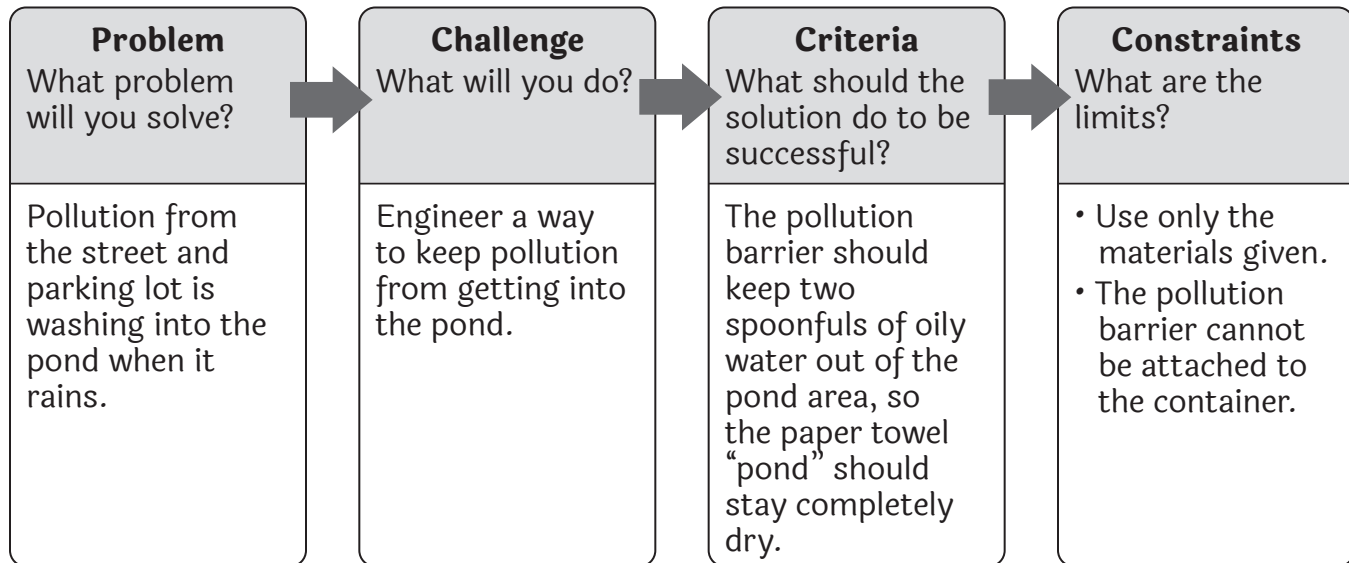


PLOT SUMMARY:

Alanna and Gus work hard to clean up their local park so they can enjoy their picnic.

POLLUTION BARRIER CHALLENGE:



OTHER POSSIBLE PROBLEMS AND CHALLENGES:

Students can use the *Universal Challenge Pages* (pages 104–107) to create solutions to any of the problems below or problems they identify themselves.

Problem	The kids want to pick up litter safely.
Possible Challenges	<ul style="list-style-type: none"> • Design a litter-picker-upper to safely pick up litter on the ground. • Design a litter-picker-upper to safely pick up litter in the water.
Problem	The kids are worried about the pollution in the pond hurting the duck.
Possible Challenge	<ul style="list-style-type: none"> • Engineer a way to clean oil from water.
Problem	The kids want to encourage others to keep the park clean.
Possible Challenge	<ul style="list-style-type: none"> • Design a trash can that separates recyclables and tells others how to keep the park clean.

MATERIALS:

Required: identical large, shallow containers (e.g., plastic washtub, large aluminum tray) and spoons, one per team; 1/4 cups; vegetable oil, cocoa powder, and water to make “oil”; small toys of similar size for duck models; paper towels

Suggested: absorbent materials such as cotton balls, fabric, sponges (cut into smaller pieces); nonabsorbent materials such as aluminum foil, plastic wrap, wax paper, bubble wrap; structural materials such as straws, craft sticks, toothpicks, cardboard tubes; connectors such as rubber bands, yarn or string, tape

PREPARATION:

Prepare water polluted with “oil” by mixing 1/4 cup of vegetable oil and a few teaspoons of cocoa powder into a gallon of water. Set cups with small amounts of “polluted” water and empty large, shallow containers out for testing. Provide paper towels for spills.

