# Hovering Fish Challenge

Read a design record, then plan a buoyancy test.

**ZOO.7.8** "Enrichment: Use an engineering design process to design a "balloon fish" that has neutral buoyancy (i.e., does not sink or float). Report which materials were used to create the "fish," and predict which materials should be added to make..."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline the materials in each balloon fish design, circle what happened when each design was released, and number the changes in the order they were tested. Use your marks to track how the designer reached neutral buoyancy.

### A Balloon Fish That Hovers

1. A fish that hovers in water is not resting on the bottom or floating at the surface. Its weight is balanced by the upward force of the water it displaces. Engineers call this neutral buoyancy. To model it, a student sealed a small amount of air inside a balloon and tested it in a tub of fresh water. Air gave the balloon volume without adding much mass. The student's goal was to release the balloon below the surface and have it stay near the same depth without being held or touching the tub.

2. The student pressed a lump of modeling clay around the balloon's tied end and fastened steel paper clips to the clay. The balloon, its air, and the clay stayed the same for every test. With one clip, the fish rose to the surface. With three clips, it sank to the bottom. With two clips, it stayed near the middle of the tub for five seconds after release. The student recorded that design as the best match for neutral buoyancy, then repeated the two-clip test to check that the result was consistent.

3. Next, the student tested possible changes to the two-clip fish. Attaching a piece of foam made it rise because the foam added more displaced water than weight. Attaching another steel clip instead made the fish sink because the clip added more weight than the upward force gained from the small amount of water it displaced. The student removed each extra material before the next test. That kept the starting design the same and made the effect of each change easier to judge. A new design would need its own tests because its materials and trapped air could differ.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. Which materials made up the fish that stayed near the middle of the tub, and what test result supported the student's choice?

2. How did the one-clip and three-clip tests guide the student toward the two-clip design?

3. Starting with the two-clip fish, which tested material would you add to make it float? Explain using the passage.

4. Starting with the two-clip fish, which tested material would you add to make it sink? Why did removing extra materials between tests matter?

## 3 YOUR TURN

Your own words

Design your own balloon fish using at least two materials not used in the passage. Name your materials, explain how you would test and revise the fish until it hovers, and predict what you would add to make it sink and what you would add to make it float.

**ANSWER KEY**

# Hovering Fish Challenge



## PART 1 · READ AND MARK

Underline the materials in each balloon fish design, circle what happened when each design was released, and number the changes in the order they were tested. Use your marks to track how the designer reached neutral buoyancy. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | Which materials made up the fish that stayed near the middle of the tub, and what test result supported the student's choice? | **A sealed, air-filled balloon, modeling clay, and two steel paper clips. It stayed near the middle for five seconds after release.** |
| 2 | How did the one-clip and three-clip tests guide the student toward the two-clip design? | **One clip made the fish rise, while three made it sink. Testing two clips found a design that stayed near the middle.** |
| 3 | Starting with the two-clip fish, which tested material would you add to make it float? Explain using the passage. | **Add foam. In the test, foam added more displaced water than weight, and the fish rose.** |
| 4 | Starting with the two-clip fish, which tested material would you add to make it sink? Why did removing extra materials between tests matter? | **Add another steel clip. Removing each extra material restored the same starting design, so the student could judge the effect of one change at a time.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

I would tie stainless steel washers and a small piece of cork to a sealed, air-filled balloon with cotton string. I would release it below the surface in fresh water and watch whether it rises, sinks, or stays near the same depth. If it rises, I would add one washer at a time; if it sinks, I would remove a washer or add a little cork. I would repeat the release test to check that it hovers. Adding another washer should make the finished fish sink, while adding more cork should make it float.

Accept designs with at least two materials absent from the passage and a test-and-revise plan that checks whether the fish stays at about the same depth. Predictions should account for how added materials change weight relative to the water displaced.