Dynamics and Statics

Relative Floatation 1

(Ireland)

Background

Building on concepts established by the Titanic Model demonstration, this demonstration emphasises that the floatation of an object depends on its density i.e. the number of particles in a fixed space.

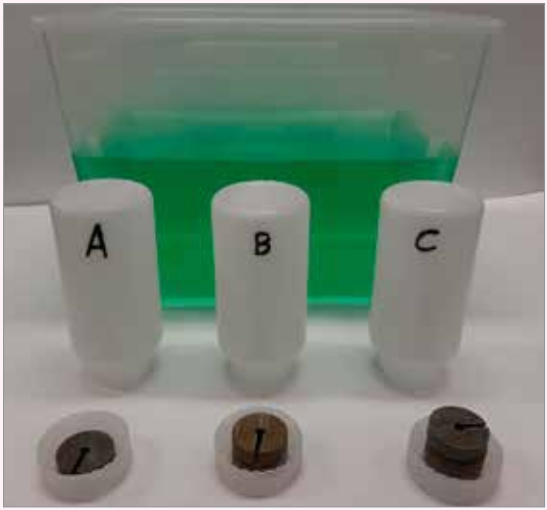
Three supposedly identical objects are placed in a water tank, but their level of flotation shows that there are differences – this demonstration explores those differences by focusing in the number of particles with each object. The demonstration emphasises conceptual, non-mathematical approach to density

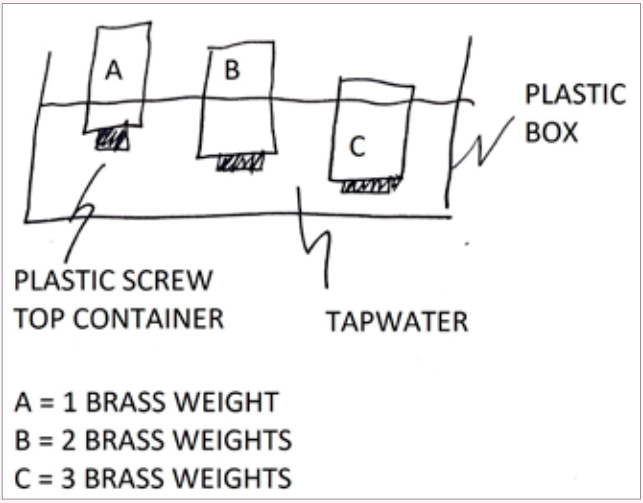
You will need….

- ✓ Felt-tip marker
- ✓ Three identical opaque, screw-top plastic containers
- ✓ Six identical brass weights
- ✓ Water
- ✓ Food colouring (cake colouring paste)

Follow these steps:

1. Mark the containers A, B and C.
2. Place one brass weight in A, two brass weights in B and three brass weights in C.
3. If this is not an immediate follow-on to the Titanic Model demonstration, three-quarters fill a transparent plastic box with tap water (ocean), adding some food dye also.
4. Before placing the containers into the “ocean”, ask your students if they are identical size and shape.
5. Then ask the students to predict what should happen if all the containers are placed in the “ocean”.
6. Students observations will generally not match their predictions, so it is important to ask: “If size and shape are the same, what is different that could explain the different floatation levels?”
7. The ensuing discussion can be nudged gently by being alert to students attempting to use particles (or corresponding words from their own vocabulary)
8. Then the contents of each container can be revealed.
9. Here it is especially important to tell students that each single brass weight is a “particle”, and of equal mass.
10. This question can then be posed: “Does the number of particles in each container explain what we observed? How?”





So what happened?

The height of containers A, B and C above the water corresponds inversely to their mass (density): the higher the container the lower its mass. As the containers are labelled and sitting in coloured water its is easy to see this.

This can be linked back to the Titanic Model at various stages of sinking.

What next?

- This can be linked to the stability of ships on the ocean as container A is more easily pushed (tipped) to one side than either B or C: this has implications for ships in storms, or when turning in heavy seas.
- Ships which have adjustable ballast tanks of water, to increase stability when sailing, especially if cargo holds are empty.
- It is possible to revisit this model when teaching forces (buoyancy). This may be helpful as students will already have a clear link to mass being a factor, and may have also completed pressure as a topic.
- This demonstration is the second of three consecutive demonstrations, and is best done following the Titanic Model demonstration, (see Titanic Model and Relative Floatation 2).