PLOT SUMMARY:

Sid and Ruby want to play kickball, but they don't have a ball. They make a ball by upcycling plastic shopping bags and string. It's so successful that they decide to make more upcycled toys.

UPCYCLED GAME CHALLENGE:

Problem What problem will you solve?	**Challenge** What will you do?	**Criteria** What should the solution do to be successful?	**Constraints** What are the limits?
Sid, Ruby, and Sky want to make more toys.	Design and build a quick, active game using upcycled materials.	• The game should include movement of some kind. • The game should be playable by one to four players. • The game should be quick to play (two minutes or less).	• Use only upcycled materials. • Must run on kid power; no batteries or electricity.

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 plastic-bag jump rope with duct-tape handles is hard to turn.
Possible Challenge	• Design a jump rope with better handles that is easy to turn.

Problem	The kids' plastic-bag ball doesn't bounce as well as a red rubber ball.
Possible Challenge	• Design a ball made from recycled materials that bounces well.

Problem	The kids want to make lots of different toys.
Possible Challenges	• Engineer outdoor toys from recycled materials (e.g., tetherball, wagon, kite). • Engineer indoor toys from recycled materials (e.g., board games, card games, toy cars, action figures, building blocks, musical instruments).

MATERIALS:

Suggested: any clean, nonhazardous, used materials such as scratch paper, empty food containers and lids, cardboard boxes, plastic bottles and caps, wood scraps, paint, rubber bands; connecting materials such as glue, tape, staples, string (For this challenge, the more materials you can offer, the better!)

LESSON PLAN:

1. Have students read the passage and discuss the problems they identified. Use these questions as prompts:
   - What toys do you like to play with?
   - Have you ever made your own toys? What did you make? How did you make it?
   - Did the kids in the story have any problems while they were making toys? How did they solve their problems?
2. Discuss the term *upcycled* with students. It means using materials that would otherwise be discarded (e.g., trash, recycling) to make something new. Examples might include using an empty plastic jar to hold pencils and pens or stretching a balloon over it to make a drum. Some people call this turning trash into treasure!
3. Introduce the Upcycled Game Challenge by reading through the challenge pages together. Show students the available materials and review the criteria and constraints. At first, students will think about active games that are played by moving something. If they have trouble thinking of examples, prompt them to think of carnival games or "minute to win it"-type games.
4. Give students time to prepare, brainstorm, plan, and build their games. 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. Students should have peers play-test their games and give feedback, then revise their designs and test again.
6. When students have completed the challenge, have them demonstrate and explain their upcycled game to the class. If desired, you could have a game day when students play one another's games.
7. Have students fill out the reflection page.
8. 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.

LET'S MAKE TOYS

Sid and Ruby were sitting on Sid's front steps, trying to think of something fun to do.

"Let's play kickball," suggested Sid.

"We don't have a ball," answered Ruby.

Sid thought for a minute. "We could make our own," he said.

"Really? How?" asked Ruby.

Sid took Ruby into his kitchen. He pulled out a box of plastic shopping bags. "My mom saves these for recycling. She won't mind if we use them." Then he got a spool of string and some scissors. He squished up a plastic bag into a small ball. Then he wrapped another bag around it.

"Oh, I get it!" said Ruby. She wrapped another plastic bag around the still-forming ball.

Once they had added enough plastic bags to make the ball about the size of a red rubber kickball, Sid grabbed the spool of string. He wrapped string around the plastic-bag ball in different directions. He kept wrapping until the plastic bags stayed together all around the ball. Finally, he tied the string and cut off the end.

Sid and Ruby ran out to the sidewalk. They kicked the ball back and forth a few times.

"Hey, this works pretty well," said Ruby. "It's not bouncy like a kickball, but it rolls okay."

They knocked on their friends' doors and asked everyone to come out and play. They had a fun game of kickball with their friends until it got dark.

The next day, Ruby asked Sid, "Can we make any other things to play with?"

NAME: _____ DATE: _____

LET'S MAKE TOYS

"Hmmm," said Sid. "Let's make a list of toys we like and then we can think about which ones we could make."