LESSON PLAN:

1. Have students read the passage and discuss the problems they identified. Use these questions as prompts:
 - When was the last time you went to a park? Did you see any pollution?
 - How did Alanna and Gus clean up the park?
 - Do you think it’s important to clean up pollution? Why or why not?
2. Introduce the Pollution Barrier Challenge by reading through the challenge pages together. Show students the available materials and review the criteria and constraints. Explain to students that they will be creating a model pond and pollution barrier. To test their models, students will place their duck (small toy) on a paper towel (representing the pond) at one end of a testing container and place their pollution barrier model across the middle of the container to protect the pond. For testing, they will pour two spoonfuls of “polluted” water in the area on the other side of their pollution barrier model. Assure them that the water is not polluted with real motor oil and it is safe for them to handle.
3. For Step 1 of the challenge (page 92), students will need access to the materials, along with a cup of water. These tests will require spilling water, so either provide shallow containers for students to do their tests in or have students test their materials outside.
4. Give students time to prepare, brainstorm, plan, and build their pollution barriers. Circulate to observe and answer questions as students work on their solutions. Remind them to use the challenge pages to guide them as they work through the engineering design process.
5. When students are ready to test their pollution barriers, direct them to the testing area. They will know their barrier worked if their paper towel stays dry. Have students share their solutions with the class and get feedback from peers, then revise their designs and test again.
6. When students have completed the challenge, have them demonstrate and explain their pollution barriers to the class. Then have them fill out the reflection page.
7. If time, allow students to choose their own problem and testing setup and use the *Universal Challenge Pages* (pages 104–107) to complete their challenge.

NAME: _____

DATE: _____

Directions: Read the passage and underline the problems the characters have to face. Write and/or sketch your ideas for solutions in the margins.

CLEANING UP

Alanna and Gus loved to ride their bikes to their local park. They swung on the swings, slid down the slide, and had picnics under the big tree. One day, as they set up their picnic, they noticed that there was trash in their way.

“Wow,” said Gus, “look at all this junk.” Where they usually sat for their picnic, they saw candy wrappers, empty juice boxes and yogurt containers, and plastic spoons.

“Looks like some other kids were eating here. Why did they leave all this trash here instead of putting it in the trash can?” wondered Alanna. Gus and Alanna always threw away their trash when they finished their picnics. There was a trash can on the other side of the park.

As they looked around, they noticed trash all around the park. It made them sad and mad. “It’s time to clean up!” exclaimed Gus.

They went home and grabbed supplies. Gus brought some trash bags, and Alanna had two pairs of rubber gloves that her dad used to do the dishes. As they passed by Mrs. Jones’s house, they noticed that she was trimming her trees. Gus had an idea.

“Hi, Mrs. Jones!” he called. “Would you mind if we took a couple of these branches?”

“Not at all,” she replied. “What are you two up to today?”

“We’re going to clean up the park,” answered Alanna. “But what do we need branches for, Gus?”

“We can use them to pick up some of the trash,” he said. “We just stab it, like this...” He grabbed a fairly straight branch and jabbed it into the grass. “That way, we don’t have to touch the really gross stuff.”

When Gus and Alanna got to the park, they began picking up food wrappers and chip bags.

NAME: _____

DATE: _____

CLEANING UP

“Ugh,” said Alanna, “all of this stuff would have been easy for them to put in a trash can.”

Gus found a plastic water bottle and some soda cans under a bush. He said, “We should put the stuff we can recycle in a separate bag.”

“Great idea!” said Alanna. She pulled a second trash bag from Gus’s backpack.

They finished cleaning up the playground area and proudly looked over their work.

“What about the pond?” asked Gus.

When they got to the pond, they were surprised. Not only was there trash in it, but there was also a rainbow-colored film on the top of the water.

