

Sample 3 – Second Level – Cartesian Diver

What's happening?

In this lesson pupils will learn about pressure changes under water.

Experiences and Outcomes and Related Benchmarks

SCN 2-08b - By investigating floating and sinking of objects in water, I can apply my understanding of buoyancy to solve a practical challenge.

- Explores the factors which affect floating, for example, the object's shape and the density of the material that the object is made of, and collates, organises and summarises findings with assistance.

LIT 2-23a - Throughout the writing process, I can check that my writing makes sense and meets its purpose.

- Reviews and corrects writing to ensure it makes sense, is technically accurate and meets its purpose.

LIT 2-28a - I can convey information, describe events, explain processes or combine ideas in different ways.

- When writing to convey information, describe events, explain processes or combine ideas in different ways:
 - Uses appropriate style and format to convey information applying key features of the chosen genre.
 - Includes relevant ideas, knowledge and information.
 - Organises and presents information in a logical way

Pupil will learn:

- What density means.
- Objects float in water when their density is lower than the water surrounding it.
- Pressure can affect the density of an object.

Resources Required

- Large plastic drink bottle and lid, cleaned with label removed.
- Droppers – such as those found here: <https://amzn.to/32tyjUI>
- Plasticine.
- Water.

Introduction

Show children the video found here, on youtube: <https://www.youtube.com/watch?v=s5eIRjmor1w>

It ends with the question “Why does the dropper sink when you squeeze the bottle?”

Explain to the children that this is what they are going to investigate.

Development

Watch the video again but this time have the children take notes about how to make the Cartesian Diver.

Distribute the resources and have the children make the diver, either in pairs or trios.

Once the divers have been made, ask the children to play with it and think about what is happening and if they can suggest any explanation for the diver floating and sinking as the bottle is squeezed and released.

Plenary

Come together as a class and ask each group in turn to explain what they think caused the diver to float and sink. As peers to comment on the suggestions of their classmates. Use a “building up” model, where children acknowledge the ideas that have gone before and suggest changes based on their own thoughts or observations. The teacher should work as a facilitator to guide the pupils to the correct answer. Once this has been shared and understood, it should be recorded by all pupils using their own language.

Assessment

The class teacher should move around the groups as they try to come up with their initial explanation, listening to pupils and taking notes.

During the plenary, use these notes to create directed questions, allowing pupils to be supported or challenged appropriately.

The recorded explanations in pupils’ jotters will allow a summative assessment.

Differentiation

The class teacher should firstly create the groups carefully, so that pupils who require support can work with a more able classmate.

During the lesson, the use of questioning can help guide pupils who are finding the task difficult.

During the plenary session targeted questioning should be used to support and challenge pupils.

Those who require support should be gathered together whilst the others are working independently and, with the teacher write a brief explanation which they can copy into jotters.

Useful Questions

Q. What causes the diver to float?

A. When anything is put into water it has to push some water out of the way. This is called displacement. If the object is lighter than the volume of water it has pushed out of the way, or displaced, it will float. If the object is heavier than the volume of water it displaced, it will sink. The dropper has air inside it. This makes it lighter than the water it displaced, so it floats.

Q. What observations did we make when we squeezed the bottle?

A. The air bubble inside the dropper got smaller. The dropper began to sink. The harder the bottle was squeezed, the quicker the dropper sank. When the bottle was released, the air bubble grew and the dropper floated to the top.

Q. What is actually happening?

A. Water can’t be compressed or squeezed into a smaller space. Air can be. When the bottle is squeezed, there is nowhere for the water to go, except into the dropper. The water entering the dropper compresses the air bubble to make space. As there is now more water inside the dropper, it becomes heavier. It becomes heavier than the volume of water it has displaced, so it begins to sink.

Q. What happens when the bottle is released?

A. The water isn’t being compressed any more, so it stops compressing the air. The air bubble expands back to its normal size and that pushes water back out of the dropper. It is now lighter than the water it has displaced so it floats back to the surface.

Why teach this?

This is a simple lesson to explore a complicated idea. It introduces the children to the principle of density. In real life it is how a submarine is able to submerge and resurface. Once children understand the principle of density it will help them to understand floating and sinking, why two items the same size can weigh different amounts, how some materials are stronger than others. These are all key engineering concepts.