Their list included outdoor toys like a tetherball, roller skates, a wagon, a kite, and a jump rope. They also listed indoor toys like video games, board games, card games, toy cars, action figures, building blocks, and musical instruments. As they looked over the list, they decided that it would be too hard to make their own video game or roller skates, but they could probably make any of the other toys on the list. The only problem was that they wouldn't have time to make them all!

First, they tied a long piece of rope onto their plastic-bag kickball. They tied the other end of the rope to a lamppost and made a tetherball out of it! Ruby had an idea for making a jump rope. She asked Sid for more plastic bags and some scissors. She showed him how to cut the bags into strips and braid them. They braided together a lot of strips until they had a rope long enough to use for a jump rope. Sid wrapped duct tape around each end for a handle. They asked their friend Sky to help them make a second jump rope. Then they all jumped double-dutch. It was fun, even if it was kind of hard to turn the ropes with duct-tape handles.

After lunch, Sid, Ruby, and Sky wanted to play inside. They decided to make their own board game. Sid got a cereal box, and they cut it open so it would lie flat. They sketched out the game on the cardboard in pencil and then filled it in with markers. They used some of Sky's mom's buttons for game pieces, and they made cards by writing on index cards. Their game was sort of a mix of a trivia game and checkers. They couldn't decide whether to call it "Checkia" or "Trivers." It was so much fun that they wanted to make more games and toys, but it was time for Sky and Ruby to go home.

NAME: _____ DATE: _____

STEP 1: PREPARE FOR THE CHALLENGE

Problem What problem will you solve?	Challenge What will you do?	Criteria What should the solution do to be successful?	Constraints What are the limits?
Sid, Ruby, and Sky want to make more toys.	Design and build a quick, active game using upcycled materials.	• The game should include movement of some kind. • The game should be playable by one to four players. • The game should be quick to play (two minutes or less).	• Use only upcycled materials. • Must run on kid power; no batteries or electricity.

Directions: Make a quick, active game from upcycled materials. Your game must include movement of some kind and must use kid power (no batteries or electricity). No board games—your game must be active!

Think of games you have played in which you must move something. For example, the kids in the story played kickball in which they **kicked** a ball. When they played tetherball, they **hit** or **pushed** the ball. Your game can be an indoor or outdoor game.

Write three examples of games below as well as the movement or movements that you use to play each game. Here are some examples of movements: push, pull, throw, kick, hit, roll, turn, twist, swing, and balance.

Game	Movement(s)

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STEP 2: BRAINSTORM, PLAN, AND BUILD

1. Brainstorm design ideas for upcycled games you can create that will meet the criteria and constraints. Sketch and write at least three ideas on the back of this page.
2. To test your game, you will ask other kids to play it. Your game should not be too hard to win, but not too easy, either! 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. Why do you think this game design is the best one?

_____

_____

_____

5. Make your upcycled game!

NAME: _____ DATE: _____

STEP 3: TEST, IMPROVE, AND SHARE

1. Check to see that your game meets each criteria and constraint:

- ☐ The game is made from upcycled materials.
- ☐ The game includes movement of some kind.
- ☐ The game can be played by one to four players.
- ☐ The game is quick to play (two minutes or less).
- ☐ The game uses kid power (no batteries or electricity).

2. Does your game design meet all the criteria? If not, how could you improve it?

_____

_____

_____

3. Ask some classmates to play your game. They must be able to understand how to play, so you may want to write some directions. After they play, ask them to answer these questions:

- Did you understand how to play the game? _____
- Was the game too hard or too easy? Explain. _____

  _____
- Did you enjoy playing the game? _____
- Do you have any suggestions to make the game better? If so, what are they?

  _____

  _____

4. How can you use your classmates' ideas to make your game better?

_____

_____

_____

5. Keep testing and improving your upcycled game!

NAME: _____ DATE: _____

STEP 4: REFLECT

1. How did you design the first version of your upcycled game?

2. How did you improve the design?

3. What was the hardest part about this challenge?

4. What have you learned from this challenge?