“Ewww,” said Alanna. “What is that?”

“I think it’s pollution,” said Gus. “The parking lot is up there.” He pointed up a small hill next to the pond. “When it rains, all the oil from the street and parking lot washes into this pond.”

“Can we clean it up?” asked Alanna.

“I don’t know how,” answered Gus.

They fished out the trash they could reach with their sticks. They saw a duck floating on the pond. They worried about it getting sick from the pollution.

As they carried their full trash bags back to where they parked their bikes, Alanna asked, “How can we keep people from making this mess all over again?”

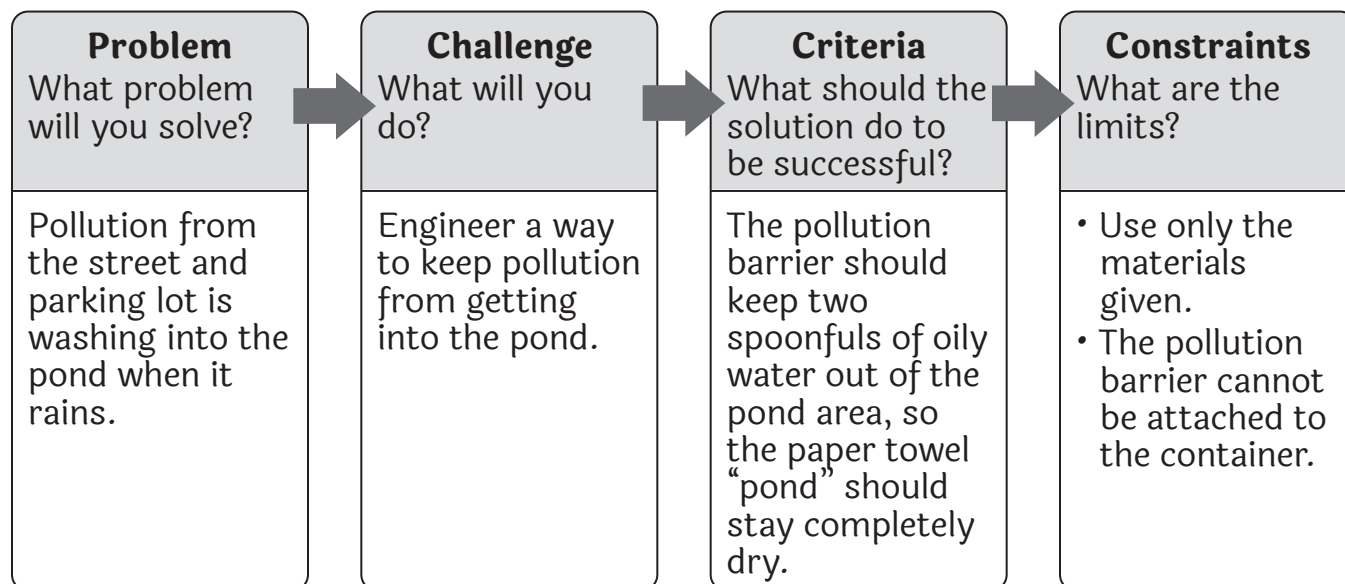
“Good question,” said Gus. “How about we make posters and hang them in the park?”

“Great idea!” said Alanna. “Maybe we should ask the city to put more trash cans in the park, too.”

“Excellent idea,” said Gus. “Now, let’s finally have our picnic!”

NAME: _____

DATE: _____

STEP 1: PREPARE FOR THE CHALLENGE

1. Your goal is to keep polluted water away from your pond, so you'll need to test some materials to see how they are affected by water. Carefully pour a spoonful of water on each material and observe. What happens to the water? Record your observations and think about how you could use each material to solve this challenge.

Material	Observations	How could we use this material?

