



## Unit Essential Question

*How do we work productively in groups?*

## Introduction

Learning to work with others is an important step in becoming a good scientist or engineer. Today's questions and problems are very complex and require many people with different types of expertise to generate possible answers or solutions. Engineers and scientists need to

- Work together to solve problems.
- Communicate by sharing their ideas and asking clarifying questions.
- Critique each other's work.
- Generate new knowledge or products.

To be a good group member, students must learn to increase their ability to be sensitive and responsive to the needs of others. They must learn that they are part of an interdependent group. Each group member's contribution is important to the success of the whole group.

In this task, students will be trying to make a complete circle from puzzle pieces given to them. Each student will receive some pieces of a circle, and they will need to exchange pieces of the circles with others in their group to complete their circle. Students will need to **pay attention to what other group members need** if the group is going to successfully complete all of their circles. By the end of the task, students should have a better understanding of what it means that **no one is done until everyone is done**.

## Objectives

Students will be able to

- Observe what other group members need to make a circle.
- Identify how well group members worked together and how they might improve next time.
- Explain why "no one is done until everyone is done."
- Describe their experience (what they thought and how they felt) after making the circles.

## Academic Vocabulary

- circle

## Language of Instruction

- observe
- exchange (give pieces to others)
- puzzle pieces



### Timing

This task can be completed in 1 class period (based on 45-minute periods).

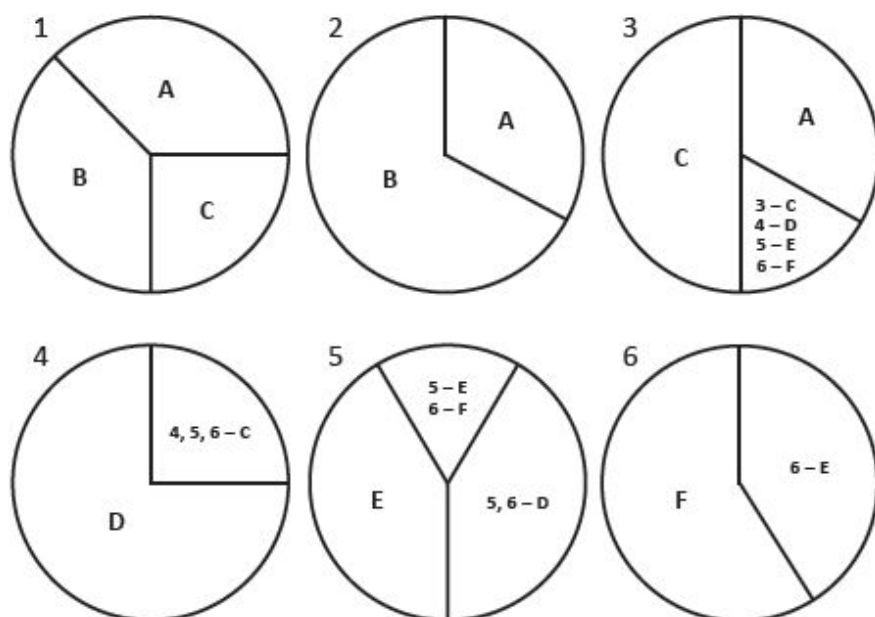
### Student Materials

per group

- Large envelopes that contain small envelopes with cut out circles (prepared using the instructions below)

#### Broken Circle Pieces Preparation

- Set of 6 circles (use Broken Circles at the end of Task 1)
  - Card stock (a different color per group)
  - Scissors
  - Set of small envelopes (number of envelopes should match number of students in each group)
  - Set of large envelopes (one for each group)
1. Make a copy of one set of the six circles for each group. (Note: For groups of four, make one set of circles 1–4; for groups of five, make one set of circles 1–5.) Copy the circle patterns on sturdy card stock using a different color for each group's set of circles. (Keep all the labels on the pieces.) This way, each group's pieces will be the same color and a different color from any other group's pieces. This arrangement will enable you to easily sort the pieces when you are preparing the materials for the activity.
  2. All the circles within the set should be the same size.
  3. For each group, mark six small envelopes each with a letter A through F. (Note: For groups of four, use three small envelopes labeled A through C; for groups of four, use four small envelopes labeled A through D; for groups of five, use five small envelopes labeled A through E.)
  4. Cut apart each group's set of circle pieces as described in step 5.



