LESSON FIVE SCIENCE/MATH ACTIVITY 5.3 Grade Level 3–6

Exhale and Dive!

OBJECTIVE

Students will investigate adaptations that seals use when they dive

TIME REQUIRED

10 minutes

BACKGROUND

Air-breathing mammals like pinnipeds (seals, eared seals and walruses) must be able to take in enough oxygen to stay conscious while they dive for food. Most eared seals dive to depths of 150-200 meters (shallow compared to other pinnipeds that can dive to 1,000-1,200 meters, but deep compared to humans!). Pinnipeds have to adapt to pressure of deep water as well as conserve oxygen while they dive.

MATERIALS

5 gallons bucket of water or large chest cooler
1-quart sealable plastic sandwich bags (2 per group)
Yardstick (optional)

PROCEDURE

- Hand out worksheet.
- Mark the bucket or cooler with marks showing ¼, ½, ¾ full, or use a yardstick in the bucket
- Fill the bucket or cooler with water
- Blow up one plastic bag with air, then seal it closed. It helps to tape the bag closed.
- Seal the second plastic bag without putting any air in it.
- Ask the students to predict which bag can be pushed farther under the water, and to write their prediction in the worksheet.
- Do three trials of pushing each bag into the bucket, and recording how far down it can be pushed down
- Have students write their conclusions
- Discuss results (see below)

DISCUSSION

- What were the results that were seen?

  Bag #2, the empty bag, went underwater easier than bag #1.

- Ask students if they have ever dived underwater. Did they take a big breath and hold it when they went underwater?
- Tell students that seals don't take a big breath and hold it. Instead, they exhale and empty their lungs when they dive, so they can go down easier. The lungs are like the plastic bags; when you fill your lungs and hold your breath, it's like the bag full of air. Seals' lungs when they exhale are like the empty bag.
- So what do seals use for air?

  Most mammals have hemoglobin which is a molecule in red blood cells that carries oxygen. Pinnipeds and cetaceans also store oxygen in a molecule called myglobin which is in the muscles and also have a lot of blood compared to other mammals (about 12% of their body weight, compared to a person who has about 7% of their body weight composed of blood). Seals can store 3 times as much oxygen in their bodies as humans, because of:

  - more hemoglobin in the blood
  - myoglobin in muscle
  - more blood in the body (up to twice as much as humans).

- Would you be able to dive for very long if you exhaled before diving?

  No, because humans do not have as much hemoglobin in their blood as seals do, and humans have very little myoglobin in their muscles to store oxygen.

ACTIVITY 5.3 WORKSHEET 5.3.1 Exhale and Dive!

Bag 1: full of air

Bag 2: empty

Which bag can be pushed farther underwater?

Prediction: _____

Data:

	Distance underwater	
Trial #	**Bag # 1**	**Bag #2**
1		
2		
3		

Conclusion: _____

ACTIVITY 5.3 **EXAMPLE 5.3.1** Exhale and Dive!

Bag 1: full of air

Bag 2: empty

Which bag can be pushed farther underwater?

Prediction: I predict that bag #2 can be pushed farther underwater because the air in the other bag will make it float.

Data:

	Distance underwater	
Trial #	**Bag # 1**	**Bag #2**
1	¼	All the way to the bottom
2	¼	All the way to the bottom
3	½	All the way to the bottom

Conclusion: My prediction was correct – bag #2 was pushed to the bottom each time while bag #1 only went part way down the bucket.