2. How could combining materials—using them together—help you in this challenge?

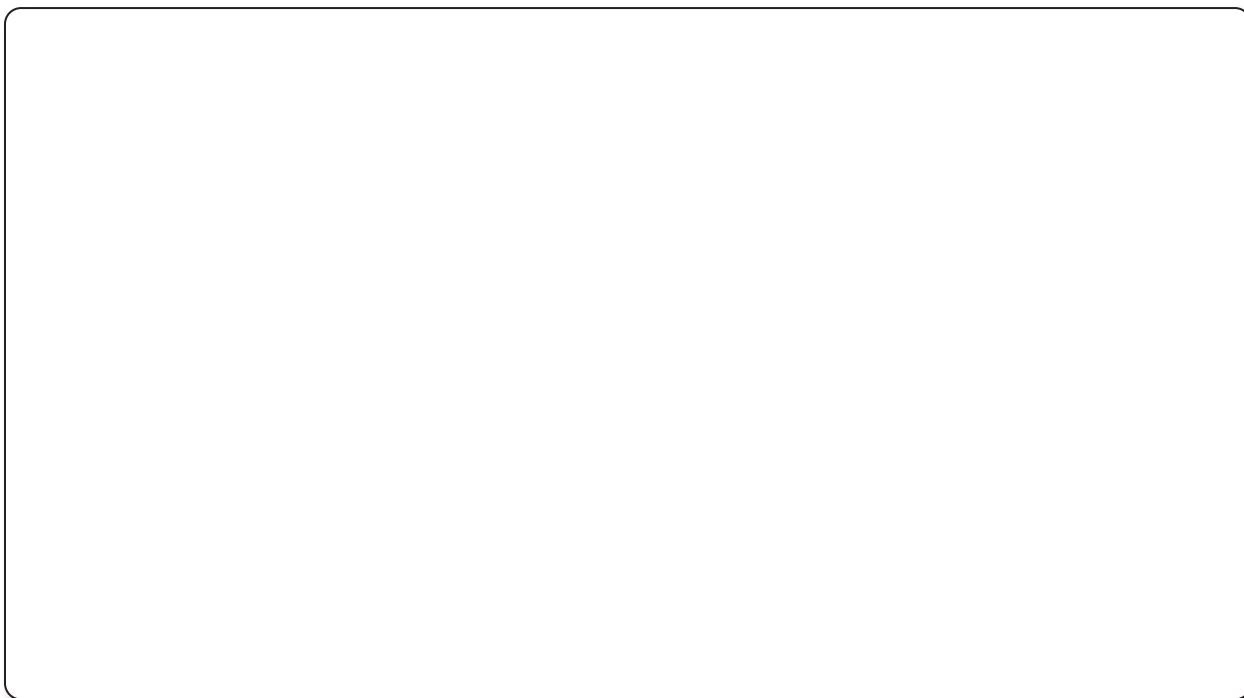
NAME: _____

DATE: _____

STEP 2: BRAINSTORM, PLAN, AND BUILD

1. Brainstorm design ideas for pollution barriers you can build that will meet the criteria and constraints. Sketch and write at least three ideas on the back of this page. Your pollution barrier should stretch from one side of the test container to the other.
2. Think about which design might perform best in testing. Draw a star by the design you will build. Why did you choose this idea?

3. Draw a diagram of your design here. Label all of the materials.



4. Describe how your pollution barrier will keep polluted water from getting to your pond.

5. Build your pollution barrier model!

NAME: _____

DATE: _____

STEP 3: TEST, IMPROVE, AND SHARE

1. Place your duck (toy) on a paper towel at one end of the test container. The paper towel represents the pond. Put up your pollution barrier across the middle of the test container. Carefully pour two spoonfuls of polluted water into the other end of the test container. Wait one minute. Did your paper towel get wet? Why do you think this happened?

2. Share your pollution barrier with classmates. How can you use their ideas to make it better?

3. Keep testing and improving until your pollution barrier keeps the paper towel dry for one minute!

NAME: _____**DATE:** _____**STEP 4: REFLECT**

1. How does your pollution barrier keep water away from your pond?

2. How did your design work the first time you tested it?

3. How did you improve your design?

4. What was the hardest part about this challenge?

5. What have you learned from this challenge?