5. On the figure above, the numbers indicate the group size, while the letters indicate the proper small envelope. For example, if you are playing with six-person groups, the piece marked 6-F goes into the F envelope, the 6-E piece goes into the E envelope, the 6-D piece into the D envelope, and the 6-C piece goes into the C envelope.
6. Put all the pieces labeled with only a letter into the small envelopes marked with those letters. These pieces never change regardless of group size.
7. If you have groups of varying sizes, it is easier to make up and label sets of varying sizes in advance. Then these envelopes can be quickly substituted when required.
8. Once you have sorted the circle pieces into the lettered small envelopes, put these small envelopes into a larger one. You are now ready to hand out the materials to the small groups.

## Teacher Materials

- Behavior Norm Cards (use Behavior Norms Cards at the end of Task 1)
- Large sheet of chart paper
- Tape or glue

## Part I • Making Your Own Circle

1. Divide the class into groups of three to six students.
2. Assign one student in each group to play the role of the Facilitator. Explain that the Facilitator will read the directions and make sure everyone in the group understands the rules. (Students will learn more about this role and others in the next task.)



### LANGUAGE SUPPORT STRATEGY

Allow ELLs to partner with a student who is more proficient in English to read the description of their roles, and have them restate their responsibilities aloud.

3. Place one large envelope containing a set of the small envelopes on each table. (The number of small envelopes depends on the size of the group.) The small envelopes should contain the different pieces of the circles organized as noted in the Broken Circle Pieces Preparation section under Student Materials.
4. Ask the Facilitator to read the goal, rules, and directions for the activity (printed in the Student Edition). The goal is for **each** group member to put together a complete circle. To accomplish this goal, group members must exchange pieces with each other. It is not immediately obvious which pieces belong to which puzzle, so this process will involve trial and error and will take some time.



### LANGUAGE SUPPORT STRATEGY

Briefly model in advance the “exchange” of puzzle pieces using a different shape. Cut two triangles of different colors into three pieces and show the verb “exchange.” Trade pieces until the broken figure is put together as a whole triangle of the same color. Also show a non-example by making a gesture or noise (point out this is a “signal”) so the non-verbal component can be emphasized prior to sharing the rules.

Here are the rules for the Broken Circle activity:

- a. No talking. There must be total silence during the task.



### NOTE

If your students have trouble being silent, practice by being silent for a moment before the activity begins. This practice will be a good way to get the giggles out of their system! Another option is to play calm music as students work. The music will be a reminder not to talk. Explain that any student who has an emergency or needs to talk to you about anything other than the game can raise their hand if needed.

- b. Students may not point or signal to other group members with their hands in any way.
- c. Each group member must put together their own circle. They may not place a piece in another person’s puzzle.
- d. No one may show another group member how to put a circle together or put the circle together for another member.
- e. This is an exercise in giving. Group members may not take a piece from another group member, and they may give their pieces, one at a time, to another group members. You may hand the piece to another group member or place the piece beside the other pieces the group member already has (but not inside a player’s circle).

5. Formatively assess whether all groups understand the rules and are ready to start.



#### LANGUAGE SUPPORT STRATEGY

Check for understanding by having students hold up five fingers if they completely understand, three to four fingers if they understand well enough to try, one to two fingers if they need to have more clarification from you.

6. When groups are ready, tell them to take the smaller envelopes out of the large one, and then take the pieces out of the envelopes. Give students a set amount of time (e.g., 10 to 15 minutes).

## Part II • Discussing Broken Circles with Your Group

When all groups have completed the task or the allotted time has passed, help students identify some of the important things that happened and analyze why they happened. Have groups answer the Group Discussion questions and be prepared to share out with the class:

- How do you feel about what happened in your group today?
- What things did your group do to successfully complete the task?
- How will this experience help you work better as a group in the future?



#### LANGUAGE SUPPORT STRATEGY

Offer sentence frames to prompt oral discussion.

| Emerging →  | Expanding →   | Bridging →  |
|---|---|---|
| The Broken Circles game showed me that _____.<br>It made me feel _____. | After participating in the Broken Circles task with my group, I felt _____ about what happened. | After participating in the Broken Circles task, I felt that _____ because _____.  |
| Our group completed the task by _____.                                  | Our group did several things to complete the task, including _____.                             | Several actions made our group successful in completing the task, such as _____.  |
| I think this will help us to work better as a group because _____.      | The experience will help our groupwork in the future by _____.                                  | Some insights I have gained from this experience that will help our group work better together in the future include _____. |

## Part III • Class Discussion

Use the poster you created to point out the following Behavior Norms that make a group successful:

- Pay attention to what other group members need.
- No one is done until everyone is done.