Cotton!'

But after some time, and some more thinking, they concluded that the weight of both would be the same since the quantity is the same.

I asked, 'Which one will occupy more area?'

The children replied, 'Cotton, as it is sparse and sugar particles are closer to each other.'

Less dense (sparse) = More area expansion = Less density

More dense = Less area expansion = More density

In this way, I was able to explain to most of the

students the characteristics of density. Had not the same thing which applied to the solids also applied to the liquids? During the experiment, the volume of water and kerosene was the same. Was the weight of the two liquids different because of which they became separate by forming layers? This question crossed their minds.

To make it simpler, I put the same volume of glycerine and sesame oil along with water and kerosene oil in a beaker. Some liquids started coming up and some were going down even as I was pouring these one after the other. The children were surprised to see the separate layers of each liquid.

This made a child ask, 'Teacher, if each matter has the same volume and yet separate layer is formed, there must be a difference in their weight. We must weigh each matter.' All students nodded in agreement.

But how to measure the mass of a matter? One boy suggested they can measure it with the help of a syringe. 'We will take the same volume of different matters in the syringe and take their weight using an electronic balance.' The children, by turns, demonstrated this action before the class and formed a table.

Sl No	Substance	Volume	Quantity/Weight
1.	Kerosene	1 ml	7.6 mg
2.	Water	1 ml	8.7 mg
3.	Glycerine	1 ml	11.7 mg
4.	Sesame oil	1 ml	8.3 mg

The children arranged these in order of reducing weight. Glycerine > Water > Sesame oil > Kerosene oil

The weight of glycerine was the highest and kerosene, the lowest. This arrangement showed the order of layers from the lower to the upper in the beaker. By now, the children were able to

understand how volume and mass affect density and why matters float or sink.

It was a great experience for me as the children were able to understand a concept on the basis of logic, experiment, analysis and by linking it to their daily lives.



Umashankar is a Science teacher at the Azim Premji School, Dhamtari since 2016. He holds a Bachelor's degree in Biotechnology and a Master's degree in Zoology. As a teacher, his interest lies in the learning processes of science by experimenting, exploring, analysing together with children. He can be contacted at umashankar@azimpremjifoundation.org