CLASSROOM ACTIVITY
Simple Submarine

What are the processes that engineers use to create a vehicle that can descend to the bottom of the ocean floor, hover there, and then return to the surface? Find out by building your own model submarine! As you and your team conduct your investigation, focus on the questions below. After you have completed the activity, respond to these questions directly in your journal.

- What makes something sink? What makes something hover under water? What makes it rise to the top?
- What conditions do deep sea researchers encounter? What mechanisms must engineers designing deep sea vessels create to meet those challenges?

Before you begin your investigation, consider what you already know about deep sea exploration. Use the questions below to structure your discussion and jot down your answers in your journal.

- As the depth of the ocean increases, why might pressure increase? Why would that be important for deep sea researchers?
- From what other conditions might deep sea researchers have to be protected inside a submersible?
- What other features would a submersible need in order to be used to conduct research in the deep oceans?

The captain should appoint group members to collect the required materials while the rest of the group reviews today's procedure. Before beginning, the captain should make sure that the group has all required materials, and that everyone knows the day's procedure.

The note taker will take notes on the group's findings for your team, but remember to record your observations and explanations in your journal for your own research notes. Include drawings to illustrate your findings.

CLASSROOM ACTIVITY | Simple Submarine

MATERIALS

These materials present just some of the possibilities. You might come up with other materials you could use to create your submarine!

- 35-mm plastic film canisters and lids (required)
- safety pins and straight pins
- duct tape (the only kind that will stick)
- glue gun and glue sticks
- aluminum foil, plastic bags, etc.
- tank, e.g., a small aquarium
- metal nuts, screws, washers, and nails**
- styrofoam peanuts
- sand
- balloons
- small paper bags*
- pennies
- Alka Seltzer Tablets
- toothpicks
- paper clips

* Use the paper bags to carry the materials you need back to your work area or back home, if you are creating your own sub at home. Then use the bag to carry your finished sub back to school, hidden from view—label your bag "TOP SECRET."

** The nuts, screws, etc. should be different weights, but all relatively lightweight.

PROCEDURE

1. Before you investigate the mechanics of underwater vehicles, consider the problems researchers might face when trying to get to the bottom of the sea to study deep sea vents. What conditions would they encounter? What features would the vehicle need in order to protect humans from those conditions? How could engineers design the vehicle so that it could get to the bottom, stay down there, or hover at various depths and then come back up? Record your ideas on your activity sheet.

2. Now take some time to discuss possible configurations (setups) for your submarine. The basic "vehicle" is the 35-mm film canister. Fill the tank with water and put the film canister in it; what happens? Record your response on the activity sheet.

CLASSROOM ACTIVITY | Simple Submarine

3. Examine the other materials you can use for your vehicle. Which ones might you want to use to construct a working unit? For each item you select, explain what role it would play in the mechanics of your submarine.

4. Create a preliminary drawing of your submarine. Illustrate how your sub would appear from different angles; label the parts and explain how the parts work and how they work together.

5. At this point, your teacher may ask you and your group to construct your subs; or your teacher may ask that you collect materials now and construct your sub individually at home.

6. After you've constructed your subs (or returned the next day with your completed subs), you'll need to test them. Use the tank filled with water. Each team member may need to test his/her sub several times. Record your observations of the tests on the activity sheet. Which of your ideas worked? Which didn't? Why?

7. Discuss what you learned about the mechanics of submarines and how you might apply these ideas to deep sea exploration. Record your ideas on the activity sheet.

CLASSROOM ACTIVITY | Simple Submarine

GROUP WORKSHEET 1
DSV TEAM _____

GROUP MEMBERS _____

CAPTAIN _____ NOTE TAKER _____

1. What conditions might scientists encounter when exploring the deeper parts of the ocean? What kind of vehicle would they need to conduct their explorations? What features would the vehicle need in order to protect humans from those conditions? How could engineers design the vehicle so that it could get to the bottom, stay down there, or hover at various depths and then come back up? (Why would all three types of movement be necessary?)

2. Fill the tank with water and put the film canister in it. What happens?

3. What might you add to this "submarine" so that it can descend to the bottom of the water tank, hover there, and then return to the top?

4. Examine the other materials you can use for your vehicle. Which might you want to use to construct a working unit? For each item you select, explain what role it would play in the mechanics of your sub. Use the chart below to record your ideas.

COMPONENT	WHAT ROLE WOULD IT PLAY?

5. Create a preliminary drawing of your submarine. Illustrate how your sub would appear from different angles; label the parts and explain how the parts work and work together.

FRONT VIEW

CLASSROOM ACTIVITY | Simple Submarine

GROUP WORKSHEET 3
DSV TEAM _____

BACK VIEW

SIDE VIEW

CLASSROOM ACTIVITY | Simple Submarine

GROUP WORKSHEET 4
DSV TEAM _____

6. After you've constructed your subs (or returned the next day with your completed subs), you'll need to test them. Use the tank filled with water. You may need to test each sub several times. Name each sub that you test. Record your observations of the tests on the activity sheet. Which of your ideas worked? Which didn't? Why?

NAME OF SUB	MAJOR FEATURES	WHAT HAPPENED DURING THE TEST(S)?

7. Consider your original ideas from Questions 1 and 2. Which of your ideas proved correct? Which ideas didn't work? Why and why not?

8. Discuss what you learned about designing a simple model of a submersible that can sink and then rise again. What conditions weren't present in your experiment but would be factors for submarine engineers creating a submarine that will be used to explore the deep ocean? In what other ways might you apply the ideas you discussed during this investigation to deep sea exploration?

GROUP DYNAMICS

Comment on how each group member participated in today's discussion.