

Two Bobbies: Engineering Design Process

Your team of engineers will build a cradle that holds and transports one islander along a zip line to the mainland. The materials you can purchase to build your cradle are pictured below.

| | | | | |
|---|---|---|--|---|
|  |  |  |  |  |
| Tooth Picks | String | Cups | Ribbon | Paper Clips |

| | | | | | |
|---|---|---|---|--|---|
|  |  |  |  |  |  |
| Craft Sticks | Masking Tape | Duct Tape | Rubber Bands | Straws | Pipe Cleaners |

- 1) Notice that the word Ask is in one of the circles in Figure 1. Ask yourself: What materials would I like to use to build a cradle? Write these materials on your STEM Challenge handout.
- 2) Notice that the word Imagine is in one of the circles in Figure 1. Imagine what your cradle will look like. Draw a picture of your cradle on your STEM Challenge handout.

Figure 1: Engineering Design Process



- 3) It is time to share your ideas with your team! Put on your listening ears and, one at a time, share your ideas!
- 4) Notice that the word Plan is in one of the circles in Figure 1. Plan what your cradle will look like. You can use one of your teammates' ideas or a combination of the teams' ideas. But remember, you must create your cradle together as a team!
- 5) Draw a picture of your cradle on your STEM Challenge handout.

Two Bobbies: Cost of Materials

Your team will be given money to spend on materials to build your cradle. First, you need to determine the cost of a few materials.

- 1) If four styrofoam cups cost \$1.00, what is the cost of one styrofoam cup?



- 2) If six rubber bands cost \$.40, what is the cost of one rubber band?



- 3) If two paper clips cost \$0.30, what is the cost of one paper clip?



Two Bobbies: Buying Time!

It is time for you to purchase the materials for the cradle your team will build!
 You have \$4.00 to spend. The items and their prices are shown below.

| Material | Cost per one item | Number of items your team would like to purchase | Total cost of the items your team would like to purchase |
|--------------------------|-------------------|--|--|
| One cup | \$0.25 | | |
| One craft stick | \$0.25 | | |
| One foot of duct tape | \$0.50 | | |
| One foot of masking tape | \$0.50 | | |
| One paper clip | \$0.15 | | |
| One pipe cleaner | \$0.25 | | |
| One foot of ribbon | \$0.50 | | |
| One rubber band | \$0.15 | | |
| One straw | \$0.15 | | |
| One foot of string | \$0.50 | | |
| One tooth pick | \$0.01 | | |
| Total Cost: | | | |

Show your work here or on the back of this handout:

Two Bobbies: Test and Improve Your Cradle

It is finally time to test your cradle.

- 1) Did your cradle slide along the zip line without any help? Write a sentence or two about why your cradle did or did not slide along the zip line without help.

- 2) Did your cradle hold one LEGO person as it slid along the zip line? Write a sentence or two about why your cradle did or did not hold one LEGO person as it slid along the zip line.

Two Bobbies: Maximum Weight of the Cradle

Your team was asked to create a cradle that will transport one person from the island to the mainland. Let's assume that this one person is an adult. Although the average male weighs about 195 pounds and the average female weighs about 166 pounds, the zip line must be able to carry above average males and females. Therefore, let's assume that your zip line will carry a maximum of 250 pounds. Since the abbreviation for pounds is lbs., we'll assume that your zip line will carry 250 lbs.

Instead of carrying only one person on the zip line, the rules have changed! You can now transport more than one person at the same time. In fact, you can take people and animals on the zip line! Isn't that awesome!

- 1) For the first trip, you are going to take three children and one adult. Make a list of the people you will transport and include each person's weight. Write an addition sentence of the four weights and include the sum of the four weights. Be sure to show your work!

Write your Addition Sentence here:

Show your work for calculating the sum here:

- 2) For the second trip, you are going to take one child, one adult, and one animal. Make a list of the people and animal you will transport. Be sure to include each person's weight and the animals' weight. Write an addition sentence of the three weights and include the sum of the three weights. Be sure to show your work!

Write your Addition Sentence here:

Show your work for calculating the sum here:

- 3) Your team has a new task! Your team must transport a group of people from the island to the mainland. It will take you more than one trip to transport everyone. Therefore, you must create a plan that includes who you will transport during each trip. Below is a list of people you must transport.

Two babies (each weighs 20 lbs.)

Three toddlers (each weighs 40 lbs.)

Two elementary school children (each weighs 70 lbs.)

One middle school child (110 lbs.)

Two adult females (each weighs 166 lbs.)

Two adult males (each weighs 145 lbs.)

Like before, the maximum weight the zip line can hold is 250 lbs.

- a. On your own, Ask yourself who you would like to take on each trip. As you think about your list, Imagine a group of people traveling together. Will the group of people you are thinking about be under 250 lbs.? What other circumstances you should consider when transporting a group of people?
- b. Make a list below of the groups of people you will have travel together.

- c. Share your list with your teammates.
- d. As a team, make a Plan for who your team will transport on the first trip, second trip, etc. List the groups of people below. Be sure to include each person's weight. Write an addition sentence of the weights for each trip and include the sum of the weights. Be sure to show your work!