

# Bottle divers

**H**ave you ever wondered how submarines can sink and then come back up to the surface?

**T**oday you will make and analyse a bottle diver.

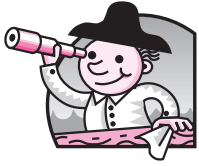


## Team investigation 1

**How can we make a bottle diver  
and find out if it is a system?**

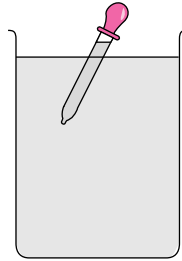
### Team equipment

- 1 eye-dropper
- 1 jug (or bucket) three-quarters full of water
- 1 nail
- 1 bottle with screw-top lid, full of water
- paper towels
- job badges for director, manager and speaker



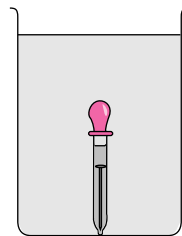
## How to do it

- 1 Use the water in the jug to fill the eye-dropper.

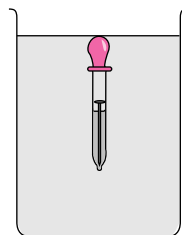


Squeeze the rubber bulb.

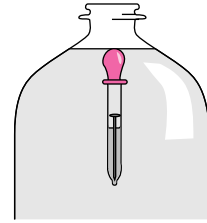
- 2 Put the eye-dropper in the jug. If it does not sink, remove the rubber bulb and put a nail inside the eye-dropper. Put the rubber bulb back on, refill the eye-dropper with water and put it back in the jug. It should now sink.



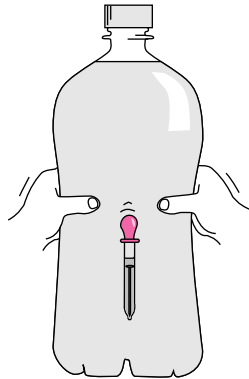
- 3 Take the eye-dropper out of the jug and squeeze out a few drops of water. Test to see if the eye-dropper will float upright, with the rubber bulb just touching the surface of the water. If it still sinks, squeeze out more water and test it again. Keep testing until the eye-dropper floats upright.



- Put the eye-dropper in the bottle of water.



- Screw the lid tightly onto the bottle.  
You have now made a bottle-diver system.
- Squeeze the sides of the bottle with both hands. Squeeze hard.  
Observe what happens to the eye-dropper.



**Caution:** Do not squeeze the bottle unless the lid is screwed right down.

Make sure each team mate has a turn at squeezing the bottle.

- Discuss whether or not you think the bottle diver is a system.  
Does it have parts? If so, what are the parts? Do the parts interact?

### Introducing analysis

When you separate a system into its parts to understand it, you are analysing the system. People do not always take a system apart physically to analyse it. They take the system apart in their minds—they think about it. When you named the parts of the bottle-diver system, you took it apart in your mind. You started to analyse the system.

One way to analyse a system is to:

- observe the system (see what is happening)
- ask questions about what you see happening
- describe how you can tell that things are interacting (the evidence of an interaction)
- identify the parts of the system
- answer the questions you asked about the system earlier.

Do you remember the balloon rocket system in Lessons 1 and 2? If you wrote down your **analysis** of that system, it might look something like this:

### Balloon rocket system

I **observed** that I had to blow up the balloon to make the rocket go.

I **observed** that the balloon got smaller as the rocket went along.

I **observed** that the rocket followed along the fishing line.

**What** made the rocket go?

The **evidence** for an interaction between the air in the balloon and the rocket is the first two observations above, the **evidence** for an interaction between the rocket and the string is the third observation.

The **necessary parts** of the system are the balloon, the air inside it, the straw and the fishing line.

The **answer** to the question is that the air coming out of the neck of the balloon makes the rocket go, and the string guides it.

You may see that this analysis follows the same set of steps suggested earlier:

- observe
- ask questions
- describe the interactions
- identify parts of the system
- answer your questions.

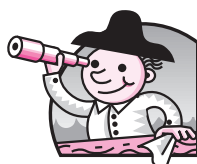


## Team investigation 2

**How can we analyse  
the bottle-diver system?**

### Team equipment

- your team's bottle-diver system



## How to do it

- 1** Observe what happens in the bottle-diver system.  
Squeeze the bottle, make the eye-dropper dive, and continue to observe the system.
- 2** Write down some of the questions your team has about the bottle-diver system.

- 3 Describe the evidence that parts of the system interacted. How do you know that some parts of the system interacted with others? What happened?
- 4 List the parts of the system.
- 5 Use your observations to answer the questions you asked in step 2. In your answers, use the parts of the system and the interactions that you identified.
- 6 Discuss these questions with your team mates.  
How did analysing help you answer a question about the bottle-diver system?  
Did identifying the interactions between the parts help you?  
Did you find any new parts you did not observe at first?

### Let's talk about it



- 1 In what ways is analysing a system useful?
- 2 Is your team a system? What are the parts of your 'team system'?
- 3 How could you improve the interactions between the parts of your 'team system'?