Grab and Go continued

3. Plan and design. Be sure to give the girls ample time to plan and design before they start to build.

POINTER: If groups are having difficulty, ask them to revisit the examples they researched. Suggest they break each design into simple pieces and build a similar version.

4. Build and Test. Throughout the building process groups should be testing their design and revising based on their results.

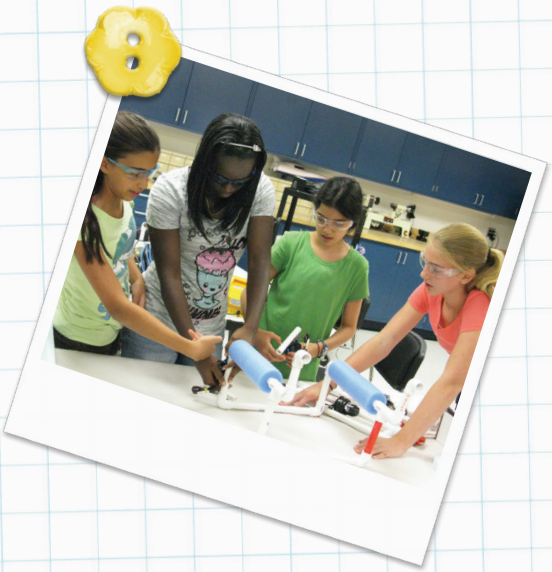
5. Share. Have each group share their design and demonstrate how it works by lifting the cup. What were the challenges? How did you overcome them? [6]

6. Continue exploring. Try adding weight to the cup and see if the arm still works. Brainstorm other things you can try picking up (stuffed animals, popcorn, pencils). How might you modify your design to address these new challenges? [6]

This activity is adapted from *The Case of the Physical Fitness Challenge* educator guide that is available in electronic format. A PDF version of the educator guide for NASA SCI Files™ can be found at the NASA SCI Files™ web site: scifiles.larc.nasa.gov. NASA SCI Files™ is produced by NASA's Center for Distance Learning, a component of the Office of Communication and Education at the NASA Langley Research Center, Hampton, VA. NASA's Center for Distance Learning is operated under cooperative agreement. Use of trade names does not imply endorsement by NASA.

Mentor Moment

Commander Angela Schedel spent nine years flying helicopters for the U.S. Navy and discovered her passion for teaching while working as a helicopter flight instructor. She is now an ocean engineering instructor at the U.S. Naval Academy. Angela is also the faculty advisor for the Academy's Concrete Canoe Team, which designs and builds a canoe entirely out of concrete to race against other universities!



Supported by: NSF, FIGS FOR GIRLS IN SCIENCE L'ORÉAL USA, NORTHROP GRUMMAN Foundation & PPG Industries Foundation

[1-7] See **SciGirls Seven** strategies on page 3.

Activity 5

Deep Sea Diver

THINK LIKE AN OCEAN ENGINEER AND DESIGN YOUR OWN MODEL DEEP SEA DIVER.

Buoyancy is the ability to float. When you put an object in water, it pushes water out of the way to make room for itself. An object floats when it weighs less than the water it displays; an object sinks when it weighs more than the water it displaces.

SMART START:

Here's one way to start this activity. Get your girls thinking about buoyancy. Show them a group of objects and ask them to predict which will sink and which will float. Then, test their ideas using a plastic container filled with water. Do the girls' predictions match the results?

You'll Need:

45 min

- items to adjust buoyancy (assorted metal washers, pennies, paper clips, binder clips, Styrofoam packing peanuts, small balloons)
- items for the body of the diver (Styrofoam balls, plastic bendable drinking straws, craft sticks, wooden skewers, plastic eggs, ballpoint pen caps, sponge, craft foam)
- items to hold the diver together (rubber bands, duct tape, or a hot glue gun)
- optional: objects that sink or float (marbles, metal spoon, Ping Pong balls, sponges, plastic spoon, pieces of fruit)

For each small group

- sturdy clear container at least 6 in. x 6 in. that can hold water
- water
- scissors
- paper and pencil

Here's how:

1. Explore buoyancy. Can you think of things that don't float on the water and don't sink to the bottom (scuba diver, submarine, fish, underwater research vehicles)? This is called "neutral buoyancy." Discuss what it means for an object to be neutrally buoyant. What are some situations where neutral buoyancy might be useful (snorkeling, using a submersible to study underwater creatures, taking measurements at different depths in the ocean)? [6]

Watch the SciGirls test a neutrally buoyant underwater robot on the *SciGirls Invent* DVD. (Select Aquabots: Test and Redesign 1.)

2. Design and build. Engineers will often build models before they design full scale. The models help them understand the factors that may be key to the success of the design. Deliver the **SciGirls Challenge**: Build a small diver (no larger than 3 in. by 3 in.) that is neutrally buoyant. In small groups,[1] have girls brainstorm what materials they'd like to use, then design and build their diver. [3]

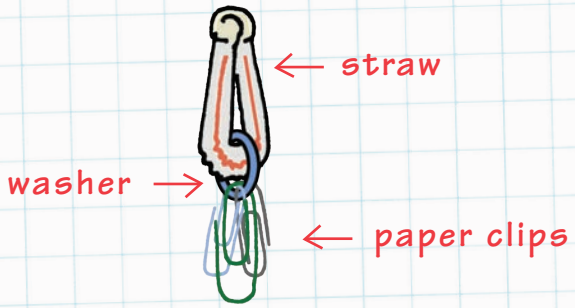
Use caution when working with hot glue.

Visit pbskidsgo.org/scigirls for videos and projects!

SciGirls PBS KIDS GO!

Deep Sea Diver continued

POINTER: If girls are having trouble try this model using a flexible straw. Bend it into a "U" shape. Cut the ends so they are even. Thread a washer onto the straw. Pinch ends of straw together (straw will form teardrop shape) and secure them with hot glue. Make sure the ends are sealed shut. Adjust weight by adding or removing paper clips.



3. Test. Place the diver into a container of water and test its buoyancy. Keep redesigning until the diver "hovers" in the center of the container of water.

4. Share. Have each group demonstrate their diver. Was it difficult to achieve neutral buoyancy? Why or why not? Have each group share their strategies for testing and redesigning. [6]

5. Continue exploring. Consider having the girls test their diver in salt water. They could even test whether the concentration of salt in the water makes a difference.

Mentor Moment

Jaye Falls is a naval architect at the U.S. Naval Academy. Besides teaching, her interests include analyzing marine vessels and studying helicopter rotors to understand how they create lift. When not working, Jaye enjoys spending time with her two children.

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Standards Correlation

The activities in this book align to national education standards including: Standards for Technological Literacy, Next Generation Science Standards and the Common Core Standards for Mathematics. To download the complete and most current alignments, please visit scigirlsconnect.org.

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1-7 See **SciGirls Seven** strategies on page 3.